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Evaluation of menus planned in Saskatchewan child-care centres participating in healthy start/depart santé program

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The Healthy Start/Départ Santé (HS/DS) intervention is designed as a population health intervention to promote physical activity and healthy eating among Anglophone and Francophone preschoolers (3–5 years old) in Child Early Learning Centers, licensed childcare centres. This intervention was implemented in over 180 childcare centres and prekindergartens in Saskatchewan between 2013 and 2016. Among licensed childcare centres, 39 were randomly selected to evaluate the impact of the intervention through a randomized controlled trial. Comprehensive data about nutrition and physical activity at child and centre levels were collected in those centres including the centres’ menus both at the baseline and end point of the intervention. A childcare centre’s food menu is a resource that provides comprehensive information about its food services. The quality of menus in childcare centres has become a growing concern around the world as the number of young children attending these facilities increases. Menu analyses are also an integral part of evaluating the success of a nutrition intervention in childcare centres. This study was conducted to assess the extent to which the planned menus in Saskatchewan’s childcare centres adhere to the Saskatchewan childcare nutrition guidelines before the HS/DS intervention. All the food and beverages that were listed on the menus of the participating centres were classified based on Canada’s Food Guide and provincial food group categories: Meat and Alternatives; Milk and Alternatives; Grains; Vegetables and Fruit; Food to Limit (Processed Food); and Beverages. The baseline data were compared with the provincial childcare nutrition guideline recommendations. The results indicated that only 15% of the participating centres met the lunch and snacks guidelines. Around 61.5% of centres met milk guideline and 38.5% met the processed food limitation recommendations. Furthermore, out of five centres that listed breakfast meal on their menus, only three centres met the breakfast guideline recommendation. Without any targeted intervention, the majority of menus in the participating centres do not follow the provincial guidelines. These data will be further compared with the endpoint data in order assess the impact of HS/DS intervention on improving menu planning practices of the participating centres. (Financial support: Public Health Agency of Canada, Heart and Stroke Foundation, Réseau Santé en Français de la Saskatchewan, Libyan-North American Scholarship.)

Assessment of habitual dietary intake of Canadian armed forces personnel using the modified healthy eating index

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Introduction: Beyond specific nutrient intake recommendations, a measure of overall diet quality is useful to evaluate the nutritional health of population groups. The Healthy Eating Index (HEI) is a measure of diet quality applied in United States but has been modified for Canada in concordance with the recommendations of the Canada’s Food Guide (CFG). Although the HEI has been applied to military personnel in United States, the diet quality of Canadian Armed Forces (CAF) personnel is unknown. The objective of this study was to use the modified-HEI as a tool to characterize, in a sample of CAF personnel, the quality of their habitual diets. Methods: Dietary intake of 18 male and female CAF (mean age 24 y), participating in a laboratory metabolism and feeding study, was assessed using the weighed food record. Modified-HEI scores were calculated by tabulating the data for the four CFG categories (total vegetables and fruits, total grain products, milk and alternatives and meat and alternatives). Other components (whole fruit, dark green and orange vegetable, whole grains, sodium and saturated/unsaturated fats) were calculated using the identification of foods in Health Canada’s CFG and ESHA nutrient composition software, using CNF2015 data. ‘Other foods’ were classified as any food other than those in the above food groups and tabulated per participant. Results: The average score was 55 out of 100 points, which is similar to general Canadian population and is defined as a diet that requires improvement. The components of the HEI on which CAF participants scored high were meats and alternatives (9 out of 10) and unsaturated fats (8 out of 10). Participants had lower scores on fruits and vegetables, grain products, milk and alternatives, and sodium, and consumed 26.9% of total energy from ‘other foods’, which lowered the overall score. Conclusion: Modified-HEI can be a useful tool to identify military personnel with lower diet quality. This may provide the opportunity to target interventions such as diet education in an effort to improve the health and performance of CAF personnel before deployment. (Research Support: Research contract awarded to principal investigator I. Jacobs by Defence Research and Development Canada.)

A maternal diet enriched with longer chain omega-3 polyunsaturated fatty acids increased lipogenesis and fetal outcome in C57BL/6 mice

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We investigated the effects of diets varying in the quantity and the quality of fat on maternal metabolic profile during pregnancy and its effect on the fetal number of C57BL/6 mice. Female mice (8 weeks) were fed diets varying in the quantity of fat (5% vs. 11%) for one week prior to mating and throughout pregnancy. The 5% diet contained fish oil as a source of omega-3 polyunsaturated fatty acids, while the 11% diet contained soybean oil. The females were checked for vaginal plug to confirm pregnancy. Maternal blood and tissues were collected at early-(day 6.5), mid-(day 12.5) and late-pregnancy (day 18.5). Plasma was assayed for triacylglycerol, cholesterol, progesterone and estradiol. Red blood cell fatty acid composition was measured. Hepatic mRNA expression of acetyl-CoA carboxylase (ACC1) and fatty acid synthase (FAS) were determined using qPCR. Implantation sites and the number of fetuses sustained throughout pregnancy were recorded. Two-way ANOVA was used to determine the main effects of diet and time, with post-hoc analysis when an interaction was observed. Alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were higher in the 5% group at each stage of pregnancy, compared to the 11% group (P<0.0001); ALA was not detected at day 12.5 and 18.5 in the 11% group. The 5% group showed higher plasma triacylglycerol (P<0.001) and lower cholesterol (P<0.05), compared to the 11% group at mid and late pregnancy. Hepatic cholesterol was higher in the 5% group, compared to the 11% group (P<0.05) at mid and late pregnancy. The mRNA expression of ACC1 and FAS were higher in the 5% group, compared to the 11% group (P<0.05) at mid and late pregnancy. Progesterone and estradiol was higher in the 5% group (P<0.005), compared to the 11% group. The number of fetuses sustained till day 18.5 was higher in the 5% group, compared to the 11%...
group (P<0.05). In conclusion, a low fat diet increased de-novo lipids synthesis, likely to meet the needs of the developing fetus. Higher levels of progesterone and estradiol in the 5% group enriched with fish oil may be responsible for sustaining a higher fetal number.

**Lowering dietary n-6 polyunsaturated fatty acids before and/or after weaning reduces arachidonic acid and its mediators in mouse hippocampus**

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Within the brain polyunsaturated fatty acids (PUFA) such as arachidonic acid (ARA, 20:4n-6) and docosahexaenoic acid (DHA, 22:6n-3), both directly and via production of bioactive mediators, regulate brain function. ARA and DHA accumulate at high concentrations during early life to support growth and development of the brain, however, their endogenous synthesis from the essential dietary precursors; linoleic acid (LA, 18:2n-6) and α-linolenic acid (ALA, 18:3n-3), respectively, are limited during infancy. Whether reducing dietary LA during maternal stage would result in major changes in brain n-6 PUFA compared to offspring stage is an interesting field to study. This study examines how lowering dietary n-6 PUFA during pregnancy and lactation compared to the offspring affects levels of n-6 and n-3 fatty acids in phospholipids (PL) and lipid mediators in the hippocampus of mice. Pregnant mice were randomly assigned to either: a deprived or an adequate n-6 PUFA diet during pregnancy and lactation. On postnatal day (PND) 21, half of the pups were weaned onto the same diet as their dams (maternal diet), and the other half were switched to the other diet for nine weeks (offspring diet). At PND 84, upon head-focused high energy microwave irradiation, hippocampi were collected for PL fatty acid and lipid mediator analyses. ARA concentrations were decreased (p <0.05) by n-6 PUFA deprivation, regardless of maternal or offspring exposure, in both total PL and PL fractions. There was no effect of diet on DHA concentration. Similarly, DHA-derived docosanoids were not changed by either dietary treatment. Several ARA-derived eicosanoids were reduced (p <0.05) upon n-6 PUFA deprivation in both maternal and offspring groups. However, some of the eicosapentaenoic acid-derived eicosanoids were increased (p < 0.05) by n-6 PUFA deprivation in both exposure groups. These results indicate that dietary n-6 PUFA treatments, regardless of their time of exposure, can regulate hippocampal ARA and some lipid mediators. Results from this study will be helpful in the design of experiments aimed at testing the significance of altering brain ARA levels over different stages of life. (Supported by Saudi Arabian Cultural Bureau in Ottawa and Canadian Institutes of Health.)

**Screening retina health and dietary intake for eye health in older adults living in Manitoba**

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In Canada, 65% of individuals over the age of 50 have some form of visual impairment. Evidence showed that micronutrients status can affect retinal function. There is a lack of information on the status of the nutrients in the aging population, especially in relation to their retinal health. The aim of this study was to evaluate if dietary intake pattern on micronutrient is a major contributing factor in retina (rod and cone) function in older adults. A total of 35 males and females aged 50-80 were recruited. Participants recorded their 3 day food intake on 2 days during the week and one day on the weekend falling in the same week. Mixed scotopic response and photopic response were used to assess rod and cone function using electroretinogram in both right and left eyes. It was found that the intake of vitamin A, thiamin, riboflavin, niacin, folate, calcium and iron slightly decreased with age, whereas the intake of vitamin B6, E and D maintained almost the same with age. Vitamin C intake increased with age. In terms of age, both rod and cone function of retina showed a weak negative correlation with age; scotopic A-wave (rod photoreceptor) maximum amplitude (r = -0.07, p = 0.7) and photopic B-wave (inner retinal cell) maximum amplitude (r = -0.18, p < 0.4) respectively. No correlation exists between micromutrient intake and retina function in older adults. (Fundning agencies: Agri-Food Research and Development Initiative (ARDI) and Manitoba Egg Farmers.)

**Effect of dietary supplementation with choline, betaine or trimethylamine N-oxide on atherosclerosis development in low-density lipoprotein receptor knockout mice**

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Introduction: Recently it has been proposed that an excess intake of choline is converted to trimethylamine (TMA) by gut microbiota; TMA is then oxidized to trimethylamine N-oxide (TMAO) by the liver enzyme, flavin-containing monoxygenase-3. It has been hypothesized that high TMAO levels in plasma may be a cause or biomarker for cardiovascular disease. Different studies have been made in athrogenic Apoe/- mice supporting this hypothesis. The aim of this study was to identify if choline and/or its metabolites exacerbate atherosclerosis in Ldlr/- male mice. Experimental Design: Ldlr/- male mice, aged 8-10 weeks, were fed with high-fat diet (HFD: 40% of calories and 0.5% of cholesterol) for 8 or 16 weeks. In the first set of experiments, mice (N=5-6/group) were randomized to one of three dietary groups: control (0.1% choline and 0% betaine wt/wt), choline-supplemented (1% choline and 0% betaine wt/wt), or betaine-supplemented (0.1% choline and 0.9% betaine wt/wt). In the second feeding trial, mice (N=7-8/group) were randomized to one of two dietary groups: control (0% TMAO wt/wt) or TMAO supplemented (0.2% TMAO wt/wt). After the dietary intervention, the animals were euthanized, and tissues and blood collected. Aortic atherosclerotic plaque area, plasma choline and lipid metabolites were quantified. Liver histology and lipids were analyzed. Results: Dietary supplementation with choline or TMAO increased plasma TMAO levels by 2- and 6-fold, respectively, while betaine did not influence plasma TMAO levels. To our surprise, HFD supplementation with choline, betaine or TMAO did not increase atherosclerosis in Ldlr/- mice after 8 weeks. Choline and betaine-supplemented diet increased atherosclerosis after 16 weeks. Dietary choline or TMAO supplementation did not alter plasma cholesterol levels. Conclusions: Long-term feeding of choline and betaine supplemented-diet increased atherosclerotic lesion, plasma choline and TMAO levels. TMAO supplemented-diet did not have any effect in atherosclerosis. This suggests that the increase of atherosclerosis following choline supplementation may be independent of plasma TMAO levels. (Supported by CONACYT Mexico, NSERC and ALMA.)

**Effect of very low caloric diet (Optifast) on morbidly obese patients who are candidates for bariatric surgery: preliminary results**

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Background: Obesity is a risk factor for the development of type 2 diabetes. A state of chronic inflammation is associated with obesity and is characterized by a high level of circulating pro-inflammatory cytokines. This state of chronic inflammation disturbs insulin signaling pathways and promotes insulin resistance. Weight loss has been associated with the reduction of pro-inflammatory cytokines and improved insulin sensitivity. Aims: This study aims to determine the
effect of Optifast, a very low calorie diet, routinely prescribed prior to bariatric surgery in morbidly obese patients. Optifast has been shown to significantly reduce blood glucose measurements. An assessment of macronutrient composition and simple sugar consumption will be conducted between diabetic and non-diabetic obese participants. Methods: Patients were recruited from the Toronto Western Hospital Bariatric Clinic. Data and sample collection took place at 2 time-points, pre-and post-Optifast regimen. Blood tests were performed to measure fasting insulin, glucose, c-peptide and HbA1c. Anthropometric measurements including height, weight, and body mass index (BMI) were recorded and a 3-day food record was completed by each patient. Results are expressed as mean ± SD. Results: Twenty-four patients (20 females, 4 males) were recruited of which 8 were diabetic and 16 were non-diabetic. Mean age of the patients was 50.2 ± 10.2 years and BMI was 46.4 ± 5.3 kg/m². The mean Optifast duration was 16.9 ± 3.5 days. Overall, blood tests significantly improved after Optifast regimen (Glucose P = 0.030, insulin P = 0.006, HOMA-IR P = 0.006, HbA1c P = 0.042, c-peptide P = 0.006). Additionally, BMI significantly decreased (P < 0.001) between pre-and post-Optifast visits. The 3-day food record data indicated high intakes of fat (38.3% of total energy) and sugar (58.6g per day) at baseline with no statistically significant differences observed between diabetic and non-diabetic obese subjects. Conclusion: These preliminary results suggest that Optifast is effective in promoting weight loss and improving glucose metabolism during short-term use by morbidly obese patients. Optifast has the potential to add to the care of Type 2 diabetic obese diabetic participants who do not respond to lifestyle recommendations. (Fundied by CIHR.)

Differential effect of eicosapentaenoic and docosahexaenoic acids on features of the small density low-density lipoprotein phenotype among men and women at cardiovascular risk

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Recent studies suggest that supplementation with docosahexaenoic acid (DHA) increases LDL-cholesterol (LDL-C) concentrations more than with eicosapentaenoic acid (EPA). However, LDL particles are heterogeneous in terms of size and density, with small dense LDL (sdLDL) being associated with a greater risk of coronary heart disease (CHD) than larger particles. The extent to which EPA and DHA differentially modify features of the sdLDL phenotype has not yet been thoroughly investigated. The objective of this study was to compare the change in sdLDL phenotype features after EPA and DHA supplementation (re-esterified triacylglycerol, 90% pure) in men and women at risk for CHD. In a double-blind, controlled, crossover study, 48 men and 106 women with abdominal obesity and low-grade systemic inflammation but otherwise healthy were randomized to a sequence of three treatment phases: 1- EPA (2.7g/d), 2- DHA (2.7g/d), 3- control (corn oil, 0g EPA and DHA). All supplements were provided as 1g capsules for a total of 3g/d. The 10-week treatments were separated by a median 9-week washout. Changes in various features of the sdLDL were analyzed as a function of treatments. Compared to EPA, DHA supplementation increased mean LDL particle size (252±22.7Å for DHA vs. 251±22.3Å for EPA, P<0.0001) and reduced the proportion of small LDL (68.9±15.7% for DHA vs. 72.0±12.0% for EPA, P<0.01). Compared to the control, DHA increased mean LDL particle peak (+0.25±0.07%, P=0.001) while EPA decreased mean LDL particle size (-0.16±0.06%, P<0.014) and increased the proportion of small LDL (+4.98±1.56%, P<0.031). These data suggest that the greater increase in LDL-C concentrations with DHA compared with EPA is paralleled by larger LDL particles. The clinical significance of differences in the modulation of lipids and features of the sdLDL phenotype by EPA and DHA in terms of CHD risk prevention remains unclear and needs to be investigated in the future. (Financial support was provided by a grant from the Canadian Institutes for Health Research (CIHR), Douglas Laboratories provided the supplements. JA is a recipient of PhD Scholarships from the CIHR and the Fonds de Recherche du Québec – Santé. CV is a fellow of the French Foundation for Medical Research.)

BMI and HDL-cholesterol as determinants of the difference in plasma carotenoid concentrations between men and women

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Adherence to nutritional recommendations is an important part of leading a healthy lifestyle and preventing chronic diseases. However, health professionals consider the evaluation of eating habits to be a challenge given the potential biases of dietary questionnaires which are frequently based on self-reported data. Circulating carotenoid concentrations, which are considered reliable biomarkers of dietary carotenoid intake as well as of fruits and vegetables consumption, are often used in the validation of dietary assessment tools. However, there is a sex difference in circulating carotenoids as women have been reported to display higher concentrations compared to men. The aim of the present study was to identify determinants of plasma carotenoid concentrations among men and women enrolled in a series of fully-controlled dietary interventions. We compiled data from a group of 155 men and 110 women who participated in 6 fully-controlled dietary interventions, showing a large variation in carotenoid intakes, and looked at the associations of post-intervention fasting plasma carotenoid concentrations (α-carotene, β-carotene, β-cryptoxanthin, lutein, lycopene and zeaxanthin) with physical and metabolic characteristics. We found that body mass index (BMI: r=-0.30, p<0.0001) and waist circumference (r=−0.27, p<0.0001) were inversely associated with total circulating carotenoids while elevated plasma total r=(r=0.48, p<0.0001), LDL-P=(r=0.37, p<0.0001) and HDL-cholesterol=(r=0.30, p<0.0001) concentrations were correlated with higher plasma carotenoids. Compared to men, women had a lower BMI (-3.0 kg/m², p<0.0001) and higher plasma total cholesterol (+22%, p<0.005) and HDL-cholesterol (+47%, p<0.0001) but showed no significant difference in plasma LDL-cholesterol (+4%, p=0.79). Women also displayed significantly higher plasma α-carotene (+17%, p<0.01), β-carotene (+35%, p<0.0001), β-cryptoxanthin (+23%, p<0.0005), lutein (+19%, p<0.0005), lycopene (+27%, p<0.0001) and zeaxanthin (+11%, p<0.05) concentrations despite having lower dietary intakes for all these carotenoids compared to men. Adjustments for BMI and plasma HDL-cholesterol eliminated the sex difference in circulating carotenoid concentrations. Our results suggest that BMI and circulating HDL-cholesterol concentrations contribute to the difference in circulating carotenoid concentrations noted between men and women and that variations in physical characteristics as well as in the plasma lipid profile should be taken into account when using plasma carotenoids as biomarkers of food intake in men and women.

Macronutrient composition of pooled, pasteurized donor human milk

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Nutrient-fortified mother’s milk, supplemented with pasteurized donor human milk, is an integral part of neonatal care for preterm infants. Donor milk is, for the most part, fortified using mother’s milk composition values; however, unlike mother’s milk, donor milk is pasteurized and undergoes multiple container changes and freeze-thaw cycles known to affect its macronutrient content. Pooling milk from multiple donors prior to pasteurization also reduces inter-batch variability. A recent Cochrane Review of donor milk versus formula

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feeding for preterm infants demonstrated slower weight, length, and head circumference gains among those fed donor milk. Our objective was to establish macronutrient composition ranges for pooled, pasteurized donor milk to use clinically when fortifying. Samples (n=311) were consecutively collected from the Rogers Nixon Ontario Human Milk Bank in Toronto, Canada between August 2014 and April 2016. Total protein, lipid, and carbohydrate concentrations were assessed using a mid-infrared human milk analyzer (MIRIS, Sweden), and lactose concentrations were determined using an enzymatic assay (R-Biopharm, Germany). Energy content was calculated from true protein, lipid, and lactose values using Atwater Factors. The median macronutrient composition of donor milk was found to be 0.9 (interquartile range, 0.9-1.0) g/dL for crude protein and 0.8 (0.7-0.8) g/dL for true protein. Median lipid, carbohydrate, and lactose values were determined to be 3.4 (2.9-3.8) g/dL, 6.9 (6.8-7.0) g/dL, and 6.5 (6.2-6.9) g/dL, respectively. The median energy content was calculated to be 59 (55-63) kcal/dL. These concentrations fall below the reported composition values of mother’s milk that are often used to fortify donor milk in the hospital. Standardized macronutrient composition values, when direct measurements are unavailable, should improve the fortification practices of donor milk to better support the in-hospital growth of donor milk-fed, preterm infants. (Funded by CIHR: FDN#143233.)

Effect of dietary phytosterol and cholesterol concentration in infant formula on circulating lipid profiles

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Cholesterol is essential for infant as an important part of the rapidly growing cell membranes but is up to five times lower in infant formula when compared to human milk. This low cholesterol absorption from infant formula is speculated to be due to presence of high phytosterol, a cholesterol absorption inhibitor in vegetable oils used in the formulation of infant formula. Therefore, the study objective was to investigate the interactive action of cholesterol versus phytosterol in infant formulas on cholesterol metabolism and concentrations using the neonate piglet as a model for human infant. A total of 32 piglets were used with 8 piglets per group in the following diet composition, high in phytosterol; low in cholesterol (Pc), high in phytosterol; high in cholesterol (PC), low in phytosterol; high in cholesterol (pC) and low in phytosterol; low in cholesterol (pc). Circulating lipid profiles after 2 days on each diet were compared between the different dietary treatments. Mean values of total cholesterol, LDL-C and HDL-C were similar in Pc and pc while Pc showed the highest mean cholesterol level 118.18±11.48 mg/dL cholesterol in the Pc (104.89±19.11 mg/dL) was the lowest compared to other dietary treatment group. Circulating levels of LDL-C in PC and pC increased at p<0.05 compared to Pc. Pc diet treatment did not have effect on circulating triglyceride when compared with Pc 18.51±6.64 mg/dL while Pc showed a slightly higher circulating triglyceride level 20.49±5.10 mg/dL. In conclusion, our speculation that the use of low phytosterol vegetable oil in combination with cholesterol in the formulation of infant formula will increase the cholesterol absorption of infants was confirmed as our Pc consuming high cholesterol with phytosterol-reduced infant formula gave the highest cholesterol level compared with the lowest level in Pc control. As such, these results are anticipated to help the manufacturing industries in proper formulation to achieve a closer dietary benefit found in human milk.

Identifying changes in dietary intake, diet quality and body composition during the first-year of university studies

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The transition from high school to the first-year of university is a critical time period for weight gain. This transition may cause young adults to adopt an unhealthy lifestyle, which can include major changes in body weight as well as in dietary intake and diet quality. The weight gain is popularly referred to as the “Freshman Fifteen”, and is a widely accepted phenomenon on university campuses and in the media. However, discrepancies exist in the literature regarding the amount of weight that is gained and the changes in dietary intake and diet quality that may occur relating to this gain. The purpose of this study was to identify changes in dietary intake, diet quality, eating habits and body composition during first-year university. Three-hundred and one students (n=71 males, n=230 females) completed a food frequency questionnaire and a dietary habits questionnaire, and had their body composition measured at the beginning and the end of first-year university. Energy intake significant decreased by ~400 kcal/d for both sexes (p<0.001). This was accompanied by a decrease in most nutrients and diet quality in both sexes (p<0.05). Males increased consumption of less healthy foods such as fried chicken and soft drinks and decreased consumption of healthier foods such as yogurt, fruit and vegetables, fish and milk (p<0.05). Females increased consumption of less healthy foods such as French fries and energy drinks and decreased consumption of healthier foods such as oatmeal, vegetables, fruit, steak, poultry and milk (p<0.05). Alcohol intake increased in both sexes (p<0.001). In terms of eating behaviours, males were more concerned about when and how they were eating than females (p<0.05). In regards to body composition, both males and females gained weight (p<0.001), however this weight gain came from lean and fat mass in males (p<0.001) and predominantly fat mass in females (p<0.001). Therefore, dietary intake, diet quality, eating behaviors and body composition changed during first-year university. These changes generally reflected negative outcomes for both males and females, highlighting the need to implement strategies to promote a healthier transition into university life. (Financial Support from CIHR-CGSM.)

Intestinal calcium absorption pathways are altered at weaning

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Calcium is essential to many vital physiological functions including bone mineralization. Peak bone deposition rate occurs in infancy and maximal bone mineral content is achieved early in adulthood. Maintaining a positive calcium balance during development is thus essential to achieving optimal bone mass. Calcium homeostasis is mediated by interactions between the intestine, kidneys, and bones. Intestinal absorption occurs by either an active transcellular or passive paracellular pathway. Currently, based on studies in adults, the duodenum is thought to be a site of largely transcellular absorption whereas the jejunum and ileum are proposed to mediate exclusively paracellular calcium absorption. There are limited studies on young animals. We therefore set out to describe calcium absorption pathways pre and post weaning in wildtype FVB/N mice at 7 ages from 1 day to 6 months old. Levels of Trpv6 and CalbD9k mRNA, mediators of transcellular calcium transport, increased six-fold between two weeks and one month of age in the duodenum with a corresponding increase in CalbindinD9k protein. In the jejunum and ileum, mediators of transcellular transport – Trpv6 (jejunum only), Cav1.3, and CalbD9k – are highly expressed prior to weaning, suggesting novel pathways of calcium absorption during development. Consistent with this, net calcium flux, measured in Ussing chambers, was not different from zero across ileum post weaning. However, we identified significant net absorption in the absence of an electrochemical gradient across ileum prior to weaning. Further, this net absorption was abolished by nifedipine, an L-type calcium channel blocker. Abundance of Cldn-2 and -15 mRNA, mediators of paracellular absorption, peak at 7 days in the duodenum. In the ileum, Cldn-2 mRNA peaks at 14 days and decreases 10-fold by 1 month, whereas Cldn-15 expression increases 3-fold from day 14 to 1 month of age. These observations are consistent with a shift

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at weaning from paracellular to transcellular calcium absorption in the duodenum and previously unreported transcellular calcium absorption from the jejunum and ileum prior to weaning mediated by CaT. This research was funded by the NSERC, and the Stollery Children’s Foundation through the Women and Children’s Health Institute.

### Comparing the impact of saturated fatty acids from different dairy sources on HDL subpopulations

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**Background:** High-density lipoproteins (HDL) constitute a heterogeneous class of lipoproteins that differ in size, composition and function. Large HDL particles are generally associated with a reduced risk of cardiovascular disease (CVD) and consumption of saturated fat (SFAs) tend to increase the size of HDL compared with other nutrients. The aim of this study was to examine how consumption of SFA from different dairy sources modifies the concentration of HDL subpopulations compared to other dietary fats (MUFAs and PUFAs) and a low-fat high carbohydrate diet. Methods: In a multicenter, randomized cross-over controlled trial, 64 men and women with abdominal obesity and relatively low HDL-C were assigned to random sequences of 5 isocaloric diets of 4 weeks each: 1) a diet rich in SFA from CHEESE (32% fat, 12.6% SFA); a diet rich in SFAs from butter (BUTTER), (32% fat, 12.4% SFA); a diet rich in MUFA in MUFAs (32% fat, 6% SFA, 16.9% MUFAs); a diet rich in PUFA (32% fat, 6% SFA, 11.5% PUFAs) and a low-fat, high carbohydrate diet (CHO), (25% fat, 6% SFA). All foods were provided to participants during the experimental phases. The concentration of HDL subpopulations (preβ-1, α-1, α-2, α-3, α-4) was assessed post diet by two-dimensional gel electrophoresis. Total serum apolipoprotein-A1 (apo-A1) concentration was determined by ELISA. Results: BUTTER compared with CHO increased apoA-1 concentration (P=0.003) while CHEESE had no effect (P=0.266). While there was no difference in the levels of small preβ-1 and large α-1 HDL between CHEESE and BUTTER, levels of the medium size α-2 and α-3 HDL and of the small α-4 HDL were significantly increased after BUTTER compared with CHEESE (P=0.009, P=0.003 and P=0.029 respectively). Levels of preβ-1 HDL after BUTTER were higher than after PUFA, while CHEESE had no effect on preβ-1 HDL compared with other diets. Conclusions: Results from this large multicenter, controlled-feeding study suggest that the cheese matrix modifies the impact of dietary SFA on the concentrations of HDL subpopulations. Indeed, SFAs from butter seem to have more effects on various HDL subtypes than SFAs from cheese. More studies are needed to examine how such differences relate to cardiovascular outcomes.

### Is nutrition marketing more common in high sugar foods?

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This study aimed to evaluate whether nutrition marketing is more prevalent on prepackaged foods and beverages that are higher in free sugar. With recommendations to limit intakes of free sugar to <10% of calories, it is imperative that labelling regulations ensure nutrition marketing aids consumers in their selection of healthier food alternatives that reduce the detrimental effects associated with excess consumption. Methods: This study was a cross-sectional analysis of the University of Toronto’s 2013 Food Label Database (n=15,342) with meal replacements and products missing sugar declarations excluded (n=83). Products were stratified into quartiles based on the percent of energy derived from free sugar into 1st (<5% of Calories), 2nd (5% - <10% of Calories), 3rd (10% - <15% of Calories), and 4th (≥15% of Calories) quartiles. A review of product labels identified products with nutrition marketing. All nutrient content claims (NCC), disease risk reduction claims (DRRC), structure function claims (SFC), and front-of-pack symbols (FOPS) were included. Odds ratios (ORs) for each type of nutrition marketing were estimated with logistic regression models. The 1st quartile of free sugar content was used as the reference. Results: The 4th quartile was less likely to have NCC than the 1st (OR 0.87, 95%CI:0.81-0.93). All quartiles were more likely to have FOPS than the 1st (OR 1.53, 95%CI:1.3-1.8; OR 1.41, 95%CI:1.3-1.75; OR 1.15, 95%CI:1.06-1.25, for 2nd, 3rd, and 4th quartiles, respectively). Lastly, the 4th quartile was more likely to have SFC than the 1st (OR 1.26, 95%CI:1.07-1.49). The heavy promotion of products with high free sugar levels is a concerning finding. Results of this study can be used to support educational messaging to assist consumer interpretation of nutrition marketing. Results suggest changes in nutrition labeling policies are needed, for example, permitting nutrition marketing only on products that meet national healthy eating objectives and contain low levels of free sugar. (CIHR PGC, TJB, TGF-38393; CIHR Collaborative Training Program in Public Health Policy (TJB); CIHR Strategic Operating Grant (20110350118150); DNS Graduate Student Fellowship (BFA); Canadian Stroke Network (2011035010194-000) (MRL); Earle W. McHenry Research Chair unrestricted research grant (MRL); and One Sweet Film Inc. (MRL.).

### Targeting hyperapoB by hypocaloric diets to reduce the risks for type 2 diabetes in obese subjects

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Type 2 diabetes (T2D) is preventable by hypocaloric diets in obese subjects; however, with large inter-subjects response variability. HyperapoB, or elevated plasma apoB-lipoproteins, promote risk factors for, and incidence of, T2D in humans. We tested the hypothesis that hypocaloric diets may reduce plasma apoB in obese subjects with hyperapoB had additional benefits on metabolic parameters. Obese subjects (n=83). Products were stratified into quartiles based on the percent of calories derived from free sugar into 1st (<5% of Calories), 2nd (5% - <10% of Calories), 3rd (10% - <15% of Calories), and 4th (≥15% of Calories) quartiles. A review of product labels identified products with nutrition marketing. All nutrient content claims (NCC), disease risk reduction claims (DRRC), structure function claims (SFC), and front-of-pack symbols (FOPS) were included. Odds ratios (ORs) for each type of nutrition marketing were estimated with logistic regression models. The 1st quartile of free sugar content was used as the reference. Results: The 4th quartile was less likely to have NCC than the 1st (OR 0.87, 95%CI:0.81-0.93). All quartiles were more likely to have FOPS than the 1st (OR 1.53, 95%CI:1.3-1.8; OR 1.41, 95%CI:1.3-1.75; OR 1.15, 95%CI:1.06-1.25, for 2nd, 3rd, and 4th quartiles, respectively). Lastly, the 4th quartile was more likely to have SFC than the 1st (OR 1.26, 95%CI:1.07-1.49). The heavy promotion of products with high free sugar levels is a concerning finding. Results of this study can be used to support educational messaging to assist consumer interpretation of nutrition marketing. Results suggest changes in nutrition labeling policies are needed, for example, permitting nutrition marketing only on products that meet national healthy eating objectives and contain low levels of free sugar. (CIHR PGC, TJB, TGF-38393; CIHR Collaborative Training Program in Public Health Policy (TJB); CIHR Strategic Operating Grant (20110350118150); DNS Graduate Student Fellowship (BFA); Canadian Stroke Network (2011035010194-000) (MRL); Earle W. McHenry Research Chair unrestricted research grant (MRL); and One Sweet Film Inc. (MRL.).

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Perceptions of the Canadian diet among Black and White school-aged children

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In Canada, surveys usually group all individuals with a Black ethnicity together, immigrants or not, even if they have different culture and region of origin, possibly masking differences within the Black community. Ethnicity and cultural aspects are important determinants of food choices and are not static; they change with contacts with other cultural groups. Little is known about how these determinants influence children of Black ethnicity and how they change depending on children’s generational status. Our aim was to examine and compare how Black and White children perceive their diet in Canada. We used the “draw and tell” method as part of a mixed-methods research project among 6- to 12-year-old Black children of African and Caribbean descent living in Ottawa. A comparison group was comprised of White children of Canadian descent. We invited children to make a drawing about eating in Canada as well as to explain their drawing and what it meant to them. Discussions were recorded and transcribed; we counted foods mentioned by children regarding their drawings. Counts were disaggregated by generational status and ethnicity of children. Thematic analysis was also performed with NVivo 10. Only one vegetable or fruit was listed among the top 5 foods of first- and second-generation of immigrant children, whereas three or more were present in drawings of third-generation Black children and of White children. Overall, White children drew more fruits and vegetables, and fewer highly processed foods than Black children. Among Black children, second-generation had the least healthy eating pattern (fewer fruits and vegetables and more highly processed foods) than first- and third-generation children which were similar in terms of healthiness. Interestingly, 10.6% of first-generation, 15.7% of second-generation, and 12.0% of third-generation Black children, as well as 19.4% of White children mentioned at least one fast-food outlet or a sit-in restaurant in their drawing. This research revealed differences between Black and White children, as well as within Black children with different generational status regarding their perception of their diet in Canada. (Supported by the Consortium national de formation en santé—violet Université d’Ottawa and the University of Ottawa.)

Substituting peas for rice significantly reduces postprandial blood glucose response and glycemic index

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Diabetes is one of the most common chronic diseases affecting Canadians and lifestyle modifications that include a diet high in fibre may lower the risk of developing type 2 diabetes. Peas are high in fibre and protein, and replacing a portion of a high starch food like rice with peas may limit the rise in blood sugar after a meal. The objective of this study was to compare the post-prandial glucose response following consumption of white rice with and without 3 common market classes of peas. Twenty-four healthy adults (9 men/15 women, age 26 ± 4.7; BMI 23.7 ± 4.0 kg/m², % body fat (men) 19.2 ± 11.9, % body fat (women) 27.5 ± 9.7) completed the randomized controlled crossover clinical trial at the I.H. Asper Research Institute in Winnipeg, MB. Each participant attended six 2.5-hour study visits separated by washout periods of 3-15 days. At the first and sixth visits, participants received 50 g available carbohydrate (AC) from white bread. At visits 2-5, participants received in random order 50 g AC from rice or 20 g AC from rice + 30 g AC from peas (yellow whole, yellow split, green split). Fasting and 15, 30, 45, 60, 90 and 120 minute post-prandial capillary blood samples were collected for analysis of blood glucose and plasma insulin. Repeated measures ANOVA and differences in LSMeans were used to determine statistical differences in incremental area under the curve (iAUC) for glucose and insulin, as well as Glycemic Index (GI) amongst treatments. Compared to white rice alone, glucose iAUC was significantly decreased (p<0.0001) by 29-31% when peas were combined with rice. There was no difference in insulin iAUC when peas were combined with rice compared to rice alone. The GI of rice (99.5±7.4) was significantly decreased (p<0.01) by addition of each pea: (yellow whole (76.6±7.4), yellow split (67.6±7.4) and green split (69.2±7.4). These results show that replacing 60% of the AC from white rice (a high GI, starch-rich food) with peas supports a Function health claim related to the reduction in post-prandial glycaemic response. (Funded by AAFC Growing Forward 2 and Pulse Canada Cluster.)

Higher prevalence of glucose abnormalities despite better clinical status: comparison between Canadian and French cystic fibrosis cohorts

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For patients with cystic fibrosis (CF), association between early glucose abnormalities and worse clinical status (weight and pulmonary function) has been reported but could differ between CF populations. We compared clinical status and glyceremic profile in two large CF standardized observational cohorts (Montreal, Canada and Rhône-Alpes region, France). All CF adult patients (≥ 18 years) without known CF-related diabetes (CFRD) of both cohorts attending the participating CF centers were included. All patients underwent an OGIT with measures of fasting (G0), 1-h (G1) and 2-h (G2) glucose values. The same day clinical data was collected: pulmonary function by spirometry (%FEV1), body mass index (BMI), biochemical dosages and genotype. Data was analyzed with non-parametric Mann-Whitney tests between cohorts. 267 Canadian and 147 French CF patients were included. Sex ratio and proportion of F508del homozygous (most frequent mutation) are similar (p = 0.6 and p = 0.4, respectively). Canadian patients are older (mean age of 26.3 ± 7.9 vs 24.9 ± 6.7, p = 0.03). Age adjusted clinical status of Canadian group is better with higher %FEV1 (72.9 ± 22.2, p < 0.0001) and higher BMI (21.8 ± 3.0 vs 20.1 ± 2.2, p < 0.0001). The prevalence of de novo CFRD diagnosis (16.5 vs 10.0%, p = 0.01), as well as G0 and G2 values were higher in the Canadian groups (respectively 5.5 ± 0.8 vs 4.8 ± 0.5mmol/L, p < 0.0001 for G0; 8.0 ± 3.3 vs 7.1 ± 2.7mmol/L, p < 0.004 for G2). For all glucose tolerance groups, Canadian patients displayed higher glucose area under the curve values compared to French patients even for patients with normal glucose tolerance (p=0.001). Unexpectedly despite higher glucose values and incidence of de novo CFRD, Canadian CF patients have a better pulmonary function and BMI compared to the French CF patients. Potential underlying factors including insulin secretion and sensitivity, modifiers genes, nutritional behavior and clinical practices may play a role in these differences.

Examining the relationship between self-reported energy intake and energy requirements for body weight maintenance

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Background. Dietary assessment is central to nutritional epidemiology, which forms the basis of dietary guidelines. However, validity of
self-reported energy intake and hence of nutrient intakes obtained via diverse techniques, including food frequency questionnaires (FFQ), has been questioned due to systematic under-reporting. Objective and measured energy intake and status meta-analysis specific to children. The 25(OH)D response to vitamin D intake appears to differ based on baseline status and delivery mode, but not age, sex or latitude. (Funding: Canada Research Chairs.)

Docosahexaenoic acid promotes apoptosis and reduces tumour growth in combination with doxorubicin in breast cancer treatment

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Breast cancer is the most common cancer among Canadian women, accounting for over 25% of diagnoses. Despite ongoing advances in screening, prevention, diagnosis, and treatment, breast cancer remains the second leading cause of cancer-related death in women. Improving treatment, while minimizing side-effects is essential to improving patient outcome. The anti-cancer effects of omega-3 long chain polyunsaturated fatty acids, including docosahexaenoic acid (DHA), found in fish oil have been shown in breast cancer and other cancers. Studies have also suggested that DHA can improve the effectiveness of chemotherapeutic drugs including the anthracycline drug doxorubicin (DOX). DOX is commonly used in the adjuvant and neoadjuvant setting for breast cancer treatment. We examined the expression of genes in the apoptotic pathway in MDA-MB-231 breast cancer cells to identify how preincubation with DHA alters cellular response to DOX. This work reveals that in addition to the previously reported changes in CD95 death receptor localization, expression of multiple genes involved in apoptotic signaling are significantly altered by pre-incubation with DHA prior to treatment with DOX in breast cancer cells in vitro. Incubating these cells with a blocking antibody to CD95 prior to treatment with DOX significantly reduced some of these effects (p<0.05), re-vealing an essential role for CD95 in mediating DHA action. The beneficial effect of DHA on DOX treatment was confirmed in a pre-clinical animal model. Nu/nu mice were injected subcutaneously with MDA-MB-231 human breast cancer cells, then mice with established tumours were randomized to high fat diet (20% w/w) ± 5% w/w DHA, and treated with DOX or placebo. Mice treated with DHA+DOX had significantly smaller tumours than mice treated with DOX alone (0.8±0.5g vs 2.3±0.8g) (p<0.05). Immunohistochemical analysis of tumour tissue found an increase in staining of apoptotic markers (CD95 and TUNEL) in DHA+DOX, compared to DOX alone. These studies reveal that one mechanism through which DHA increases the efficacy of DOX is through CD95 mediated apoptosis. (Supported by CIHR and Alberta Canola Producers Commission.)

Investigating the use of a smartphone-based dietary intervention within an adolescent population

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Diet quality is a modifiable risk factor for several critical health conditions facing Canadians today. In an effort to promote healthier diets among Canadians, SmartAPPetite was developed as a cross-sector collaboration between researchers and community stakeholders. SmartAPPetite is a local food messaging app that was developed to provide users with credible nutrition information approved by a registered dietitian. An eight-week pilot study using SmartAPPetite as a dietary
Snacking in preschool-aged children: does genetics play a role?

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Background: Developing an understanding of eating habits that contribute to the growing childhood obesity epidemic has become a priority for governments worldwide. Snacking is an integral component of eating habits in young children that is often overlooked in nutrition research. In the past 40 years, the prevalence of daily snacking in U.S. children has increased from 74% to 98%, with snacks contributing 27% of a child’s caloric intake. While existing evidence identifies snacking as a significant source of calories in preschoolers’ diets, there is limited knowledge about the factors that drive the quantity and quality of snacking. The genetics of taste is one factor that may help better understand snacking habits of children. Gustatory receptors, which elicit fat, sweet, and bitter taste, are of particular interest as dietary intake patterns associated with these taste modalities are often linked to poorer health outcomes. Specifically, the A allele of the rs1761667 single nucleotide polymorphism (SNP) in the CD36 gene has been linked to lower oral sensitivity to fatty acids, the T/T genotype of the rs25674116 SNP in the TAS1R2 gene has been related to a preference for sweet foods, and the C/C genotype of the rs713398 SNP in the TAS2R38 gene has been associated with the super-taster phenotype. Super-tasters are more likely to have an aversion to the bitterness of green leafy vegetables whereas non-tasters (G/G) do not. Objective: To determine the relationship between taste receptor SNPs, and snack quantity and quality in preschoolers in the Guelph Family Health Study. Methods: Preschoolers’ dietary energy intake from snacks, frequency and timing of snack consumption, and quantity of snacks was assessed using parent-completed three-day food records. Saliva was collected for genotyping (n=45-47). Results: Evening snack consumption was more frequent in children with the T/T genotype of the TAS1R2 SNP compared to C allele carriers (p<0.01). Snack total energy density was highest in super-tasters compared to non-tasters (p<0.01), and greater in A/A genotype of the CD36 SNP compared to G allele carriers (p=0.02). Conclusion: Genetic variation in taste receptors may impact snack quantity and quality. (Supported by the Health for Life Initiative, University of Guelph.)

Effects of linoleic acid lowering in diets on ethanol binge consumption in mice

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Prevalence of binge and heavy drinking is 25% among adult ages 18 or older. Three-quarters of the total economic cost of alcohol misuses is related to binge drinking. Pilot human and animal data suggest n-3 polyunsaturated fatty acids (PUFA) may reduce relapse and intake of...
alcohol, respectively. The aim of our study is to examine if supplementation of n-3 PUFA can reduce voluntary alcohol consumption via morphological changes in synaptosomal density of mesocorticolimbic system in a mouse model of chronic ethanol binge. Since reduction in dietary linoleic acid (LNA; n-6 PUFA) to evolutionary levels is as effective as supplementation of eicosapentaenoic acid and docosahexaenoic acid (EPA/DHA; n-3 PUFA) in raising tissue levels of n-3 PUFA, we are also examining if reduction in n-6 PUFA can have similar effect on voluntary alcohol binge consumption behaviour as compared to n-3 PUFA supplementation. Alcohol-prefering mice (CS7BL/6J) are randomized into four custom diets varying in the levels of n-3 and n-6 PUFA that model contemporary American as compared to evolutionary intakes. After eight weeks of dietary interventions, mice were exposed to 20% ethanol for 4 hours during peak drinking hours in the dark. After six weeks of binge drinking, brains were collected for dendritic/spine analysis. Interim data analyses suggest that mice fed a diet low (1 en%) in LNA significantly lowered weekly voluntary ethanol binge consumption by 29-30% between 3rd and 6th week as compared to mice fed diets high (8 en%) in LNA, high in LNA with supplementation of EPA/DHA (0.5 en%) or low in LNA with supplementation of EPA/DHA (p < 0.05). Currently, morphological changes in dendritic/spine density are being examined between dietary and ethanol treatments. In conclusion, dietary intake of PUFA, specifically n-6 PUFA, may significantly impact voluntary binge ethanol drinking behaviour. (Financial support by NIH Intramural Research Program.)

Epigenetic study of the impact of persistent organic pollutants on the development of metabolic syndrome

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The dramatic increase in the number of people affected by metabolic disorders, mostly associated with obesity, resulted in the rapid development in studies to identify the specific causes of this epidemic. These disorders include many conditions such as cardiovascular and hepatic diseases, diabetes and obesity and are caused by a combination of genetic and environmental factors. Various environmental pollutants, such as persistent organic pollutants (POPs) found in fatty fishes and in omega-3 dietary supplements are known to accumulate in the adipose tissues once ingested. Our objectives are to determine if these pollutants have an effect on the development of metabolic disorders associated with obesity and if they can modify epigenetics signatures that could predispose future generations to complications similar to those of the directly exposed individuals. To verify our hypotheses, we used a murine model of nutritional intervention, studied over several generations. This model will allow us to identify the effects of pollutants, both at the metabolic level and the epigenetic level. Our current results suggest that POPs predispose for metabolic syndrome and cause changes in epigenetic signatures which are transmitted between generations. We have observed a decrease of glucose tolerance in animals two generations down from the exposed animals. Now that we know these pollutants can have negative effects, we will need to study the mechanisms of those effects to find ways to reverse their impact.

Phospholipid class-specific brain enrichment in response to lyso-phosphatidylcholine docosahexaenoic acid infusion

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Recent studies suggest that two major pools of plasma docosahexaenoic acid (DHA) supply the brain: free-DHA and lysophosphatidylcholine-DHA (LPC-DHA). The mechanisms by which these two forms of DHA enter the brain are not clear. In contrast to free DHA, brain uptake of LPC-DHA appears to be mediated by a specific transporter, but it is currently unknown whether both forms of DHA target similar brain phospholipid (PL) pools. The objective of this study was to evaluate brain uptake of free DHA vs LPC-DHA into brain PL classes. Fifteen week-old rats were infused iv with carbon 14 radiolabelled free-DHA or LPC-DHA (n = 4/group) over five mins to achieve a steady-state plasma level. Thereafter, rats were sacrificed by microwave irradiation, brain PLs were extracted and separated by thin layer chromatography and radioactivity was quantified by liquid scintillation counting. The rate of entry of LPC-DHA into the brain was between 62% and 85% lower than the rate of entry of free-DHA, depending on the PL class (P < 0.05 for every class). Compared to the free-DHA group, the proportion of total PL radioactivity in the LPC-DHA group was significantly higher in choline glycerophospholipids (ChoGpl) (48% vs 28%, respectively, P = 0.03) but lower in ethanolamine glycerophospholipids (EnGpl) (32% vs 46%, respectively, P = 0.03). In both groups, radioactivity was disproportionately high in phosphatidylinositol and ChoGpl but low in phosphatidylserine and EnGpl compared to the corresponding DHA pool. These results suggest that the transport of LPC-DHA into the brain might be choline dependant but that free DHA is the main pool supplying brain DHA in every PL class. The difference in the proportion of radioactivity between the PL classes and their corresponding DHA pool size suggest that DHA undergoes extensive PL remodeling after entry into the brain. (Supported by NSERC.)

Vitamin A and alcoholic liver disease: what’s the link?

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Chronic alcohol consumption is associated with significant morbidity and mortality. The liver is one of the primary organs affected by alcohol abuse, causing a wide spectrum of disease progressing from alcoholic fatty liver, to alcoholic hepatitis and cirrhosis. The literature shows that chronic alcohol consumption has a profound effect on whole-body vitamin A homeostasis. This effect is most strikingly observed in the liver, where alcohol abuse is associated with a progressive decline in hepatic vitamin A content that correlates with the severity of alcoholic liver disease. Our overall research goal is to better understand how alcohol’s effect on hepatic vitamin A metabolism and signaling, contributes to the pathogenesis of alcoholic liver disease. Using a mouse model of chronic alcohol consumption, our recent work has characterized several important effects of chronic alcohol consumption on hepatic vitamin A homeostasis. This includes the observation that alcohol has a biphasic effect on hepatic vitamin A levels. In the first phase, alcohol drives the export of hepatic vitamin A stores to extra-hepatic tissues, whereas the second phase involves the catabolic breakdown of vitamin A within the liver. The net result of these two phases is a significant reduction in the amount of vitamin A (i.e. retinol and retinyl ester) present in the liver, as well as altered expression levels of genes and proteins important in hepatic vitamin A metabolism. We have also observed alcohol-induced changes in the acyl composition of hepatic retinyl ester stores, reflecting broad changes in the fatty acyl pool of the liver, and an extremely early and reversible marker of alcohol consumption. This work, and our continuing efforts to characterize the interaction between hepatic vitamin A and alcohol metabolism, and it significance for the development of alcoholic liver disease, will be presented. In conclusion, it is evident that chronic alcohol abuse has a profound effect on hepatic vitamin A metabolism and signaling. Our improved understanding of this effect will lead to a better understanding of the initiation and progression of alcoholic liver disease, and how altered vitamin A signaling may also contribute to other diseases of the liver.

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Iron is an important nutrient for both the host and the bacteria that inhabit it. Since most of the iron ingested by the host remains largely unab sorbed, oral iron supplementation effectively leads to an accumulation of iron in the gastrointestinal tract. Excess iron in the gut may potentially impact the composition of the microbiota, and may be particularly damaging to susceptible individuals, such as patients suffering from inflammatory bowel disease (IBD) in which gut dysbiosis has been reported. However, IBD patients may require oral iron supplementation to treat their iron-deficiency anemia. We fed mice diets supplemented with ferrous sulfate (FS) at different doses (5, 50 and 500 mg of iron/Kg chow) and with different iron formulations (FS, ferrous bisglycinate (FBG) and ferric ethylenediaminetetraacetic acid (FEDTA)), then analyzed the effects on the composition of the gut microbiota via 16S ribosomal RNA gene sequencing. Using the Dextran Sodium Sulfate (DSS)-induced colitis mouse model, we investigated the effects of iron supplementation in colitis severity. Iron supplementation with different doses of FS induced shifts in the gut microbial communities and several inferred metabolic pathways. In addition, FS iron supplementation had a modest, but significant protective effect on DSS-induced colitis. However, depending on the iron formulation used in the diets, the impact of iron supplementation on colitis ranged from beneficial (FBG) to highly detrimental (FEDTA). Our data shows that the form of the iron used to treat iron deficiency may differentially impact the gut microbiota and colitis in mice, and as such suggests that iron forms may be of particular relevance to IBD patients. (This project is funded by CCRS1 and CIHR.)

A diet rich in docosahexaenoic acid partially decreases loss of the structural integrity of the blood-brain barrier in knock-in mice for human E4 apolipoprotein

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Carrying an epislon 4 allele of apolipoprotein E (APOE4) is the most important genetic risk factor for late Alzheimer’s disease. In humans, a diet rich in docosahexaenoic acid (DHA), an omega-3 fatty acid, appears to prevent cognitive decline and cardiovascular disease. We have shown that providing a diet rich in DHA prevented cognitive decline in APOE4 mice but the mechanism explaining this prevention effect remain unknown. The blood-brain-barrier (BBB) is an obligatory interface between the cardiovascular system and the brain and previous studies showed that there is a loss in the integrity of BBB in APOE4 mice. We therefore evaluated whether a diet rich in DHA could prevent the loss of BBB in APOE4 mice. APOE4 (control) and APOE4 mice received a control or a DHA diet from 4 months to 12 months of age (n=12-14 per group). Lectin and collagen IV were used as markers of the integrity of cerebral blood vessels. All images were acquired by confocal microscopy and FluoView software was used to analyse images. In APOE4 mice, lectin was lower expressed on the blood vessels walls compared to APOE4 mice. Also, the thickness of the endothelial cell wall of the blood vessels was thinner in APOE4 mice compared to APOE4 mice. Furthermore, collagen IV and lectin expression were discontinuous in APOE4 mice, suggesting leakage and a loss of integrity of the BBB. From our preliminary results, it seems that DHA improved blood vessel integrity as seen by continuous staining of the vessel walls and higher vessel thickness in APOE4 mice as compared to those fed the control diet. These preliminary results suggest that providing a high dose of DHA in the diet for 8 months prevented the loss of integrity of the BBB in APOE4 mice. These encouraging results will be confirmed by performing more staining.

Proposed taxation on sugar-sweetened beverages

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Context: In February 2016, a proposal to tax sugar-sweetened beverages was put forth by Dietitians of Canada. The goal of this proposal is to reduce consumption of sugar-sweetened beverages due to their association with overweight, obesity and chronic diseases in children and adults. Goal: To determine the level of knowledge and support among registered dietitians for the new taxation proposal, in particular regarding milk-based or plant-based nutritious beverages. Method: 527 registered dietitians, signed up for the NutriNews® newsletter, completed the online survey conducted by Ipsos Marketing between March 31 and April 14. Results: Among survey respondents, 82% were somewhat or completely in agreement with the taxation proposal. A large proportion of the registered dietitians would not recommend that flavoured milk, such as chocolate milk (74%), flavoured drinkable kefir (76%) and flavoured plant-based beverages (75%) be included in the proposed taxation. Based on the data collected from the registered dietitians to determine if they were aware of the proposed taxation and comfortable with the recommendation, we divided the beverages into three categories. First, legitimate beverages, which include energy drinks, slushies, regular soft drinks, fruit beverages such as fruit cocktails and punch, and sweetened, ready-to-drink iced tea and coffee. Second, ambivalent beverages, which include sports drinks as well as sugar-free soft drinks. Third, beverages to exclude from taxation, which include flavoured milk, such as chocolate milk, flavoured plant-based beverages, flavoured drinkable yogurt and flavoured drinkable kefir. Conclusion and implication: The survey results indicate that certain aspects of Dietitians of Canada’s position should be re-examined. (NutriNews® is a registered trademark of Dairy Farmers of Canada.)

Modulation of the biomarkers of inflammation and oxidative stress by trans fatty acids in vascular endothelial cells (HUVEC)

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Background: Trans-fatty acids (TFA) intake has been linked to cardiovascular diseases (CVD) by altering blood lipid profiles. However, the effect of TFA on other CVD risk factors, such as inflammation and oxidative stress, remains controversial. Moreover, evidence suggests that natural rumen-deriven TFA (rTFA) and industrial TFA (iTFA) may have differential health effects. Prostaglandins are biomarkers of inflammation whereas F2-isoprostanes (F2-isop) and the class III isomer 8-iso-PGF2α, are biomarkers for oxidative stress. Objective: To determine whether TFA alter the markers of inflammation and oxidative stress in endothelial cells. Methods: Human umbilical vein endothelial cells (HUVEC) were treated with 24h with 50 μM of rTFA (trans-vaccenic acid (tVA) or trans-palmitoleic acid (tPA)) or iTFA (elaidic acid (EA)). Prostaglandins PGE2 and PGF2α, as well as F2-isop isomers were determined in cell supernatants by liquid chromatography tandem-mass spectrometry (LC-MS/MS). Gene expression was determined by qPCR. Fatty acid composition of cell membranes was obtained by gas chromatography. Results: All TFA decreased the TNFα-induced expression of PGE2 (~75%) and PGF2α (~67%) compared to the control. Moreover, TFA considerably reduced (~90%) the TNFα-induced expression of TNF, vascular cell adhesion molecule-1 (VCAM-1) and superoxide dismutase-2 (SOD2) genes. Regarding F2-isop, EA increased class VI isomers 5,12-iso-IP(2α) (~43%) and 5-IP(2α) (~48%) and iP(2α) (~43%) in all TFA groups. Oppositely, tVA mostly raised class III isomers 8-iso-PGE2 (~105%) and 8-iso-15(R)-PGF2α.
Evaluation of the protective effects of wild blueberries polyphenolic extracts against metabolic disorders in a mice model of diet induced obesity

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The consumption of wild blueberries (WB) (V. [angustifolium] ait) has been proposed to prevent many chronic diseases. Moreover, gut microbiota dysbiosis can partly explain the incidence of those disorders. Recently, many studies have documented the close relationship between the consumption of dietary polyphenols and the modulation of the gut microbiota. Indeed, many polyphenols such as proanthocyanins (PACs) reach the colon intact and can interact/affect the microbiota. The objective of this study was, therefore, to assess the protective effects of different fractions of polyphenols from WB on dysbiosis and metabolic disorders associated with obesity. To test this hypothesis, 5 groups of 12 C57BL/6J mice were fed high-fat high-sucrose diet (HFHS) for 8 weeks and separated daily by gavage with either the vehicle (water) or one of the four WB extracts: a total polyphenol extract, PAC/phe-nolic acid-rich fraction, a flavonol and oligomeric flavan-3-ol fraction (dp<3) and a PAC polymer fraction (dp>4). Other mice were fed a Chow diet and treated with vehicle as a healthy reference control group. Insulin and glucose tolerance tests were performed at 6 and 8 weeks of treatment, respectively. Body weight and food intake were measured weekly. Among HFHS fed groups, we did not observe any change in the body weight gain or food intake. However, glucose tolerance tests revealed that mice receiving PAC polymers might be particularly beneficial for glucose homeostasis. Interestingly, the weight of the caecum of the mice receiving the WB total extract was significantly increased as compared to the HFHS vehicle treated group, suggesting an additional effect of WB polyphenols on the gut microbiota. Our data suggest that PACs are the key polyphenols involved in the beneficial effects of WB consumption on metabolic health. Further analyses are underway to assess whether these metabolic effects of WB PACs can be linked to modulation of the gut microbiota.

Regional adiposity and markers of inflammation in pre-school age children

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In neonates, the enzyme responsible for the initial step of creatine synthesis, the conversion of arginine to guanidinoacetic acid (GAA), occurs mainly in the pancreas and kidney. The subsequent methylation of GAA to creatine primarily occurs in the liver. The quantitative importance of the kidney, pancreas and gut as sources of GAA for hepatic creatine synthesis has not been studied. In neonatal piglets, we used catheters and blood flow probes to measure the net balance of GAA and creatine across the kidney, pancreas and intestine in sow-fed piglets (SF), and in fasted piglets during acute intravenous infusions of arginine + methionine (ARG), creatine + arginine + methionine (CRE), citrulline + methionine (CIT), or alanine (ALA). In SF piglets, the kidneys contributed 87% of the measured GAA produced, with the remainder released by the pancreas. Infusion of ARG and CIT also produced much greater net release of GAA from the kidneys compared to that released from pancreas and gut. However, renal GAA release was greatest with CIT infusion suggesting that citrulline is a better precursor than arginine for GAA synthesis in the kidney. In contrast, ARG, but not CIT, resulted in net release of GAA (or creatine) from the pancreas or intestine, suggesting the gut and pancreas do not have the capacity to convert citrulline into GAA. CRE infusion resulted in much higher GAA release from the gut and pancreas compared to other treatments, perhaps because with CRE infusion, GAA is not used for intracellular creatine synthesis and is released.ALA control failed to produce differences in net GAA release among renal, pancreatic and intestinal tissues. Furthermore, arginine, with or without creatine, produced the greatest net release of creatine from intestinal tissues compared to renal and pancreatic tissues. In summary, GAA released from the kidneys that is synthesized from arginine or citrulline appears to be the major source of GAA for hepatic creatine synthesis in neonatal piglets. (Funded by CIHR.)
Impact of cheese matrix on postprandial lipemia: a clinical study
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Evidence suggests that cheese matrix attenuates the cholesterol-raise effect of dairy fat in comparison with butter. However, the impact of cheese matrix per se on postprandial lipids, which play a major role in the pathogenesis of atherosclerosis, remains unknown. The objective of this study was to investigate the differential impact of fat provided from firm cheese (cheddar) and fresh cheese (cream cheese) on postprandial concentrations of triglycerides (TG) and apolipoprotein (apo) B-48 in healthy subjects. Forty-three healthy women and men were recruited for this single-blinded, randomized, crossover, controlled trial. In a random order, at interval of 14 days and after a 12-hour (h) fast, subjects had to ingest 33 g of fat from cheddar or cream cheese incorporated in standardized meals matched from macronutrients. Blood samples were collected immediately before the meal and at 2, 4, 6 and 8 h. At 2 h, the cream cheese induced a higher increase in TG concentrations than the cheddar cheese (Δ vs baseline: +44 ± 5% vs +47 ± 5%; P=0.0001). At 4 h, the cream cheese and the cheddar induced a similar increase in TG concentrations (P=0.08). At 6 h, the increase in TG concentrations was lower with the cream cheese than with the cheddar (Δ vs baseline: +14 ± 5% vs +42 ± 7%; P=0.0007). Overall, no difference was observed in the incremental area under the curve (iAUC) for TG (P=0.9). The cream cheese led to a lower apolipoprotein B-48 response at 4 h (Δ vs baseline: +42 ± 5% vs +61 ± 5%, P=0.02) and 6 h (Δ vs baseline: +4 ± 5% vs +40 ± 5%, P=0.0002) compared with the cheddar. These differences induced a reduced apolipoprotein B-48 iAUC with the cream cheese (Δ vs cheddar: -26 ± 5%, P=0.004). This study suggests that, in healthy subjects, cheese matrix modulates the TG response and the secretion of chylomicrons after consumption of dairy fat. The cream cheese matrix, characterized by a soft acid curd and small homogenized lipid droplets, likely enhances intestinal fat absorption compared with the firm cheddar matrix. (Funded by the Dairy Farmers of Canada.)

Dysfunctional white adipose tissue dysfunction in humans
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Dysfunctional white adipose tissue (WAT) increases the risk for type 2 diabetes (T2D). Evidence from our lab suggests that elevated concent-
tration of atherogenic apoluB-lipoproteins (hyperapoB) promotes WAT dysfunction and associated risks for T2D in obese subjects. Reduced plasma PCSK9 (proprotein convertase subtilisin/kexin 9) relative to apoluB, which promotes higher tissue-uptake of apoluB-lipoproteins, further increased the association of hyperapoB to WAT dysfunction and IR. The mechanisms linking apoluB-lipoproteins to WAT dysfunction remain unknown. The inflammatory cytokine interleukin 1 beta (IL-1β) promote metabolic abnormalities in adipocytes; however, the metabolic signals that regulate WAT IL-1β system are unclear. Here we tested the hypothesis that apoluB-lipoproteins promote WAT dysfunction through upregulation of the IL-1β system and that this can be attenuated by PCSK9 and omega-3 fatty acids (omega-3 FA). Non-diabetic subjects (N=22, 45-74 years, BMI≥25 kg/m², enrolment on-going) were examined for postprandial fat metabolism (after 13C-triolein was lower in the high n-3PUFA group. Both males and females fed the low n-3 PUFA group (P<0.001), while arachidonic acid, an n-6 PUFA, was lower in the high n-3 PUFA group. Both males and females fed the high n-3 PUFA diet showed higher mRNA expression of SCD1 at weaning, compared to the low n-3 PUFA diet (P<0.05). At weaning, males fed a high n-3 PUFA diet had higher mRNA expression of MBP, compared to the low n-3 PUFA group (P<0.05); while females showed an age-dependent effect of diet. In conclusion, the accretion of DHA in the cerebellum in response to perinatal and postweaning diets high in n-3 PUFA was age and sex-dependent. Furthermore, our findings demonstrate that a diet high in n-3 PUFA upregulates the mRNA expression of SCD1 and MBP during a critical period of brain development, which may aid in the formation and maintenance of the myelin sheath. (Funded by NSERC.)

Omega-3 polyunsaturated fatty acids have an age and sex-specific effect on the regulation of stearoyl-CoA desaturase-1 and myelin-basic protein in the cerebellum of C57BL/6 mice

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The cerebellum is composed of myelinated and unmyelinated neurons, forming the white matter and gray matter. Lipids form a major structural component of the brain’s white and gray matter, with a specific fatty acid composition that changes during development. We investigated the effects of diets high or low in omega (n-3) polyunsaturated fatty acids (PUFA) on cerebellar fatty acid composition, and the mRNA expression of stearoyl CoA desaturase-1 (SCD1), myelin-basic protein (MBP), and brain-derived neurotrophic factor (BDNF) in male and female offspring of C57BL/6 mice. Female C57BL/6 mice were fed semi-purified diets (20% w/w fat) containing 10% (high) or 2% (low) n-3 PUFA before mating, during pregnancy, and until weaning. The offspring were studied at weaning and 16 weeks postweaning on their mothers’ designated diets. The cerebellum phospholipid fatty acid composition and the mRNA expressions of SCD1, MBP and BDNF were measured. Saturated fatty acids decreased (P<0.001), while monounsaturated fatty acids increased (P<0.0001) from weaning to 16 weeks in females. The SCD1 index (oleic acid; C18:1/steaacid; C18:0) increased from weaning to 16 weeks on a high n-3 PUFA diet (P<0.05) in both sexes. Docosahexaenoic acid (DHA), an n-3 PUFA, was higher in the male and female offspring fed the high n-3 PUFA diet, compared to the low n-3 PUFA group (P<0.001), while arachidonic acid, an n-6 PUFA, was lower in the high n-3 PUFA group. Both males and females fed the

Vitamin K distribution in male and female LOU/c rats during development and aging

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Introduction: Discovered for its role in blood coagulation, vitamin K (VK) is now known to be involved in bone, cardiovascular and energy metabolism as well as brain function. In Sprague-Dawley rats, we have shown differential tissue distributions of the K vitamins phylloquinone (K1) and menaquinone-4 (MK-4) as a function of age, sex, and diet. The LOU/c rat is a model of healthy aging characterized by longer lifespan free of disease, low adiposity, and preserved metabolic functions. Here we present the tissue VK distribution of LOU/c rats. Methods: Young (Y 4-7 mo), Old (O 24-32 mo) and Very-Old (VO 39-42 months) male (M) and female (F) LOU/c rats (n=6) were used for this study. K1 and MK-4 were assessed in hippocampus, frontal cortex, cerebellum, pons medulla, striatum, liver (L), pancreas (P), heart (H), kidney (K), and adipose tissue (AT), by HPLC. Results: In all brain regions tested in H, K and P, MK-4 was the main K vitamin whereas a mixture of K1 and MK-4 was observed in AT and L. In all tissue investigated, the effect of sex was minimal. Except in L, total VK tended to increase as a function of age (Y vs O and VO, p<0.05), especially in F rats; in VO M rats, total VK tended to decrease (ns). Conclusion. Whether the observed age-related changes in VK tissue distribution are linked to the phenotype of this rat strain remains to be determined. (Funded by the Québec Network for Research on Aging.)

Vitamin K and cognition: mechanistic studies in a warfarin-treated rodent model

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Introduction. There is growing evidence that vitamin K (VK) plays a role in cognition. Some in vitro studies have shown how VK affects different molecular pathways in brain cells, but few in vivo studies have been conducted. Warfarin (W), a widely used oral anticoagulant, acts by blocking the VK cycle. In a previous report, we observed VK treatment to result in a significant decrease in MK-4 concentration in a treated rodent model (Funded by NSERC.)
Effect of omega-3 long-chain polyunsaturated fatty acids on the immune response in preterm infants < 29 weeks gestation. Results from a single-centre nested study in the N3RO randomised controlled trial

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Preterm infants are predisposed to developing inflammatory disorders during the neonatal period. Omega-3 long-chain polyunsaturated fatty acids are known to exert an immunoregulatory effect in adults and animals and preliminary data in preterm infants suggests a benefit. This study aimed to assess the effect of supplemental enteral docosahexaenoic acid (DHA) on levels of inflammatory biomarkers in preterm infants. This single-centre nested study in the N3RO randomised controlled trial (ACTRN 12612000503820) included a total of 51 preterm infants (27 intervention, 24 control) < 29 weeks gestational age with no major congenital malformations. Infants in the intervention group received an enteral lipid emulsion providing 60 mg/kg/day DHA and infants in the control received a control (soy) emulsion without DHA from baseline (approximately 3 days postnatal) to study end (36 weeks postmenstrual age/discharge/transfer). A blood sample was collected at baseline, approximately two weeks postnatal and at study end. Pro-inflammatory (IL-1β, IL-6, IL-8, IL-12p70, IL-17A, IL-23, MIP-1α, TNFα and IFNγ) and regulatory cytokines (IL-10) (MILLIPLEX® MAP high sensitivity magnetic bead panel), surfactant protein D (SP-D) (ELISA) and fatty acid levels (gas chromatography) were assessed in blood samples. Remaining blood was incubated with/without E. coli lipopolysaccharide and pro-inflammatory and regulatory cytokines were assessed in supernatants (flow cytometry). Within both DHA and control groups, there was a significant increase over time in IL-8 and TNFα levels in unstimulated whole blood and in IL-10 and TNFα levels following LPS stimulation. IL-6, IL-8, IL-10, TNFα, and TGFβ1 levels in plasma changed significantly over time but were not significantly different at any time point between groups. SP-D levels were significantly reduced in the intervention group at study end. Supplementation DHA at a dose of 60 mg/kg/day does not attenuate the release of pro-inflammatory mediators nor does it upregulate regulatory mediators in preterm infants < 29 weeks gestation. The reduction in SP-D at 36 weeks postmenstrual age in the intervention group and the relationship to lung development deserves further research.

Impact of a nutritional intervention in type 1 diabetic patients with metabolic syndrome

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Recent data has shown that up to 45% of patients with type 1 diabetes (T1D) have metabolic syndrome (MS), a comorbidity in rapid rise. The MS is a cluster of risk factors including abdominal obesity, hypertension, dyslipidemia and insulin resistance. It is an emergent problematic with few preventive or therapeutic interventions reported yet. A balanced low fat diet is recommended to improve the lipid profile and reduce cardiovascular risk for T1D patients. However, recent studies have demonstrated health benefits of a Mediterranean diet (MED) in the general population and in type 2 diabetic patients. The objective of this study is to compare 2 nutritional interventions (MED diet vs low fat diet) on waist circumference in T1D patient with MS. Participants are randomised into 2 groups: 1) MED diet or 2) Low fat diet. The intervention includes 12 visits over 36 weeks with 9 nutritional education sessions. At inclusion, after 3 months and 6 months, anthropometric and biochemical measures are taken. To date, 20 participants are included (52,0±9,4 years, BMI:30,3±3,5 kg/m2, Waist circumference:104,1±9,4 cm), and 7 have completed the study. Preliminary results show no significant difference in waist circumference reduction between both dietary interventions (-3,86cm low fat diet vs -2,33cm MED diet; p=0.542) or BMI (-1,08kg/m2 low fat diet vs -0,73kg/m2 MED diet; p=0,59) after 6 months. In conclusion, these preliminary results demonstrate that a nutritional intervention on T1D patients with MS leads to a waist circumference and BMI reduction, with no significant difference between both diets. The planned complete sample size (n=28) will allow to determine if one of the diets brings more benefits on cardiometabolic profile. Moreover, the results could allow the comprehension of the advantages associated with a MED diet and might contribute to the development of nutritional strategies for those patients.
Practices, perceptions and expectations for carbohydrate counting in patients with type 1 diabetes – results from an online survey

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Precise carbohydrate counting (CC) is important to achieve good glycemic control in diabetic patients on insulin therapy, but this task can be challenging for many patients. The objective of this study is to characterize adult patients with diabetes on intensive insulin therapy in terms of: a) practices and perceived difficulties relative to CC and diabetes treatment, and b) their perceptions and expectations relative to CC. Participants completed a 30-question web-based questionnaire. Participants with type 1 diabetes (T1D) and using CC as part of their treatment plan (n=180) were included in this analysis. Participants were predominantly women (64%), aged 42 ± 13 years old and had diabetes for 22 ± 13 years. Result show that a large proportion of participants reported being confident in applying CC (78%) and considered precise CC as being important for glycemic control (91%), while only 17% reported finding CC difficult. Despite the low perceived difficulty associated with CC, many specific difficulties were encountered by patients such as the perception that glycemia fluctuates even with appropriate CC and that CC complicates the management of diabetes. A larger proportion of participants with a lower level of education (less than university degree) and current or history of depression reported not feeling confident in applying CC. Most respondents believed that new technologies could facilitate CC (57%) and would be interested in such technology (62%). In conclusion, although a majority of participant reported being confident in applying CC, many difficulties and constraints associated with CC have been identified. These results highlight that patients with a lower level of education and with a history or current depression could benefit from specific CC education strategies. Future studies should examine the efficacy of technology tools to facilitate CC.

Assessing the nutritional quality of prepackaged foods carrying nutrient content and front-of-pack claims in the Canadian food supply

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Consumers can use nutrition claims displayed on food labels to inform their food choices. However, claims highlight certain nutrients or beneficial components while minimizing other less desirable ones, potentially misleading consumers to think products are healthier than they are. In Canada, the use of nutrient content claims (NCC) is regulated and allowed only when products meet the established criteria for a given nutrient. The use of front-of-pack (FOP) claims, such as hybrid and calorie specific systems, are also allowed as “other general claims”. Since the overall the nutritional quality (or “healthfulness”) of foods is not a criterion required for a product to carry a claim, the nutritional quality of products with claims remains unknown. Objective: To assess the proportion of “healthier”/“less healthy” prepackaged foods and beverages carrying NCC and FOP in the Canadian food supply. Methods: Cross-sectional analysis of the University of Toronto 2013 Food Label Information Program (n=15,342). Analyses were limited to prepackaged products carrying NCC (n=6442) and FOP (n=3056). The Food Standards Australia New Zealand Nutrient Profiling Scoring Criterion (FSANZ-NPSC), a system developed to determine the eligibility of a food to carry health claims, was used to determine a summary score of “healthfulness” for each product based on the content of nutrients to limit (e.g. sodium) and nutrients to encourage (e.g. fibre). Products were classified as “healthier”/“less healthy” using established cutoff scores in the FSANZ-NPSC. Results: 41.3% of products carrying NCC and 36.3% of products carrying FOP were considered “less healthy”. However, the proportion varied across the different subtypes of claims. For instance, products carrying trans fat, lean, or saturated fat claims were the ones “less healthy” (55%, 48%, 45%, respectively). In regards to different FOP, 45.4% of foods carrying calorie specific systems were “less healthy”, in contrast with only 21.3% of foods carrying FOP hybrid systems. Conclusion: More than a third of products carrying a NCC or a FOP were considered “less healthy”, although the proportion of products that were “less healthy” varied across the different subtypes of claims. (Funding: Department of Nutritional Sciences Graduate Student Fellowship [BFA], E. W. McHenry Research Chair Operating Grant [MRL].)

Determination of dietary protein intake in stable, active infection and hospitalized HIV patients living in Vancouver, Canada

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BACKGROUND: Wasting, defined as the loss of fat and lean tissue, is still prevalent in human immunodeficiency virus (HIV) infection despite effective highly active antiretroviral therapy (HAART) and potentially leads to muscle weakness and organ failure. Loss of lean mass is particularly challenging in a person living with HIV (PLWH) due to their suggested increased nutrient needs due to HIV and other related opportunistic infections. In particular dietary protein could play a role in preservation of lean mass. Protein requirements in HIV according to ESPEN guidelines are set at 1.2 g/kg/d during stable phases, and at 1.5 g/kg/d during active acute illness, although these are factorially derived. There is no data comparing protein intakes among PLWH who are stable (asymptomatic), PLWH with opportunistic infections (not requiring hospitalization) or PLWH with opportunistic infections requiring hospitalization, and whether they meet current recommendations. METHODS: Convenience sampling (n=10 from each group) of patients within the Immunodeficiency Clinic and Infectious Diseases Clinic (IDC), St. Paul’s Hospital was conducted among PLWH, PLWH-I (with active infections) and PLWH-H (hospitalized). Three-day food records (2 weekday and 1 weekend) were collected and analyzed using ESHA Nutrition Analysis Program. RESULTS: Body weight was significantly different among the three groups PLWH (80.5±10.2 kg), PLWH-I (76.1±11.6 kg) and PLWH-H (70.8±12.8 kg) (p<0.05). Similarly, BMI was also significantly different among the 3 groups – 26.4±3.9 kg/m², 26.3±5.9 kg/m² and 21.2±4.4 kg/m² for the PLWH, PLWH-I and PLWH-H groups, respectively. Preliminary results suggest that protein intakes were 1.18 ±0.65 g/kg/d, 1.16 ±0.10 g/kg/d and 1.55 ±1.0 g/kg for the PLWH, PLWH-I and PLWH-H groups, respectively and was significantly different (p<0.05). CONCLUSION: Our results suggest that although PLWH who are stable and PLWH-H who are hospitalized meet the average daily protein needs, PLWH-I with active opportunistic infections do not have adequate protein intakes. The PLWH-H group presumably meet their recommended protein intakes due to the hospital menu being more appropriate for patients, although their BMI was the lowest, and suggests wasting. Future work should determine the actual protein needs among PLWH-I/H to prevent wasting. (Supported by a Providence Health Care Practice-based Research Challenge award.)

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Abstracts

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Trimodal prehabilitation attenuates the loss of lean body mass and enhances functional capacity post-colectorectal surgery for cancer: a pooled analysis of randomized controlled trials

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Background: Prehabilitation is an intervention designed to use the waiting period before surgery to optimize functional reserve. Trimodal prehabilitation consists of nutrition counselling with whey protein supplementation, aerobic and resistance exercise, and anxiety-reduction strategies that begin 4 weeks before surgery and continue for 8 weeks after surgery. The impact of prehabilitation on body composition before and after surgery is unclear. Methods: A pooled analysis of two randomized controlled trials of trimodal prehabilitation (n=68) vs. rehabilitation (n=61) at a single university-affiliated tertiary center was conducted. The primary objective was to evaluate the capacity for prehabilitation to improve the lean body mass (LBM) of adults before and after colorectal surgery for cancer within the context of Enhanced Recovery After Surgery. Body composition measurements were obtained using bioelectrical impedance and recorded in absolute (kg) and relative (% of body weight) terms at baseline, day of surgery, and 8 weeks after surgery. Six-minute walk test (6MWT) measurements were recorded at the same time points to assess functional recovery; excellent recovery was defined as a change in 6MWT >20m. Data were analyzed using independent and paired t-tests, and reported as mean, 95% confidence interval (95%CI). Results: Patients following prehabilitation experienced a positive shift in body composition before surgery: relative LBM improved by +0.4%(95%CI: 0.04 to 0.8%, p=0.03) and fat mass reduced -0.7% (95%CI: -1.2 to -0.1%, p=0.02). No preoperative differences were found in the rehabilitation group. Eight weeks after surgery, the rehabilitation group experienced a statistically significant loss in relative and absolute LBM compared to baseline (-1.8%, 95% CI: -3.3 to -0.3, p=0.023; -1.1kg, 95%CI: -1.9 to -0.3kg, p<0.01), while LBM was preserved in the prehabilitation group (-0.04%; 95%CI: -1.1 to 0.3%, p=0.274; -0.6kg, 95%CI:-1.2 to 0.04kg, p=0.07). Nearly twice as many prehabilitated patients experienced an excellent functional recovery after surgery (52.3 vs. 27.3%; p<0.01). Conclusion: Maintenance of lean mass is increasingly recognized as a primary outcome for cancer care. Patients following prehabilitation maintained LBM and experienced an earlier functional recovery at 8 weeks post-colectorectal surgery for cancer. Prehabilitation might thus be a complementary addition to the treatment of surgical cancer patients.

Safety of a simplified meal bolus approach with an artificial pancreas

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Mild to moderate hypoglycemia (blood glucose <4.0 mmol/L) is recommended to be treated with 15g of carbohydrates and to repeat treatment if hypoglycemia persists after 15-min. This recommendation was established before intensive insulin therapy (IIT) and based on studies using insulins with different pharmacokinetic profiles from actual insulin analogues showing that 15g of glucose increases blood glucose by ~1.5 mmol/L in 15-min. The objective was to examine if 15g of carbohydrates is effective to treat hypoglycemia in type 1 diabetes (T1D) patients treated with IIT and to explore factors associated with treatment effectiveness. This is a secondary analysis of the control arm of three observational inpatient studies with a standardized and supervised treatment of hypoglycemia (<3.3 mmol/L with symptoms or <3.0 mmol/L without symptom) in patients using continuous subcutaneous insulin infusion (“insulin pumps”; CSII). The treatment consisted of 15g of glucose tablets with a second treatment after 15-min if the hypoglycemia persisted (<3.3 or 3.0 mmol/L). Plasma glucose values were measured. A total of 15 adolescents and 42 adults with TID were included (65% men; 38.8±17.2 years old; with TID for 22±13 years; A1c 7.7±0.8%). A total of 70 hypoglycemia episodes were observed in 34 participants. Plasma glucose increased over 4.0 mmol/L in ≤15min in only 14 cases (20%) and a second treatment was necessary for 11 episodes (16%). The average time required for normoglycemia recovery (>4.0 mmol/L) was 24±12 [min 4 – max 58] minutes. The average rise in plasma glucose following the 15g treatment was 0.68 mmol/L in 15-min. Factors associated with a slower rise of plasma glucose are; a lower proportion of prandial vs basal insulin doses and a longer duration since last meal (p=0.009 and p=0.002). Inversely, physical activity practice <3 hours before the episode was associated with a more rapid rise of plasma glucose (p=0.002). In the context of actual IIT with CSII, it is possible that 15g of carbohydrates is insufficient to treat a majority of hypoglycemia episodes. Several factors which might need to be considered for hypoglycemia treatment have been identified. (Supported by the J.A. De Sève Foundation and a CHIR-Foundation Grant.)

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Determining the source of brain DHA via compound specific isotope analysis

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Background: The fat-1 transgenic mouse possesses the ability to endogenously convert omega(n)-6 polyunsaturated fatty acids (PUFA) into omega(n)-3 PUFA. Recent studies performed by our lab have revealed that the addition of n-3 PUFA to a diet rich in n-6 PUFA does not further augment brain DHA concentrations in fat-1 mice beyond the levels attained when fed a diet solely containing n-6 PUFA. When fed a diet rich in both n-3 and n-6 PUFA, it remains unclear if the fat-1 mouse obtains its brain DHA from preformed dietary DHA or via endogenous synthesis of DHA from n-6 PUFA. Objective: The objective of this study is to determine the source of brain DHA in fat-1 mice fed a diet rich in both n-3 and n-6 PUFA. Methods: We utilized natural abundance compound specific isotope analysis to determine the source of brain DHA, an approach that has not been previously applied to analyze brain lipids. Fat-1 mice and their wild-type litter-mates were bred in house and weaned onto one of the following 10% fat diets: 8% corn oil, 2% menhaden oil diet, 10% corn oil diet, 8% safflower and 2% menhaden oil diet or a 10% safflower oil diet. Animals remained on their respective diet until 12 weeks of age at which point they were euthanized via cardiac puncture. Fatty acids were extracted from brain tissue, methylated and 13C isotopic values of fatty acid methyl esters were assessed via gas chromatography-combustion-isotope ratio mass spectrometry. As the n-3 and n-6 PUFA components from different dietary sources display unique 13C values, the source brain DHA can be determined through comparing 13C values of DHA to the 13C of the fatty acids within their respective diets. Results: The results of this project are currently being analyzed and will be available prior to May 2017. Significance: In addition to determining the main source of brain DHA in fat-1 mice, this is the first study to apply compound specific isotope analysis to trace the source of brain lipids. Validation of this methodology provides a novel approach to answer future physiologically relevant questions pertaining to brain lipids.

Vitamin D status of a Canadian cohort of children with sickle cell disease

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Background: Sickle cell disease (SCD) can lead to multiple complications, including bone complications and pain crisis. Vitamin D has been reported to have multiple skeletal and extra-skeletal effects, which might help prevent those complications. Objectives: The objectives of our study were to 1) evaluate the clinical practice at the Sainte-Justine University Hospital Center (UHC) regarding the assessment of vitamin D status in children with SCD, and 2) document the prevalence of vitamin D deficiency, vitamin D intakes and compliance to vitamin D supplementation in our cohort. A secondary objective of our study was to determine if vitamin D deficiency is associated with SCD complications. Methods: Children from our population of patients with SCD (n = 307) whom had a vitamin D level measured within the year prior to data collection were included. Serum 25-OH-vitamin D and SCD-related complications were extracted from medical charts. Vitamin D deficiency was defined as 25-OH vitamin D less than 30 nmol/l and vitamin D insufficiency as 25-OH vitamin D less than 50 pmol/l. Vitamin D intakes and adherence to supplementation were also assessed for 46 of those patients. Results: Our study population included 116 SCD patients. Amongst those, 67% of children were vitamin D insufficient while 33% were deficient. Vitamin D intakes were also insufficient (352.59 +/- 234 IU) and were correlated to serum 25-OH-vitamin D levels (p = 0.005). Moreover, 17% of patients took vitamin D supplements, but only 50% were adherent to their supplementation. Finally, 28.6% of insufficient patients had renal complications, compared to 7.9% for non-insufficient patients (p=0.020) while 22.2% of deficient patients had gall-bladder complications compared to 7.0% for non-deficient patients (p= 0.023). Conclusion: Given the high prevalence of vitamin D deficiency and its potential association with SCD complications, vitamin D supplementation and effective compliance strategies should be considered in Canadian children with SCD. These results highlight the need for randomized double blind placebo controlled trials to test the impact of optimal vitamin D supplementation on clinically important outcomes in children with SCD.
Mother-to-fetus transfer of probiotic lactobacilli in CD-1 mice during pregnancy

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Background: Gut microbial colonization is largely determined in early life. Some studies suggest that this process may start during pregnancy. In fact, probiotics administered to pregnant mothers, including *Lactobacillus rhamnosus* GG, have been found in the feces of their offspring. This may result from vertical transfer, including transmission of microorganisms from mother to child during pregnancy, birth and lactation. *Lacidofil®* is a commercial probiotic mixture of *L. rhamnosus* R0011 and *L. helveticus* R0052 sustaining gut microbiome composition in children and adults. Aim: To investigate the transfer of *Lacidofil®* strains from the dam to fetus during pregnancy. Methods: Six-week old female CD-1 Elite mice were randomized to receive *Lacidofil®* (1x10^9 CFU/mL, n= 6) or nothing (control, C; n= 4) in drinking water for 1 week prior to mating and throughout pregnancy. Probiotic viability was assessed via plating onto de Man Rogosa Sharpe agar. Dams were sacrificed at end of gestation. Dam umbilical cord, placenta and feces and fetal small and large intestine were used for bacterial quantification by qPCR (*L. rhamnosus* R0011 and *L. helveticus* R0052) and digital droplet PCR (total bacteria and lactobacilli). Results: The 2 probiotic strains were recovered in feces of probiotic-treated dams, but not controls, throughout pregnancy. All dam and fetal tissues studied in each group contained lactobacilli. Probiotic *L. rhamnosus* R0011 was quantified in the placenta (1.49 x 10^9 ± 8.49 x 10^3 CFU/g) and large intestine (2.44 x 10^6 ± 4.22 x 10^6 CFU/g), but not in the umbilical cord and fetal small intestine nor in any control tissues. Conclusions: These findings indicate that fetal tissues contain an abundance of lactobacilli. Moreover, we demonstrate that the fetal microbiome is modifiable via probiotic administration prior to and during pregnancy, which supports the concept of vertical transfer of microorganisms. (NSERC Discovery and Lallemand Health Solutions donation (EMC). NSERC CGSM (AH). OGS (SES). CIHR MOP-89894 and IOP-92890 (PMS), Canada Research Chair in Gastrointestinal Disease (PMS). Law- son Family Chair in Microbiome Nutrition Research (EMC).)

Vitamin B6 status in healthy older adult women in metro Vancouver

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Vitamin B6 deficiency, defined as having plasma pyridoxal 5-phosphate (PLP) concentration <20 nmol/L, has been associated with impaired immune responses and depression. Suboptimal B6 status (plasma PLP= 20-30 nmol/L) has been associated with an increased risk of cardiovascular disease and breast, lung, and colorectal cancer. A 19.4% prevalence of inadequate dietary B6 intake was reported among older adult women (51-70 y) in the Canadian Community Health Survey 2004, compared to a 9.6% prevalence in young adult women (19-30 y). Our group reported a 12.4% prevalence of low B6 status (plasma PLP <30 nmol/L) among 202 healthy young adult women in Metro Vancouver; thus, a higher prevalence of low B6 status was hypothesized in older adult women. This study aimed to assess the prevalence and predictors of B6 deficiency and suboptimal B6 status in older adult women residing in Metro Vancouver, BC. We conducted a descriptive, cross-sectional study on 223 self-reported healthy, older adult women (51-70 y). The participants were recruited using the convenience sampling method between 2015 and 2016. Vitamin B6 status was assessed by determining fasting plasma PLP concentrations.
Anthropometric, demographic, and lifestyle data were collected, and dietary intake was assessed using the Canadian Diet History Questionnaire II. The prevalence of B6 deficiency and suboptimal B6 status was 2.3% and 10.9%, respectively, in these older adult women with a mean (95%CI) BMI of 24.9 (24.2, 25.6) kg/m². Mean (95%CI) plasma PLP concentration was 77.1 (68.4, 86.8) mmol/L. Overall, the participants were highly educated and 30% reported the use of B6-containing supplements. Mean (95%CI) dietary B6 intake was 1.8 (1.7, 1.9) mg/d (EAR 1.3 mg/day); 23% had inadequate dietary B6 intake. The overall 12.3% prevalence of low B6 status in this sample of older adult women was similar to the 12.4% prevalence we observed in young adult women in Metro Vancouver; more research is underway to identify predictors of low B6 status. In light of the association of suboptimal B6 status with leading causes of death, and our findings in this demographic, we propose that there is a need to investigate B6 status in a representative sample of Canadians.

The effect of modulating brain omega-3 polyunsaturated fatty acids on inflammatory gene expression and concentrations of eicosanoids and docosanoids in a mouse model of Alzheimer’s disease

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Mounting evidence implicates neuroinflammation as a mechanism by which amyloid-β (Aβ) plaques cause neuronal death in Alzheimer’s Disease (AD). Omega-3 polyunsaturated fatty acids (PUFA) and molecules derived from them, including EPA-derived eicosanoids and DHA-derived docosanoids, are known to have both anti-inflammatory and pro-resolving properties in the periphery, while human observational data links consumption of these fatty acids to decreased risk of AD. While several studies have identified anti-inflammatory effects of omega-3 PUFA feeding in AD models, none have investigated whether these effects are mediated by changes in brain eicosanoids and docosanoids. Fat-1 mice and their wildtype littermates were fed diets containing either fish oil (high n-3 PUFA) or safflower oil (negligible n-3 PUFA) from weaning. Fat-1 mice have a transgene that allows them to synthesize omega-3 PUFA, and previous work in our lab showed that these animals attain similar levels of brain DHA to wildtype mice fed fish oil, and significantly higher levels than wildtype mice fed safflower oil. After 12 weeks of feeding, animals underwent intracerebroventricular infusion surgery, in which either Aβ or a control peptide were injected into the left lateral ventricle of the brain. Ipsilateral hippocampi were collected from the Aβ and control peptide injected animals, as well as non-surgery controls, 10 days following surgery. This time point was identified in our previous work as the peak neuroinflammatory response. Microarray with gene ontology analysis was used to identify changes in inflammatory gene expression in response to either brain omega-3 PUFA composition or injection of Aβ peptide, and validation of these results with real time PCR is underway. Liquid chromatography with tandem mass spectrometry will be used to measure brain eicosanoids and docosanoids. Results will be presented at the conference. This study will be the first to investigate the relationship between omega-3 PUFA feeding, brain docosanoid and eicosanoid levels, and neuroinflammation in an AD model. It will therefore provide important mechanistic insight that could aid in the development of nutritional recommendations and novel therapeutics. (R.P.H: holds a CIHR grant and CRC and K.E.H holds a Vanier scholarship.)

Dietary patterns and metabolic syndrome among Canadians 12 to 79 years old

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Two main causes of death in Canada are cardiovascular diseases and diabetes. Metabolic syndrome (MetS) is constituted of the important risk factors that are strongly associated with these non-communicable diseases. Diet is an important factor in modifying the status of MetS. Recently, researchers have used the dietary pattern approach rather than the nutrient or food group methods to evaluate the association between diet and MetS. The objective of this study was to determine the association between prevalent dietary patterns with MetS among 12 to 79-year-old Canadians. Data were obtained from the Canadian Health Measures Survey combined Cycles 1 & 2 data collected between 2007-11. Food frequency questionnaire was used to determine the usual dietary intake. To extract the dietary patterns of Canadians, the principal component analysis method was used. The status of MetS was determined using the harmonized MetS statement for adults and adolescents. After controlling for potential covariates, logistic regression was used to determine the association between MetS and dietary patterns. To produce nationally representative results, weighting and bootstrapping were applied (alpha= 0.05). Excluding individuals with diabetes, 17% of Canadians aged 12-79y had MetS. Abdominal obesity was the most prevalent (32.5%) MetS component. Four different prevalent dietary patterns were extracted, and these were named: “Western”, “Healthy like”, “Dairy, cereal and fruit” and “Unhealthy grains” dietary patterns. The “Healthy-like” dietary pattern, characterized by high intakes of beans, nuts, fruits, tomato/sauce, lettuce, spinach, other vegetables, regular fat salad dressing/mayonnaise, was found to be inversely associated with MetS among Canadians 12-79y (P=0.027). Similarly, the “Dairy, cereal and fruit” dietary pattern was marginally inversely associated with MetS (p=0.058). After excluding the adolescents from analysis, a “Healthy-like” and a “Fast food” dietary pattern emerged that had an inverse (P=0.054) and direct (P=0.011) association with MetS, respectively. Our findings suggest that a “Healthy like” dietary pattern characterized by high intake of fruits, vegetables, dairy and cereal may protect against the risk of developing MetS among Canadians age 12-79y. These results require further investigation among smaller sociodemographic groups. (Supported by a contribution from the Dairy Research Cluster Initiative and the University of Saskatchewan.)

Protection of parenteral nutrition solutions from ambient light reduces oxidative stress and improves intestinal blood flow during parenteral feeding in neonatal miniature piglets

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Exposure of total parenteral nutrition (TPN) solutions to ambient light amplifies oxidative stress which may contribute to the development of enteral feeding intolerance due to reduced mesenteric blood flow, secondary to nitric oxide depletion. The major intracellular antioxidant is glutathione, a tripeptide containing cysteine, which may be an essential amino acid in neonates. Unfortunately, cysteine has limited solubility in solution and is either absent or low in neonatal TPN products. N-acetyl cysteine (NAC) has proven to be a stable, bioavailable source of cysteine in TPN-fed piglets. Photoprotection of TPN solutions and supplementation with NAC may be viable options to reduce the induced oxidant load, spare nitric oxide to sustain mesenteric blood flow, and attenuate gut atrophy associated with TPN. Neonatal Yucatan miniature piglets (N=20, 7-9d old) were surgically fitted with central venous catheters and an ultrasonic blood flow probe around the superior mesenteric artery (SMA). Piglets were fed continuously for 7 d either light-protected (LP) or light-exposed (LE) complete TPN that was either NAC- or alanine (ALA)-enriched. There were no differences in final body weight among groups after 7 d. Hepatic lipid peroxidation (i.e., thiobarbituric acid reactive substances) was reduced by 25% in piglets receiving LP versus LE TPN (P<0.05). SMA blood flow decreased in all pigs between d 2 and 7 (P<0.0001). Photoprotection alone (LP-ALA) attenuated the TPN-associated decrease in blood flow to 61% of baseline on d 7 compared to 41% for LE-ALA pigs (P<0.05);
LE-NAC and LP-NAC piglets had intermediate reductions in blood flow (57% and 43%, respectively). Overall, gut morphology was not different. Photoprotection of TPN in piglets attenuates hepatic lipid peroxidation and TPN-associated decline in blood flow to the gut. Surprisingly, addition of NAC as a source of cysteine appeared to offset this photoprotective effect. It is possible that cysteine was not limiting glutathione production. Photoprotection is a simple, effective method to attenuate TPN-induced gut atrophy which may facilitate re-introduction of enteral feeding. (Supported by Janeway Children’s Research Foundation.)

Exercise and consumption of n-3 polyunsaturated fatty acids independently reduce the onset of mammary tumor development
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Development independently reduce the onset of mammary tumor
Research Foundation.)

High protein (HP) diets are increasing in popularity, but their effects on muscle mass and strength (sarcopenia). Although sarcopenia has multifactorial causes, it might be partly attributed to a blunted response to anabolic stimuli. Leucine acutely increases muscle protein synthesis through the Akt/mTORC pathway. Resistance training (RT) is the strongest stimuli to counteract sarcopenia and was recently shown to improve insulin sensitivity (IS) in frail elderly women. Discrepancies exist whether chronic supplementation of leucine in conjunction with RT can improve muscle mass and IS. We determined the effects of leucine supplementation and RT on IS in prefrail elderly women as part of an ongoing double-blinded placebo controlled study. Methods: Eleven non-diabetic prefrail elderly women (79±12.9 y, BMI: 23.8±1.3 kg/m2), based on the Frailty Phenotype underwent a 3-month intervention of RT 3x/week with protein optimized diet of 1.2 g/kg/d and 7.5 g/d of leucine (LEU) supplementation vs. placebo alanine (ALA). Pre/post-intervention fasting glucose, insulin and 4-hour responses to a standard meal of complete liquid formula, body composition using DEXA and leg press by 1-repetition maximum test were measured. Statistical analysis comprised of 2-factor ANOVA, and pooled data by paired t-test. Significance was p<0.05. Results: No significant effects of exercise and/or supplementation were observed for postprandial areas under the curve of insulin or glucose in LEU vs. ALA groups (p=0.31). When group data were pooled, there were no within-group differences pre vs post (insulin: 79667 ± 8975 pM & 72742 ± 10493 pM; glucose: 806 ± 59 mM & 781 ± 72 mM; NS). Total LBM and leg strength increased significantly for both groups post-intervention (0.81 ± 0.13 kg, and 61±8 kg respectively, p<0.001). The delta gain between LEU vs ALA groups of LBM was 0.61 ± 0.15 kg & 0.98 ± 0.18 kg (NS) and of leg strength was 56.4 ± 12.5 kg & 62.4 ± 13.9 kg (NS). Conclusion: Preliminary data show that IS was not affected by RT and leucine supplementation in non-diabetic prefrail elderly women. Therefore, leucine supplementation does not appear to influence IS under these conditions, which remains to be confirmed at study completion.

A high protein diet alters rat kidney and liver oxylipins
Md Ariful Islam and Harold Aukema

Combined leucine supplementation with resistance exercise training in prefrail elderly women does not alter insulin sensitivity
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Background: Frailty is a clinical condition associated with loss of muscle mass and strength (sarcopenia). Although sarcopenia has multifactorial causes, it might be partly attributed to a blunted response to anabolic stimuli. Leucine acutely increases muscle protein synthesis through the Akt/mTORC pathway. Resistance training (RT) is the strongest stimuli to counteract sarcopenia and was recently shown to improve insulin sensitivity (IS) in frail elderly women. Discrepancies exist whether chronic supplementation of leucine in conjunction with RT can improve muscle mass and IS. We determined the effects of leucine supplementation and RT on IS in prefrail elderly women as part of an ongoing double-blinded placebo controlled study. Methods: Eleven non-diabetic prefrail elderly women (79±12.9 y, BMI: 23.8±1.3 kg/m2), based on the Frailty Phenotype underwent a 3-month intervention of RT 3x/week with protein optimized diet of 1.2 g/kg/d and 7.5 g/d of leucine (LEU) supplementation vs. placebo alanine (ALA). Pre/post-intervention fasting glucose, insulin and 4-hour responses to a standard meal of complete liquid formula, body composition using DEXA and leg press by 1-repetition maximum test were measured. Statistical analysis comprised of 2-factor ANOVA, and pooled data by paired t-test. Significance was p<0.05. Results: No significant effects of exercise and/or supplementation were observed for postprandial areas under the curve of insulin or glucose in LEU vs. ALA groups (p=0.31). When group data were pooled, there were no within-group differences pre vs post (insulin: 79667 ± 8975 pM & 72742 ± 10493 pM; glucose: 806 ± 59 mM & 781 ± 72 mM; NS). Total LBM and leg strength increased significantly for both groups post-intervention (0.81 ± 0.13 kg, and 61±8 kg respectively, p<0.001). The delta gain between LEU vs ALA groups of LBM was 0.61 ± 0.15 kg & 0.98 ± 0.18 kg (NS) and of leg strength was 56.4 ± 12.5 kg & 62.4 ± 13.9 kg (NS). Conclusion: Preliminary data show that IS was not affected by RT and leucine supplementation in non-diabetic prefrail elderly women. Therefore, leucine supplementation does not appear to influence IS under these conditions, which remains to be confirmed at study completion.

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Impact of eating behaviour traits in genetic susceptibility to obesity

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Genetic factors and eating behaviour traits have been associated with obesity. Eating behaviour traits have also shown genetic influences. The aim of this study was to evaluate whether eating behaviour traits mediate the association between obesity-related genetic variants and obesity. We hypothesized that eating behaviour traits partly mediate this association. Seven hundred and eighty-eight individuals (body mass index (BMI) = 28.1±7.7 kg/m2; age = 44±6.6 years) who participated in the Québec Family Study were included in the analysis. A genetic risk score (GRS) of obesity was calculated based on the 97 obesity-related loci identified in a recent genome-wide meta-analysis of BMI. Anthropometric variables (BMI, waist circumference (WC)) were measured. Eating behaviour traits (cognitive restraint, disinhibition, susceptibility to hunger and subscales) were assessed using the Three-Factor Eating Questionnaire. Logistic regressions, adjusted for age and sex, showed that the odds of being obese (BMI≥30 kg/m2) or being abdominally obese (women WC≥88 cm; men WC≥102 cm) were 0.20, p=0.002; indirect=0.04, p=0.02), internal locus of control (indirect=0.03, p=0.03) partially mediated the association between GRS and BMI or WC, respectively. This study suggests that genetic susceptibility to obesity partly influenced obesity through undesirable eating behaviour traits, which need to be targeted in obesity treatment and prevention. (Supported by Canadian Institutes of Health Research.)

Elevated soluble transferrin receptor concentrations among Congolese children 6–59 months with glucose-6-phosphate dehydrogenase deficiency

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Background: Glucose-6-phosphate dehydrogenase (G6PD) is an enzyme that protects red blood cells from oxidative damage. G6PD deficiency is a X-linked recessive inborn error of metabolism, which arises from mutations in the G6PD gene. In central Africa, the G6PD A-variant is thought to be most prevalent and is characterized by the co-inheritance of two mutations in the G6PD gene (A376G [rs1050829] and G202A [rs1050828]). Certain triggers (e.g., certain foods such as fava beans, or certain drugs) can result in acute or chronic hemolysis (destruction of red blood cells) in individuals with G6PD deficiency. Our aim was to genotype children 6–59 months in the Democratic Republic of the Congo for the A376G and G202A mutations, and to investigate the associations between G6PD A- deficiency and soluble transferrin receptor concentration (sTfR, a biomarker of iron status). Methods: Venous blood was collected from n=708 children in South Kivu and Kongo Central provinces using a proportionate-to-size sampling method. DNA was extracted from buffy coat and qPCR was used to detect the A376G and G202A mutations. Serum was analyzed for sTfR concentrations using an s-ELISA. Results: A total of 21% (n=146/708) of children had the A376G mutation (in hemi-, hetero-, or homozygous form), 45% (n=316/708) had the G202A mutation, and 20% (n=140/708) had G6PD A- (co-inherited A376G & G202A mutations). Overall, median (IQR) sTfR concentration was 8.1 (6.6, 11.4) mg/L. sTfR concentrations were significantly higher among children with any type of G6PD A- deficiency (hemizygous boys and heterozygous or homozygous girls), as compared to children without (9.2 [7.3, 11.8] vs. 7.9 [6.5, 11.1] mg/L, respectively; Wilcoxon ranksum test, P=0.001). Further, iron deficiency prevalence based on sTfR (>8.3 mg/L) was significantly higher among children with any type of G6PD A- deficiency, as compared to children without (60% [n=80/133] vs. 43% [n=234/544], respectively; P<0.001). Conclusions: One-fifth of our study population had G6PD A- deficiency. The accuracy of sTfR to diagnose iron deficiency in children with G6PD A- deficiency is in question. More

Adequacy of vitamin B6 and effects of supplementation on high-intensity exercise performance in collegiate distance runners: a pilot study

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Athletes may have increased requirements for vitamin B6, a coenzyme for glycolysis, due to increased turnover and losses. To determine the B6 status in male varsity cross-country runners, fasting plasma pyridoxal phosphate (PLP) was measured before, and following seven days of B6 supplementation (100 mg/day; n = 5) or placebo (sugar pill; n = 4). To determine the effects of B6 supplementation on exercise performance, participants performed a graded treadmill test to volitional exhaustion before, and again on the seventh day of supplementation. A comparison group of non-athletes given B6 (100 mg/day; n = 9) or placebo (sugar pill; n = 9) followed a similar protocol, but with a stationary cycle ergometer. Blood lactate (BL) and blood glucose concentration (BGC) were measured immediately before, immediately following, and 10 min after the exercise test. All athletes had adequate PLP status prior to supplementation (78.6 ± 33.4 nmol/L), which correlated with B6 intake estimated from two dietary recalls (r=0.73; P=0.025). Non-athlete PLP status trended lower with greater BMI (BMI<25: 68.7 ± 48.5 nmol/L; BMI>25: 42.0 ± 16.6 nmol/L; P=0.14). Following supplementation, PLP increased five-fold for athletes (P=0.01), whereas no change was observed with placebo. No differences were observed in exercise performance following supplementation, nor in BLC between the treatment groups in athletes or non-athletes. For athletes, there were no changes in BGC following supplementation in the placebo group. However, BGC 10 min post-exercise was 11% lower (P=0.055) in the treatment group following supplementation. Additionally, baseline PLP correlated with the observed drop in BGC in the 10 min post-exercise period (r=0.71; P=0.038). Among non-athletes, BGC did not rise following exercise, with or without supplementation, but a training effect following one week of cycling (30 min/d at 60% VO2peak) was observed in the placebo group (greater external power output during the final exercise test; P=0.011). High-dose vitamin B6 may reduce glucose production and/or enhance muscle glucose uptake following exhaustive, high-intensity exercise in athletes, as well as blunt the response to exercise training in non-athletes. (Supported by CIHR & NSERC Student Research Awards; St. Francis Xavier University URPTA Awards; NSERC Discovery Grant.)

Retrieval of glucose-6-phosphate dehydrogenase (G6PD) activity

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Background: Glucose-6-phosphate dehydrogenase (G6PD) is an enzyme that protects red blood cells from oxidative damage. G6PD deficiency is a X-linked recessive inborn error of metabolism, which arises from mutations in the G6PD gene. In central Africa, the G6PD A- variant is thought to be most prevalent and is characterized by the co-inheritance of two mutations in the G6PD gene (A376G [rs1050829] and G202A [rs1050828]). Certain triggers (e.g., certain foods such as fava beans, or certain drugs) can result in acute or chronic hemolysis (destruction of red blood cells) in individuals with G6PD deficiency. Our aim was to genotype children 6–59 months in the Democratic Republic of the Congo for the A376G and G202A mutations, and to investigate the associations between G6PD A- deficiency and soluble transferrin receptor concentration (sTfR, a biomarker of iron status). Methods: Venous blood was collected from n=708 children in South Kivu and Kongo Central provinces using a proportionate-to-size sampling method. DNA was extracted from buffy coat and qPCR was used to detect the A376G and G202A mutations. Serum was analyzed for sTfR concentrations using an s-ELISA. Results: A total of 21% (n=146/708) of children had the A376G mutation (in hemi-, hetero-, or homozygous form), 45% (n=316/708) had the G202A mutation, and 20% (n=140/708) had G6PD A- (co-inherited A376G & G202A mutations). Overall, median (IQR) sTfR concentration was 8.1 (6.6, 11.4) mg/L. sTfR concentrations were significantly higher among children with any type of G6PD A- deficiency (hemizygous boys and heterozygous or homozygous girls), as compared to children without (9.2 [7.3, 11.8] vs. 7.9 [6.5, 11.1] mg/L, respectively; Wilcoxon ranksum test, P=0.001). Further, iron deficiency prevalence based on sTfR (>8.3 mg/L) was significantly higher among children with any type of G6PD A- deficiency, as compared to children without (60% [n=80/133] vs. 43% [n=234/544], respectively; P<0.001). Conclusions: One-fifth of our study population had G6PD A- deficiency. The accuracy of sTfR to diagnose iron deficiency in children with G6PD A- deficiency is in question. More
research is warranted to examine the effect of these mutations on iron status and to investigate other associated health risks in affected individuals. (Funding: HarvestPlus/IPRRI.)

A comprehensive local food environment policy monitoring framework

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Diet is strongly influenced by the food environment in which consumers make food choices. Government food environment policies are critical to affect the availability, affordability, and marketing of healthy foods. Local governments are often the first to implement innovative food environment policies; however, the implementation of such policies in Canadian local jurisdictions is unclear. This study aimed to create a comprehensive policy monitoring framework to characterize key local food policy domains and identify promising practices in food environment policy in North America. The Government Food Environment Policy Index (Food-EPI), originally developed to assess national and state policies, was adapted to the local municipal context. The original tool contains 7 policy “domains” (composition, labeling, promotion, prices, provision, trade, and retail) with specific policy indicators within each domain. A scoping review of peer-reviewed and grey literature was conducted to provide a comprehensive scan of current local food environment actions in either American or Canadian municipalities, regions or counties in urban, suburban, rural, and remote contexts. Of the 7 policy domains of the original Food-EPI framework, 6 were relevant to municipalities. While several indicators were not relevant locally, such as reformulation targets for packaged food products, others were fully within local policy control, such as zoning for farmer’s markets and mobile food vendors. The majority of indicators (13 of 19 indicators) could be implemented at the local level. Additional domains were added to include nutrition education and communication initiatives and healthy food equity. Local food environment policies have significant potential to influence the food environment policy landscape in Canada. Bottom-up approaches beginning at the municipal level have helped to spur policy action at the state and national level in areas such as tobacco, and recently in calorie labelling on restaurant menus. This policy monitoring framework is an inventory of potential policies to prevent rising rates of obesity and can be used by local jurisdictions to evaluate the strengths, weaknesses, and gaps in their local food environment policies. This tool will next be employed to evaluate local policies in municipal jurisdictions in Canada. (Fundied by the Canadian Institutes of Health Research.)

Soci-economic and cultural facilitators and barriers of refugee households’ food insecurity: a snapshot of the food security status of Afghan refugees in Pakistan

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Despite the efforts of international institutions and host countries, refugees struggle to meet their basic needs throughout their displacement. Among all needs, food is one of the basics of livelihood and one of the social determinants of health that is affected by dislocation. In a social ecological framework, the overall economic status of the host country is among factors affecting refugees’ access to basic services. The refugee influx creates an extra burden on the health, employment, and education system of the host country. Pakistan is a developing country hosting Afghan refugees for more than thirty years. The objectives of this research are to evaluate the prevalence of household food insecurity of the Afghan Refugees in Pakistan and identify the barriers and facilitators toward their food security status. We used a mixed methods design to allow triangulation for more reliability and credibility. In the quantitative component, we recruited 299 refugee families in Karachi. With A standard tool from the Canadian Community Health Survey (CCHS) and the United States Department of Agriculture (USDA) food security questionnaire were used. To address the second objective, we conducted a series of in-depth interviews with semi-structured questions. We found 82.2% of the adults and 69.3% of the children were food insecure based on our analysis. Emerging themes from both the family in-depth, and quantitative data showed financial limitation, employment status, education, lack of information and resources associated with health services and food literacy were the main barriers to household food security. A very high prevalence of food insecurity existed among refugee households and children. Identifying the responsible organization in the area, and further assistant and support in providing employment support, education, accessible health services, nutritional workshops, may help to improve the food security status of the Afghan refugees. Our findings warrant further investigation in refugees related policies in Pakistan. Illuminating the role of stakeholders who are involved in providing settlement and health services, as well as the level of coordination and collaboration among the world aid organization and local government may enhance the refugees reintegration and access to basic needs.

Prevalence of partially and hydrogenated oils in the Canadian food supply

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Partially hydrogenated oils (PHO) are the main source of trans fatty acids (TFA) from industrial sources in processed foods and are associated with increased risk of cardiovascular events. In Canada, despite efforts towards the reduction of PHO in the food supply, there are still foods containing industrially produced PHO. Moreover, hydrogenated oils (HO) can also contain certain amounts of TFA. Objectives: This study aimed to collect data on: 1) the prevalence of TFA, PHO and HO in the Canadian food supply, and 2) assess the proportion of foods with PHO and HO that met or exceeded the recommended TFA limits. Methods: Using the University of Toronto Food Label Information Program (Version 2013, n=15,342), a database of the Canadian prepackaged food supply, products displaying PHO and HO in the list of ingredients were identified. The amount of TFA (per 100g) of each product was determined using the Nutritional Facts table. Results: Overall, 22.63% of the Canadian packaged food supply contained TFA, and most foods (84.6%) that contained TFA within each category met the recommended TFA limits (<0g/100g). However, some categories had a large proportion that exceeded the recommended TFA limits including: dessert toppings and fillings (91%), cereals and other grain products (86%), miscellaneous (79%), and potatoes/sweet potatoes (67%). In regards to PHO, 0.77% of packaged foods contained this ingredient. However, only 0.43% of products declaring PHO contained more than 0g/100g of TFA. Overall, 5.11% of packaged foods contained HO, although only 0.70% of products declaring HO exceeded the threshold of TFA. Conclusion: Partially hydrogenated oils are still little used in the Canadian food supply. This study shows that if Canada bans the use of PHO in the food supply, as it has been recently proposed, it would not have a significant effect as many foods are PHO free. Notably, some products with hydrogenated oils did not meet the threshold of 0g/100g; therefore, a TFA limit for products containing HO should be recommended. Policymakers can use this information to develop appropriate regulations to reduce the availability of TFA in the Canadian food supply through restrictions in the use of industrially produced PHO/HO.

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The impact of homework on the adiposity profile in school-aged children through the examination of eating behavior

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High mental workload was shown, in 1990, to increase the energy intake in adults. More recent studies in adults have shown an increased energy intake following a mental work compared to a seated-rest period. This increase in energy intake was not compensated by a decrease in energy intake in the subsequent meals during the day thus leading to a positive energy balance. However, the effects of mental work on children’s eating habits and consequently their adiposity profile have not been studied. The aim of this study is to investigate in school-age children the relationship between eating habits and mental work i.e. homework. The information of the children (n=527) who participated in the first phase (8-10 years old) of the QUALITY cohort study was used. Homework duration and stress related to schoolwork were obtained by means of questionnaires. The eating habits (kcal, saturated fat, number of snacks and high sugar drinks) were acquired by three 24-hour dietary recalls. DXA was used to get an accurate profile of the children’s adiposity. We found that children who performed higher amounts of homework had a higher trunk fat percentage. When children were divided into two groups (stressed vs. not stressed by school-related work), stressful homework was significantly associated with total body fat and trunk fat. High sugar drink intakes mediated the relationship between stressful mental work and trunk fat percentage. The energy intake, saturated fat and number of snacks consumed per day did not mediate the relationship between mental work and adiposity profile under all the conditions. This study adds to the existing literature by showing a mediating role of sweet-beverage consumption in the homework and adiposity relationship. (Supported by: CIHR Postdoctoral Fellowship (MEL); Earle W. McHenry Endowed Chair (MRI); Burroughs Welcome Fund-Innovation in Regulatory Science (MR&ML)).

Systematic review of nutrient profile models developed for nutrition-related policies and regulations aimed at noncommunicable disease prevention

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Nutrient profile (NP) models can support various public health policies, when there is a need for a transparent and reproducible method to define “healthier” or “less healthy” food. Given the proliferation of NP models worldwide, it is now recommended to adopt or adapt an existing model. However, an up-to-date and accessible resource summarizing existing NP models is currently unavailable. This study aimed to develop such a resource which summarizes and evaluates key characteristics of NP models with applications in government-led nutrition policy and regulation. Information was first collected from a key, but unpublished catalogue of NP models built in 2012 by Rayner and colleagues. A systematic literature search was also conducted in 3 databases of the peer-reviewed literature (PubMed, Embase, Scopus) and 15 grey literature databases (e.g. PAIS Index). Included models had to meet the following characteristics (selected): a) Developed or endorsed by governmental or intergovernmental organizations; b) Allow for the evaluation of single food items; c) Consider multiple nutrients or food components; d) Have publicly available nutritional criteria. A total of 387 potential NP models were initially identified, including n=119 models from Rayner’s catalogue and n=268 models from the full text assessment of >600 publications. Seventy-nine models were included. The majority of models (n=76; 96%) provide summary ratings of the healthfulness of food products. Almost half originate from the Americas, and most (n=37; 72%) were introduced within the last 10 years. The most common primary applications of the models include school food standards or guidelines (n=27), restriction of the promotion of foods to children (n=11), and food labelling (e.g. front-of-pack; n=11). All models consider nutrients to limit (e.g. sodium), and 78% also consider at least one nutrient or food component to encourage (e.g. fibre). Overall, this new resource will be highly valuable for assisting health professionals, nutrition professionals and policy makers in the selection of an appropriate NP model when the establishment of nutrition-related policies or regulations will require the use of nutrient profiling (Supported by: CIHR Postdoctoral Fellowship (MEL); Earle W. McHenry Endowed Chair (MRI); Burroughs Welcome Fund-Innovation in Regulatory Science (MR&ML)).

Abstracts

Natural abundance compound specific isotope analysis as a method to study dietary n-3 contribution to brain docosahexaenoic acid levels

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Brain docosahexaenoic acid (DHA, 22:6n-3) may be derived from two sources, prepared dietary DHA or through endogenous hepatic synthesis from α-linolenic acid (ALA, 18:3n-3). Synthesized and preformed DHA are chemically indistinguishable, therefore quantifying the actual dietary contribution of either source to tissue levels is unachievable without the administration of costly isotope labelled tracers. We plan to explore the use a novel approach using compound specific isotope analysis (CSIA) at the natural abundance level to discriminate between the incorporation of synthesized or preformed DHA into the brain following chronic feeding of n-3 PUFA. Mice were initially maintained on a background chow diet (Baseline). 13-17 day pregnant dams were placed onto purified n-3 PUFA diets containing either pure ALA or DHA (2% of fatty acids) as the only source of n-3 PUFA. Mice were maintained on diets over two generations, and males were sacrificed at 6 weeks of age. Fatty acid methyl esters were quantified by gas chromatography, and isotopic analysis was conducted by gas chromatography-combustion-isotope ratio mass spectrometry (GCcMS). Animals maintained on ALA diets were found to have significantly lower brain DHA concentrations than those maintained DHA diets after one generation (16.62±2.27 μmol/g vs 18.02±1.8 μmol/g, P<0.0001; mean±SD). Brain DHA concentrations remained stable in the successive generation. δ13C signatures of purified PUFA in the ALA and DHA diets were -31.12 % and -24.32 %, respectively. After one generation, brain δ13CDHA signatures responded dramatically to each diet, with changes from baseline (ALA= -2.52±0.15 % vs DHA= -2.79±0.18 %, P<0.0001) reflecting the differences in dietary δ2H signatures. Changes were maintained over the next generation with subtle variation. These results demonstrate that to achieve a stable brain δ13CDHA signature animals must be maintained on diets over at least one generation. In addition to highlighting the sensitivity of CSIA to detect subtle changes in tissue δ13CDHA following dietary treatments, our results demonstrate the viability of this technique to distinguish between the tissue incorporation of preformed or synthesized DHA. Future studies plan to utilize CSIA to study the turnover of brain DHA in animals undergoing chronic feeding of purified n-3 diets. (NSERC).

Questionnaire development for dietary restrictions in runners to mitigate gastrointestinal symptoms

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Anecdotally, endurance runners report they struggle to find foods to optimally fuel performance without causing unpleasant gastrointestinal symptoms, preformed dietary DHA or through endogenous hepatic synthesis from α-linolenic acid (ALA, 18:3n-3). Synthesized and preformed DHA are chemically indistinguishable, therefore quantifying the actual dietary contribution of either source to tissue levels is unachievable without the administration of costly isotopically labelled tracers. We plan to explore the use a novel approach using compound specific isotope analysis (CSIA) at the natural abundance level to discriminate between the incorporation of synthesized or preformed DHA into the brain following chronic feeding of n-3 PUFA. Mice were initially maintained on a background chow diet (Baseline). 13-17 day pregnant dams were placed onto purified n-3 PUFA diets containing either pure ALA or DHA (2% of fatty acids) as the only source of n-3 PUFA. Mice were maintained on diets over two generations, and males were sacrificed at 6 weeks of age. Fatty acid methyl esters were quantified by gas chromatography, and isotopic analysis was conducted by gas chromatography-combustion-isotope ratio mass spectrometry (GCcMS). Animals maintained on ALA diets were found to have significantly lower brain DHA concentrations than those maintained DHA diets after one generation (16.62±2.27 μmol/g vs 18.02±1.8 μmol/g, P<0.0001; mean±SD). Brain DHA concentrations remained stable in the successive generation. δ13C signatures of purified PUFA in the ALA and DHA diets were -31.12 % and -24.32 %, respectively. After one generation, brain δ13CDHA signatures responded dramatically to each diet, with changes from baseline (ALA= -2.52±0.15 % vs DHA= -2.79±0.18 %, P<0.0001) reflecting the differences in dietary δ2H signatures. Changes were maintained over the next generation with subtle variation. These results demonstrate that to achieve a stable brain δ13CDHA signature animals must be maintained on diets over at least one generation. In addition to highlighting the sensitivity of CSIA to detect subtle changes in tissue δ13CDHA following dietary treatments, our results demonstrate the viability of this technique to distinguish between the tissue incorporation of preformed or synthesized DHA. Future studies plan to utilize CSIA to study the turnover of brain DHA in animals undergoing chronic feeding of purified n-3 diets. (NSERC.)

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tinal symptoms. The lack of information regarding athletes’ pre-exercise food intolerances and preferences has hindered nutrition professionals with regard to general recommendations. The objective was to develop a valid and reliable questionnaire that assesses the pre-run, voluntary food restrictions used to minimize gastrointestinal symptoms. Validity testing consisted of an initial review by three Registered Dietitians and a trainee whose feedback was incorporated into a second draft. The second version was sent out to four different experts who were asked to rate each question using a Likert rating scale with 1=unacceptable, 3=acceptable and 5=highly acceptable and provide any other feedback. Subsequently, the questionnaire was administered to 22 participants in a test/re-test format. Kappa statistics were used to assess the reliability of the questionnaire by evaluating the intra-rater agreement of the test/re-test results. All questions had an average Likert scale rating of 4/5 or greater. Categories with an observed agreement below 90% and kappa values below 0.4 were flagged. All test/re-test results falling under basic information (gender, age, performance level, running hours per week, years running, and competition distance) exhibited kappa values above 0.61, demonstrating substantial agreement. Test/re-test results for medical information exhibited one flagged category out of 54. Results for dietary restrictions while training exhibited 11 flagged categories out of 46 and results for dietary restrictions while racing exhibited three flagged categories out of 46. However, a third of the flagged categories may be deemed reliable because the adjusted kappa (PABAK: prevalence-adjusted bias-adjusted Kappa) is more appropriate in the cases of extreme prevalence and/or bias. It can be concluded that the questionnaire, overall, exhibits substantial agreement and may be considered a valid and reliable tool in evaluating voluntary dietary restrictions among endurance athletes. Reliable feedback regarding consumption or avoidance of specific food and/or fluids prior to exercise to reduce gastrointestinal distress and optimize performance will contribute to improved and more specific nutritional recommendations in the future. (Funded by Mount Royal University.)

I-FABP as a marker of small intestine dysfunctions in obesity-related metabolic alterations
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Recent studies underline the implication of the gut in the etiology of chronic diseases. Hypertrophy of the small intestine mucosa is observed in presence of insulin resistance (IR) or type 2 diabetes (T2D) in animal models and severely obese subjects. These results were obtained using invasive methods, which are inappropriate for healthy subjects or large cohorts. Considering its important role in lipid metabolism, it is crucial to develop tools to improve our understanding of gut physiopathology in T2D. Intestinal-type fatty acid-binding protein (I-FABP) is a promising non-invasive biomarker of enterocyte renewal and has been validated in several enteropathies. Objective: Evaluate intestinal function in men covering a wide range of adiposity and glucose homeostasis statuses. Methods: The study cohort (n=226) included 153 nondiabetic men and 73 diabetic men on habitual diet, the link between DSD and D6D activities from the product-to-precursor ratios. Results: Plasma apoB levels in T2D men were higher than those observed in non-diabetic subjects (1.43±0.97 vs 1.90±1.06 mmol/L, p<0.05). Interestingly, plasma I-FABP levels in T2D men were positively correlated with glycated hemoglobin (r=0.23; p<0.05) and triglycerides (r=0.22; p=0.06). Conclusion: Plasma I-FABP, a biomarker of enterocyte renewal, seems more related to the presence of metabolic alterations (i.e. dyslipidemia and hyperglycemia) than adiposity, IR and T2D, per se. However, the role of metformin in this accelerated turnover remains unclear. Further assessment of morphological alterations will be performed using plasma citrulline, a non-essential plasmatic amino acid synthesized by the enterocyte. A better understanding of IR and T2D physiopathology in the small intestine could lead to the design of novel intervention to prevent the development of concomitant metabolic alterations.

The association of delta-5 and delta-6 fatty acid desaturase activities with risk factors for type 2 diabetes is dependent on plasma apoB in obese subjects
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Objective: Prediabetes is characterized by high insulin secretion (IS), insulin resistance (IR), delayed fat clearance and chronic inflammation. High number of apoB-lipoproteins (measured as plasma apoB) promotes white adipose tissue dysfunction and risk factors for type 2 diabetes (T2D). Dietary intake of omega-3 fatty acids (FA) regulate plasma apoB. Delta-5 (D5D) and delta-6 (D6D) FA desaturases convert dietary omega-3 and omega-6 FA into their bioactive counterparts. Their activities associate negatively or positively with the incidence of T2D, respectively. We hypothesized here that the link between DSD and D6D activities and risk factors for T2D is dependent on plasma apoB. Methods: We examined IS and IR in N=81 (40% men, e27kg/m2, 45-74 yrs, post-menopausal, non-diabetic and not on omega-3 therapy) using Botnia clamps, which is a combination of an intravenous-glucose-tolerance test and a hyperinsulinemic-euglycemic clamp. Plasma clearance of dietary fat was examined following the ingestion of a 13C-triolein-labeled-high-fat meal (N=30). Fatty acid concentrations in plasma phospholipids were measured by gas chromatography-mass spectrometry and used to estimate D5D and D6D activities from the product-to-precursor ratios. Results: Plasma apoB ranged from 0.3-1.8g/L and average plasma omega-6:omega-3 FA was 12:1. Estimated DSD activity correlated negatively with plasma apoB (r=-0.36, p<0.001), IR (r=-0.27, p=0.017), 2nd phase IS (r=-0.28, p=0.013), delayed chylomicron clearance (r=0.45, p=0.015) and plasma interleukin-1 receptor antagonist in women (an indicator of an activated interleukin-1β system) (r=-0.53, p=0.001). Estimated D6D activity correlated positively with plasma apoB (r=0.49, p<0.001), IR (r=0.44, p=0.001) and delayed fat clearance in women (r=0.69, p=0.019). Adjustment for plasma apoB eliminated all associations of DSD and D6D with risk factors for T2D, except for that between DSD and chylomicron clearance (r=0.77, p=0.027). Conclusion: In obese subjects on habitual diet, the link between DSD and D6D activities with risk factors for T2D is dependent, at least in part, on plasma apoB. (Source of funding: Canadian Institutes for Health Research Operating Grant to May Faraj (MOP# 123409), Vanier PhD Award to Valérie Lamantia.)
Comparison of nutritional assessment tools in cirrhotic patients

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Background: Malnutrition, one of the most frequent complications of cirrhosis, can lead to loss of muscle mass and function. In addition to affecting quality of life and mortality, malnutrition is associated with poor prognosis. Traditional methods used for assessing nutritional status are not suitable for cirrhotic patients due to interference of liver disease with certain nutritional parameters including fluid accumulation (ascites and/or edema). Objective: The aim of this study is to describe the performance of different measures of nutrition among cirrhotic patients including body mass index (BMI), mid-arm muscle circumference (MAMC) and handgrip strength (HGS) in comparison to skeletal muscle index (SMI), an objective measure of skeletal muscle mass, and subjective global assessment (SGA). Methods: In this pilot study, patients with and without cirrhosis are recruited at the Centre hospitalier de l’Université de Montréal (St-Luc Hospital) in Québec, Canada. Their nutritional status is assessed via: BMI, MAMC, HGS as measured with a calibrated dynamometer, SGA and SMI, as measured by computed tomography scan at the level of the third lumbar vertebrae. Spearman correlation coefficient is used to assess correlation between different tools. Results: For now, 40 patients with and 10 patients without cirrhosis were recruited. Preliminary results show that malnourished patients, as assessed by SGA, present a tendency towards slightly lower BMI, HGS and SMI compared to well-nourished patients. The MAMC does not correlate with the nutritional status of the patients and there is no correlation between the SMI and the other measures. Discussion: These results show the difficulty in assessing the nutritional status of cirrhotic patients. More patients are needed to establish a statistically significant correlation. The use of other objective tools would be potentially necessary. With objective measures of nutritional status of patients with cirrhosis, health care professionals will be able to rely less on subjective measures permitting better risk assessment in that particular population. This could help reduce the scope of the multiple complications experienced by these cirrhotic patients and, eventually, even patients suffering from other chronic liver diseases.

Perceptions and beliefs about “healthy eating” and “eating pleasure” among adults

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Abstracts

Perceptions and beliefs about “healthy eating” and “eating pleasure”. Some food characteristics emerging from participants’ perceptions and beliefs were the same for “healthy eating” and “eating pleasure”, namely nutritional quality, food quality (e.g. freshness and organoleptic quality) and variety. These findings show that many perceptions and beliefs about pleasure expressed by participants were compatible with a healthy diet. Results from this study could be used to develop nutrition interventions that integrate the notion of pleasure as perceived by the population to promote healthy eating. (Supported by the Canadian Institutes of Health Research.)

Freeze drying affects total starch, and resistant starch assessment in potato tubers

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Identification of nutritionally superior genotypes from potato (Solanum tuberosum L.) has the potential to improve the nutritional status of populations since this is a highly consumed staple crop worldwide. Freeze-drying (FD) has utility for high throughput phytonutrient assessment when very large numbers of cultivars, parental lines, and advanced breeding lines need to be tested after harvest or at various storage intervals, when working with fresh materials would be impractical. There is limited information, however, regarding the reliability of FD for starch measurements in potato tubers. This study tested the impact of FD on total starch (TS), digestible (DS) and resistant starch (RS) measurements in four potato varieties. The impact of FD was tested on TS, DS and RS by comparing: (a) control tubers boiled and then cooled for 1 h at room temperature (RT) or 24 h at 4 C; (b) tubers boiled and then cooled for 1 h with subsequent FD; and (c) raw tubers that underwent FD, then were rehydrated, boiled, and cooled for 1 h. The TS and DS content was not different between control samples cooled for 1 h versus 24 h but RS content increased at 24 h, an indicator of nutritionally improved starch properties. Relative to controls, FD modified TS content in three of four varieties. Furthermore, FD caused overestimation of DS and underestimation of RS in the same three varieties. Modifications to cooking and rehydration procedures following FD of raw tuber samples did not improve reliability of TS, DS, and RS values. Microscopy showed that cells remained intact following cooking whereas cell wall integrity was reduced when FD followed cooking. A complete loss of cellular structure occurred when cooking followed FD. The morphological microscopic evidence thus supports the finding of unreliable starch measurements in association with FD. In conclusion, the use of either raw potato or cooked potato samples in the FD format cannot be recommended for starch analysis. The present findings have implications regarding the accuracy of using FD for estimates of rapidly and slowly digestible starch, glycemic index and glycemic load of cooked potato. (Supported by NSERC.)
PICU energy intake and its impact on clinical and hospital outcomes

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Energy is essential for the treatment and recovery of children admitted to Pediatric Intensive Care Units (PICU). There are significant immediate and long-term health consequences of both under- and over-feeding in this population. Energy requirements of critically ill children vary depending on age, nutritional status, severity of illness, and treatments. This study aimed to determine the incidence of over- and under-feeding and to compare hospital outcomes between these feeding categories. An ethics approved retrospective study of children admitted to PICU was performed. All intubated patients admitted to PICU (2008-2013) were included, except those in which an IC test was not feasible. Data collection included demographics, the primary outcome reported as under feeding (<90%MREE), appropriate (MREE ±10%) or overfeeding (>110%MREE) determined through comparison of measured resting energy expenditure (MREE) using indirect calorimetry (IC) to actual energy intake based on predicted basal metabolic rate (PBMR) and clinical outcomes (mechanical ventilation and PICU length of stay (LOS)).

Data was analyzed with descriptive methods, ANOVA and linear regression models. A total of 139 patients aged 10 (range 0.03-204) months were included. Sixty (43%) were female while 77 (55%) were admitted after a surgical procedure. A total of 210 IC tests were conducted showing a statistically significant difference between MREE measurements and PBMR (p=0.019). Of the 210 measurements only 26 measures (12%) demonstrated appropriate feeding, while 72 (34%) were underfed and 112 (53%) were overfed. Children who were overfed had significantly longer PICU LOS [mean 49.5(35.4) days] compared to those children in the appropriately fed [mean 41.6 (39.5) days], and underfed groups [24.4 (26.4) days]. There was a mean difference between the over and under feeding category and ventilation days after adjusting for age and PRISM score (p=0.026), suggesting increased mechanical ventilation days for overfed group. This retrospective study confirms that estimations of energy expenditure in critically ill children are inaccurate leading, mainly, to the over feeding. Even more important, over feeding seems to be associated with prolonged mechanical ventilation and PICU LOS.

A thematic analysis of staff perspectives on how to improve nutrition care practices in Canadian hospitals: results from the More-2-Eat project

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Staff play a key role in the prevention, detection and treatment of hospital malnutrition. When making change that involves staff, it is important to understand what the knowledge, attitudes and practices (KAP) of those staff are at baseline and after the improvement activity has occurred. The More-2-Eat (M2E) implementation project aims to improve nutrition care in five Canadian hospitals by implementing the Integrated Nutrition Pathway for Acute Care (INPAC). To understand the views of staff before and after implementation, a reliable KAP questionnaire, based on INPAC activities, was administered. In the post-implementation questionnaire, additional questions focused on whether or not staff noticed a change, and their perceived involvement in making improvements. The online, 27-item KAP questionnaire was completed by n=189 at baseline and n=147 after 1 year of INPAC implementation. At baseline, the mean KAP score from the five sites was 93.6/128 (Range 51–124), while post-implementation the mean KAP score increased to 99.5/128 (Range 88–111). There was a significant increase in KA scores (t=-2.4, p=0.016), practice scores (t=-4.5, p=0.000), and KAP scores (t=-4.2, p=0.000) post implementation. Scores changed significantly in 22 of 28 questions (p<0.05). For the additional post-implementations questions, 69% (n=102/147) of respondents noticed positive changes in the past year, 12% (n=18) noticed both positive and negative changes, 1% (n=1) noticed a negative change, and 17% (n=25) did not notice a change. When asked what changes were noted responses generally focused on nutrition screening, more patients being ready for their meal, use of MedPass, volunteer support, and increased access to snacks for patients. All changes are in line with INPAC activities. 90% (n=132) of staff agreed they were aware of the changes occurring on the unit, and 59% (n=86) felt that they were involved in the change process. Staff are an important part of the change process for improving nutrition care. After 1 year of INPAC implementation, staff KAP scores increased and many felt like they had been included in the process to improve nutrition care. (Funded by CFN (Canadian Frailty Network), which is supported by the Government of Canada through the Networks of Centres of Excellence program.)
Developing the More-2-Eat virtual toolkit: perspectives from hospital staff and management in 5 Canadian hospitals

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The More-2-Eat (M2E) implementation project aims to improve the prevention, detection and treatment of malnutrition in Canadian hospitals. In M2E, five hospital units from four provinces worked towards changing their nutrition care practices to align with the Integrated Nutrition Pathway for Acute Care (INPAC). To share learnings from each unit, a virtual toolkit within the Canadian Malnutrition Task Force website is being created. The purpose of this analysis was to identify from the perspectives of staff and management at the 5 sites, key aspects and recommended content for this toolkit. After one year of M2E implementation, a qualitative study was conducted using purposive sampling techniques to recruit participants for focus groups (FG)(n=11), small group interviews (n=4) and key informant interviews (n=45) with a variety of hospital staff and management. Participants were asked to describe what should be included in the toolkit. Responses included general advice through to specific tools and resources. General advice included the need to: include all disciplines in the change process; have a champion lead the change efforts; have a clear plan of action; have effective communication; and recommendations for making change. Tools and resources included: evidence, particularly statistics, about the prevalence and cost of malnutrition; template posters and pamphlets to raise awareness among staff, patients, and visitors; examples of how to implement nutrition screening; forms and images for monitoring food intake; draft education materials directed for a variety of staff, including food service; audit templates for recording local data to track success; and resources to assist with obtaining management support. All sites wanted to learn from each other and believed that other hospitals would benefit from shared learning along with specific templates and examples. Use of stories, videos and interactive pages were recommended, as long as the toolkit remained user-friendly. All discussions supported the development of a toolkit to assist other sites that want to implement INPAC to improve nutrition care in their hospital and these findings will be used to develop this toolkit. (Funded by CFN (Canadian Frailty Network), which is supported by the Government of Canada through the Networks of Centres of Excellence program.)

Targeting malnutrition using the integrated nutrition pathway for acute care (INPAC) at Niagara health, greater Niagara general site, Niagara Falls, Ontario: a quality improvement initiative

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Malnutrition affects up to 45% of medical inpatients upon admission to Canadian hospitals, negatively affecting patients and healthcare systems through increased morbidity, mortality, length of stay (LOS), healthcare costs, and readmission risk. In order to improve nutrition care practices to ultimately identify and treat malnourished patients in medical inpatient care, we implemented key aspects of the Integrated Nutrition Pathway for Acute Care (INPAC), an evidence-based nutrition care pathway, on two medical inpatient units over 12 months. Specifically, we aimed to identify malnourished patients on admission using the using the Canadian Nutrition Screening Tool (CNST), comprehensively assess patients using the Subjective Global Assessment (SGA), and put nutrition care strategies in place. In addition, we aimed to reduce the number of patient-identified mealtime barriers, as persistent mealtime barriers and poor food intake were found to be key components in malnutrition that extend LOS. This project is running concurrently and in collaboration with the More-2-Eat implementation project being conducted by researchers at the University of Waterloo. Biweekly data was collected by on-site research associates and analyzed monthly by More-2-Eat researchers to measure CNST and SGA completion percentages, as well as data regarding patient-identified mealtime barriers and food intake using My Meal Intake Tool and Mealtime Audit Tool. Over a 12-month period, CNST completion rates approached our goal of 70% on Units 1 (65.3%) and 2 (66%) by December 2016. SGA completion rates reached 100% of at-risk patients in Unit 1 and 70% in Unit 2. Additionally, through this project, the average number of patient-identified mealtime barriers decreased from 3.25 at baseline to 1.25 as of December 2016. This data suggests that successful implementation of key aspects of INPAC supports a reduction in patient-identified mealtime barriers. INPAC implementation and sustainability efforts are ongoing. This study has also identified and prioritized the importance of food intake and post-discharge nutrition care in reducing LOS and risk of hospital readmission due to malnutrition, respectively. Our efforts and results support the integration of INPAC as a gold standard in nutrition screening, assessment, and management for medical inpatient units in Canadian hospitals. (Funded by Canadian Frailty Network (CFN).)

Association between glucose intolerance and bacterial colonisation in an adult population with cystic fibrosis, emergence of Stenotrophomonas maltophilia

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Stenotrophomonas maltophilia is a multidrug-resistant organism whose prevalence is increasing in CF. Chronic infection to Stenotrophomonas maltophilia increased risk of pulmonary exacerbation (PEX), of lung transplantation and death. The improvement of life expectancy has led to the emergence of new comorbidities; the most common one is CF-related diabetes (CFRD). When blood glucose is ≥8 mmol/L, glucose is detected in the airway, creating a favourable environment for bacterial growth in the lungs of CF patients. We investigated the relationship between dysglycemia and lung pathogens in CF. This is a cross-sectional observational and prospective analysis of adult CF patients, without known CFRD. All patients (N=260) underwent a 2 h-Oral Glucose Tolerance Test with glucose measurements each 30 min. Pulmonary bacterial colonisation of airway mucus, forced expiratory volume in 1 sec (FEV1), age, gender, nutritional status and the number of PEx requiring intra-venous antibiotics were collected. We collected data three years later for the follow-up prospective analysis. Statistical analysis using the Mann-Whitney U-Test and Chi2 non-parametric T-Test was done. Patients were 25.8 ± 7.9 years old with a mean body mass index of 21.8 ± 3.0 kg/m² and FEV1 of 73.0 ± 21.9. Stenotrophomonas maltophilia positive patients (N=41, 15.8%) had significantly lower FEV1 (p < 0.001) and underwent a higher number of PEx (p < 0.001) when compared to patients with no Stenotrophomonas maltophilia colonisation. The proportion of Stenotrophomonas maltophilia positive patients was significantly higher in abnormal glucose tolerant and diabetic patients (20.2% and 21.6% respectively, p = 0.036) compared to normotolertant (8.7%). However, the growth of Stenotrophomonas maltophilia was not affected by the evolution of the glucose tolerance after three years follow-up. This suggests that the presence of Stenotrophomonas maltophilia was
Fedding a mixture of choline forms representative of human intake during lactation improves offspring growth and maternal immune function

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In humans, including women during lactation, dietary choline is consumed as a mixture of forms, primarily as phosphatidylcholine (PC, 50%), free choline (FC, 23%) and glycerophosphocholine (GPC, 19%). We previously demonstrated in our rodent model that providing choline as PC enhanced immune maturation and function of offspring, compared to providing FC. However, the effect of feeding a mixture of choline forms representative of human dietary intake during lactation on maternal immune function is not known. The objectives of this study were to examine parameters of maternal immune function and offspring growth during lactation when dams are fed a mixture of choline forms, or a diet high in PC. At parturition, dams (n=6/diet) were randomized to 1 of 3 nutritionally complete, fatty acid balanced diets, providing 1g/kg total choline: Control (100% FC), Mixed Choline (MC) (50% PC, 25% FC, 25% GPC), or High GPC (HGPC) (75% GPC, 12.5% PC, 12.5% FC). At weaning (3 weeks), immune cell phenotypes and cytokine production by Concanavalin A (ConA)- or lipopolysaccharide (LPS)-stimulated splenocytes were measured. There was no difference in dam’s weight amongst diet groups, but feeding MC and HGPC diets improved pup’s growth compared to Control (+22% body weight, P<0.05). In spleen, MC and HGPC dams had higher proportions of memory cytotoxic T cells (CD8+CD27+), total B cells (CD45RA+), and dendritic cells (OX6+OX62) compared to Control dams (all P<0.05). When stimulated with ConA, MC and HGPC splenocytes produced significantly less IL-6 and IFN-γ compared to Control dams (P<0.05), yet there was no difference in IL-2 production (proliferation marker) between groups. Following LPS stimulation, MC and HGPC splenocytes produced less IL-1β and IL-6 than Control dams (P<0.05). In summary, feeding a mixture of choline forms during lactation improved offspring growth and resulted in a more efficient maternal immune response following ex vivo immune challenges. (Supported by NSERC and Dairy Farmers of Canada.)

n-3 and n-6 polyunsaturated fatty acids differentially modulate the hypoxic and inflammatory response in an in vitro model of obese adipose tissue

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Visceral adipose tissue (AT) expansion induces local hypoxia, a key contributor to chronic low-grade inflammation that drives development of obesity-associated metabolic dysfunctions. In healthy AT, hypertrophic adipocytes become hypoxic and produce HIF-1, a transcription factor that regulates expression of angiogenic genes to stabilize HIF-1α signaling. A subset of cultures were also stimulated with lipopolysaccharide (LPS, 10ng/mL) to mimic in vivo obese endotoxin levels. CoCl2-treated adipocytes served as the control. In adipocytes stimulated with CoCl2 alone and in combination with LPS, EPA and DHA maintained or increased, whereas AA decreased, mRNA and secreted protein levels of the angiogenic factors leptin and VEGF-A, while all PUFA increased mRNA expression of the angiogenic factor Angpt1 (P<0.05). Further, in CoCl2 plus LPS-stimulated adipocytes, though EPA and DHA maintained, while AA blunted, mRNA expression of the anti-inflammatory adipokine adiponectin, all PUFA increased the mRNA and secreted protein levels of inflammatory IL-6, MCP-1, and MIP-1α, yet the effects of AA were more potent (P≤0.05). Finally, EPA and DHA maintained the phosphorylation status of the inflammatory transcription factor NF-κB (Ser536) in CoCl2-stimulated adipocytes and blunted the additive inflammatory effect of LPS, whereas AA increased NF-κB phosphorylation under both conditions (P≤0.05). Overall, these data suggest that n-3 and n-6 PUFA differentially modulate the adipocyte response to the hypoxic and inflammatory microenvironment of obese AT. (NSERC.)

DNA methylation in fetal rat brains prenatally exposed to alcohol

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Feeding a mixture of choline forms representative of human dietary intake during lactation improves offspring growth and maternal immune function

In Canada, prevalence of fetal alcohol spectrum disorder (FASD) is closer to 1% and their excessive dependence on medical care puts huge burden on the health care system. DNA methylation associated with alcohol exposure could be a potential mechanism through which genes involved in neurogenesis are suppressed during fetal stages. The main objective of this study is to identify differentially methylated regions in rat fetal brains exposed to alcohol. 9-10 week old Sprague Dawley female rats received either ethanol 3g/kg body weight or iso- caloric dextrose twice a day by gavage. On G20 (gestational day 20), fetal brains were harvested and genomic DNA was extracted. DNA library was prepared by fragmentation, bead based enrichment of methylated fragments, adaptor ligation and amplification, emulsion PCR and sequenced on the SOLiD5500 platform. DNA methylation was significantly higher in alcohol groups, when compared to control group. A number of differentially methylated regions DNA are being identified for validation and gene expression analyses. The results from this study show that alcohol exposure increases DNA methylation in fetal rat brains. A number of these regions could be in close proximity to genes associated to neuronal and brain development. The current finding could be further explored to identify, if any of these methylation sites could be universally adopted to be used as an early marker for detecting FASD in newborns.

N-Acyl phosphatidylethanolamine-specific phospholipidase D knockdown decreases mouse body weight and adipose mass independent of dietary fatty acids

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Dietary fatty acids are precursors to lipid signaling mediators, called N-acyl ethanolamines (NAEs). The enzymatic synthesis of NAEs re-
quires multiple redundant steps. Evidence indicates that dietary fatty acids can be converted to NAEs via several enzymes including N-acylphosphatidylcholine-phospholipase D (NAE-PLD). Previous work indicates that changes in dietary fatty acids can alter NAE levels, which in turn impacts physiological outcomes. However, the mechanistic details of this process have not been elucidated. The objective of this project was to assess if the enzyme NAE-PLD is necessary for the synthesis of NAEs upon chronic feeding of AIN-93-based diets containing different fatty acid sources. Male wild-type (C57Bl/6) mice, heterozygous (NAE-PLD -/+ ) and homozygous (NAE-PLD -/- ) mice received either beef tallow, corn oil, canola oil or fish oil (10% w/w from fat) post-weaning for 9 weeks. Our results generally showed that liver, jejunum and whole brain fatty acids and NAEs reflected the fatty acid content of the diets. NAE-PLD -/- mice had lower levels of NAEs in the plasma compared with the wild-type mice, but this was not reflected in the tissues. Our physiological outcome data showed that NAE-PLD -/- mice had lower (p < 0.0001) body weight, food intake and fat volume to body weight ratio than wild-type mice. Fish oil fed animals had higher (p < 0.05) body weight than the other three diets and had higher (p < 0.05) food intake than the canola oil diet. These results demonstrate that NAE-PLD is not necessary for NAE synthesis from dietary fatty acids, but does result in a leaner phenotype independent of dietary fatty acid composition. This research will improve our understanding of how dietary fatty acids regulate NAE production and signaling. (Supported by Natural Sciences and Engineering Research Council of Canada.)

SCD1 and PLD2 involvement in the migration of metastatic breast cancer cells

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Introduction: High levels of Stearoyl-CoA Desaturase-1 (SCD1) expression have been reported in breast cancer (BC). SCD1 is an enzyme that catalyzes the desaturation of saturated fatty acids (SFA) at position delta 9 to produce monounsaturated fatty acids (MUFA). SCD1 synthesizes oleic acid (OA) and palmitoleic acid from stearic acid and palmitic acid, respectively. It has been shown that OA specifically stimulates the migration of metastatic breast cancer cells. In addition, OA can activate phospholipase D2 (PLD2), an enzyme synthesizing phosphatidic acid. Phosphatidic acid activates mTORC1, a complex that regulates cell migration in the context of BC. Aim: This study aims to better characterize the link between SCD1, OA and the PLD2 / mTORC1 signaling pathway, as well as their joint involvement in metastatic BC. Methods: We used the MDA-MB-231 cell line, derived from a human breast adenocarcinoma as a model of migrating BC cell. SCD1 and PLD2 activity were modulated by treatment with inhibitors, A939572 and VU0285651-1 respectively. The two enzymes were inhibited separately and jointly. Cells were treated with OA in order to mimic SCD1 activity in the presence or absence of the PLD2 inhibitor. Activity of the mTORC1 complex was measured via p70S6K1 phosphorylation (an mTORC1 effector). In parallel, cell migration potential was measured by wound healing assay. Results: Cell migration promoted by OA treatment is eliminated when the PLD2 inhibitor is used. OA treatment also increases p70S6K1 phosphorylation in a PLD2-dependent fashion. The effect of OA on mTORC1 pathway activation therefore depends on PLD2 activity. Inhibiting SCD1 and PLD2 activity separately results in a decrease of cell migration. Joint inhibition decreases cell migration similarly to the inhibition of SCD1 alone, suggesting that not all of SCD1’s effect on cell migration is due to OA activation of PLD2. Conclusion: These results strongly suggest that SCD1 activity regulates the PLD2 / mTORC1 signaling pathway in MDA-MB-231 cells. Furthermore, another parallel pathway regulating BC cell migration might involve SCD1 activity. We are currently investigating this intriguing possibility.

Antimicrobial locks for the prevention of catheter-related blood stream infections (CRBSI) in patients on parenteral nutrition – a systematic review

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Background: Catheter-related blood stream infection (CRBSI) is a serious complication of parenteral nutrition (PN). The efficacy of antimicrobial lock solutions as prophylaxis against CRBSI in the PN population is unclear. Methods: We performed a systematic review to assess the efficacy of antimicrobial lock solutions compared to control (heparin or saline) to prevent CRBSI in adult and pediatric patients on PN. We searched EMBASE, MEDLINE, CENTRAL, ISI Web of Knowledge (earliest to December 2015) for randomized controlled trials (RCT) and observational studies. Critical appraisal of bias was performed using the Cochrane Risk of bias tool and ROBINS-I. Results: The search identified 771 citations, 112 reviewed in full, and 19 studies selected, totaling 536 patients, including 9 pediatric (122 patients) and 10 adult (414 patients) studies. Nine studies assessed ethanol lock, 9 taurodilidine, and 1 tobramycin. Two open-labeled RCTs were included, both using taurodilidine (Klek and Bisseling). The remaining studies were observational, and employed a pre- and post-design at moderate to high risk of bias. Methodological and clinical heterogeneity precluded pooling of the data by meta-analysis. All studies, except one by Klek which used taurodilidine lock in low-risk patients, report lower CRBSI rate in the treatment group compared to controls. The negative trial by Klek et al. documented 1 CRBSI (0.273/1000 catheter-days) in the taurodilidine plus citrate arm, and none in the taurodilidine or control arms (p=1.000). This contrasts to the Bisseling study reporting lower CRBSI rates (0.19 versus 2.02 CRBSI/1000 catheter-days, p=0.008), and longer mean infection-free survival in the taurodilidine arm (641 (95% CI 556-727) versus 175 (95% CI 85-266) days, log-rank p<0.0001 in the control group (heparin). Amongst the observational studies, infection rates ranged from 0 to 14.3 CRBSI/1000 catheter-days for antimicrobial locks versus 3.53 to 26.5 CRBSI/1000 catheter-days in for controls. The CRBSI rate ratios all favored antimicrobial locks (range 0.4-0.54). Conclusion: Pooled results appear to support the use of antimicrobial lock solution as prophylaxis for CRBSI in parenteral nutrition patients, yet are limited by limited study quality and sample sizes. High quality studies are needed to confirm these findings.

Hemp food product consumption for 4 weeks did not impact glucose metabolism, compared to a soybean and sesame control product, in free living participants who were overweight or obese

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Hemp foods are an excellent source of omega-6 (n-6) polyunsaturated fatty acids (PUFA) and omega-3 (n-3) PUFA. Hemp seeds and oil contain high amounts of linoleic acid (LA) and alpha linolenic acid (ALA) in approximately a 3 to 1 ratio. Due to historical restrictions on the growing of hemp, the investigation of its health benefits has been limited. Thus, there is a need for nutritional interventions that investigate the potential health benefits of hemp consumption. The objective of this study was to assess the impact of hemp food products on glucose homeostasis following 4 weeks of consumption. A free-living, double-blind, randomized, 2 period cross-over feeding study (NCT02400203) was conducted in participants who were overweight or obese. Treatment products were hulled seeds and salad dressing which were given for 28 days. Participants were given hulled hemp seeds, and salad dressing containing 30 g/d of hemp oil (HEMP), or hulled sesame seeds, and salad dressing containing 30g/d of soybean oil (CONTROL). Participants were instructed by the research team to integrate the products (2 prepackaged sachets of seeds, 1 serving of...
salad dressing) into their daily meals and to avoid other dietary sources of n-3 PUFA. The primary outcome of the study was RBC fatty acids. Glucose metabolism, assessed by fasting glucose, insulin and HOMA-IR, was a secondary outcome. Serum glucose was measured by automated colorimetric assay, insulin was measured by radioimmunoassay. The homeostatic model assessment method was used to quantify insulin resistance (HOMA-IR) A total of 37 participants were enrolled and 30 participants completed the study protocol. No difference was seen in fasting glucose (5.41 ± 0.10 mmol/L vs 5.31 ± 0.10 mmol/L, p=0.2274 for HEMP and CONTROL), fasting insulin (17.83 ± 1.36 mIU/L vs 18.10 ± 1.36 mIU/L, p=0.7789 for HEMP and CONTROL) or HOMA-IR (4.34 ± 0.37 mIU/L vs 4.33 ± 0.37 mIU/L, p=0.9733 for HEMP and CONTROL) between treatments. These results suggest that consumption of hulled hemp seeds and oil, compared to sesame seeds and soybean oil for 4 weeks had little to no impact on glucose metabolism in free living participants who were overweight or obese.

The relationship between dietary fatty acid consumption, plasma fatty acid concentrations, and biomarkers of cancer risk in children in the Guelph family health study
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BACKGROUND: Dietary and circulating fatty acids (FAs) are associated with the development of many chronic diseases. Certain FAs may be of particular importance during early life development and may affect long-term disease risk. Of these fatty acids, n-3 polysaturated fatty acids (PUFA) and n-6 PUFA are thought to be particularly important. Preclinical studies have linked early exposure to n-3 and n-6 PUFA to cancer outcomes later in life; however, this has been understudied in children. STUDY DESIGN: This study aims to examine dietary n-3 and n-6 PUFA consumption, plasma levels of n-3 and n-6 PUFA, and their associations with BMI z-score in children in the Guelph Family Health Study, a prospective family-based study of families with children aged 2 to 5 years. Dietary FA was analyzed from 77 children and plasma FA concentrations were analyzed from 20 children. RESULTS AND DISCUSSION: Dietary n-3 PUFA consumption in children was low, with average intakes of 507mg, 28mg, and 68 mg of alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), respectively. These values are comparatively lower than those found in previous research in Canadian children and do not meet current recommendations for ALA intake. Average blood levels of n-6 PUFA were 10.8 times higher than n-3 PUFA. In both human and animal models, high n-6 to n-3 PUFA ratio has been linked to increased cancer risk, specifically in the case of breast cancer. Blood ALA concentrations were inversely associated with BMI z-score. Because high BMI, excess weight, and obesity are major risk factors for metabolic diseases and cancer, increasing dietary intake and plasma n-3 PUFA levels in children may attenuate obesity-related cancer risk later in life. CONCLUSIONS: This study uniquely examines dietary consumption and plasma FA levels of preschool children, contributing to the identification of potential modifiable biomarkers of cancer risk in early life. (Supported by the Health for Life Initiative, University of Guelph.)

Evaluation of supplement use in high-performance athletes with physical disabilities
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Supplement use in Canadian, high-performance athletes with physical disabilities remains largely unexplored and specialized recommendations are lacking; placing these athletes at risk. The primary aim of this study was to evaluate the types of supplements being consumed by high-performance athletes with physical disabilities. The second aim was to establish differences in supplement intakes with regards to gender. Male (n=17) and female (n=22) athletes were recruited from various Paralympic sports. Participants completed a valid and reliable questionnaire designed to assess dietary and performance enhancing supplement use in athletes. Supplement use was categorized as daily, occasionally, or never. Chi squared tests determined differences between genders. Findings showed that 90% of all athletes used supplements at least occasionally. One hundred percent of males and 82% of females used supplements, but there was no statistically significant difference between the genders. The five most commonly used supplements on a daily basis included: multi-vitamin/multi-minerals (MVMM), vitamin D, protein powders, sport bars, and sport drinks. Daily use of MVMM supplements was 23.5% in males and 13.6% females. Daily usage of vitamin D was 23.5% in males and 40.9% in females. Forty one percent of males used protein powder on daily basis as compared to 22.7% for females. Sport bars had a daily intake of 41.2% for males and 13.6% for females. Lastly, sport drinks had daily consumption of 35.3% in males and 9.1% in females. Males were more likely to use iron supplements daily or occasionally than males at 55.5% versus 5.9% (p=0.02). Conversely, males were more likely to use branched chain amino acids occasionally at 29% versus females at 0% (p<0.01). In conclusion, high-performance athletes with physical disabilities demonstrated a high usage of supplements designed for health and performance. Currently, there are no specific recommendations with respect to supplement use for these athletes, making it exceedingly difficult for nutrition professionals to assess and advise them. Future research should focus on the development of recommendations and educational interventions for Paralympic athletes. (Funded by Mount Royal University.)

Safety of implementing a high potassium diet in heart failure patients: effects on serum potassium concentrations
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There is little literature exploring alternative dietary strategies for individuals living with heart failure (HF), such as the dietary approaches recommended for hypertension. Implementation of such a diet would results in a marked increase in potassium intake due to the emphasis of food groups such as fruits and vegetables. HF patients receive drugs that block the renin-angiotensin-aldosterone system and have common co-morbidities which all can predispose to elevated serum potassium. The safety of a hypertension type dietary approach emphasizing fruit and vegetable intake in this setting has not been explored. Therefore, the purpose of this study was to investigate the impact of increasing potassium intake, through whole foods, on serum potassium concentrations in a medicated HF population. We conducted an open controlled clinical trial in 30 HF patients who were randomized to a usual diet group (UD n=17), or a high potassium diet group (HKD, n=13). Fruits and vegetables were used to increase potassium concentrations in a medicated HF population. We explored. Therefore, the purpose of this study was to investigate the impact of increasing potassium intake, through whole foods, on serum potassium concentrations in a medicated HF population. We conducted an open controlled clinical trial in 30 HF patients who were randomized to a usual diet group (UD n=17), or a high potassium diet group (HKD, n=13). Fruits and vegetables were used to increase potassium intake. All participants were on stable therapy. Serum potassium concentration and food records were completed at baseline, day 10, and at the end of the 3-week study. 24 Hour urine collections were completed at baseline and at 3 weeks. Differences were tested using 2-way repeated measures ANOVA. In the HKD group, dietary potassium intake was 3393±1171 (SD) mg/d at baseline, 4281±849 mg/d at day 10 (p<0.05 compared to baseline and UD group at day 10), and 4073±6247 mg/d at week 3 (p<0.001 versus baseline and UD group at week 3). There was also a 14 percent increase in urinary potassium excretion at week 3. In the HKD group there was a significant increase in serum potassium at day 10 and week 3 (baseline, 4.52±0.4 mmol/L;
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day 10, 4.7±0.4 mmol/L; and week 3, 4.6±0.4 mmol/L; p<0.05 compared to baseline). Two individuals had serum potassium levels above normal at Day 10 and week 3 in the HKD group. In conclusion, an increase in potassium intake was associated with a significant rise in serum potassium in medicated HF patients. Careful monitoring of all HF individuals is necessary when implementing a diet high in potassium.

Positive impact of retinoid (vitamin A / retinoic acid) in obesity, insulin resistance and type 2 diabetes

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Introduction: Obesity and diabetes (T2DM) are associated with impaired metabolism of insulin, energy and vitamin A (ROI-retinol; RE-retinyl esters; RA-retinoic acid) and with cardio-vascular diseases. Hepatic ‘retinol binding protein’ (RBP4) is the ROI equimolar transporter in serum. It is also secreted as an adipokine. Serum RBP4 is elevated in obesity and T2DM. Reducing serum RBP4, improves on insulin resistance (IR). Supplemental RA in rodents reduces serum ROI and variably influences body weight, IR and the heart. These impacts are still under investigation for better understanding. Hypothesis: In a diabetic and obese animal model, a RA treatment will reduce serum ROI and RBP4, glycaemia, IR and body weight. These effects are associated with impacts on retinoid and energetic metabolism. A cardio-protective effect may occur too. Aims: To evaluate in ob/ob mice (obese and diabetic), the RA impact on: A) serum and tissue levels of vitamin A and RBP4, glycaemia, IR and body weight. B) genes (mRNA) from vitamin A metabolism, energy metabolism and of the natriuretic peptides (ANP, BNP) cardio-protective system. C) adipose tissues and heart morphology. Methods: Ob/Ob mice were treated with RA (2μg/g bw/d) for 16 days. Extractions RNA from: subcutaneous fat (SF), visceral fat (VF), skeletal muscle (SM), liver (LIV) and heart (HEA) Gene (mRNA/RtqPCR), proteins by Western Blot, vitamin A by HPLC, glycaemia, glucose and insulin tolerance test. Histology by staining tissues. Results: Lower serum ROI, RBP4, glucose, IR and body weight, but similar food intake, in treated versus untreated mice; Genes expression variations for: 1) tissues vitamin A metabolism 2) energy (increased UCPI and PGC1α) 3) increased ANP and BNP; Normalised RBP4 and vitamin A rate in tissues; Adipocytes sizes, heart fibrosis and apoptosis reduction. Conclusion: The RA treatment: 1) Decreases serum ROI and RBP4, glycaemia and IR. 2) Reduces the mRNA of the RBP4 adipokine. 3) Modulates vitamin A metabolism gene expression improving on its homeostasis. 4) Normalise tissues RBP4 and vitamin A. 5) Increases UCPI and PGC1α genes expression, a brown/beige fat signature. 6) Improves on energy metabolism reduc- ing adipocytes size and body weight. 7) Induces an anti-fibrotic cardio-protective effect.

Fish consumption may prevent type 2 diabetes in Manitoba First Nations communities

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Background: Consumption of fish, the main source of omega-3 fatty acids (n-3FAs), has been postulated to prevent type 2 diabetes (T2D). However, the potentially beneficial effect of fish and n-3FAs may be modified by persistent organic pollutants (POPs) present in fish. Objective: To explore the association between self-reported T2D and fish consumption, dietary n-3 FAs and POPs intake in a regionally repre- sentative sample of First Nations adults living on reserve in Manitoba. Design: Data from the cross-sectional First Nations Food Nutrition and Environment Study were examined. The sample comprised 706 Mani- toba First Nations adults living in 9 communities across 4 ecozones in 2010. Household interviews were used to collect social and lifestyle data. The consumption of fish was estimated using a traditional food frequency questionnaire along with portion size information ob- tained from 24-hour recalls. Fish samples were analyzed for the presence of contaminants including dichlorodiphenyldichloroethylene (DDE) and polychlorinated biphenyls (PCBs). Dietary DDE and PCBs intake was estimated using community-specific concentrations of contaminants in fish samples. Multiple logistic regression models adjusted for potential risk factors for T2D including age, gender, body mass index, physical activity, total energy intake, smoking, and edu- cation were developed. Results: In Manitoba First Nations, the prevalence of T2D was 22%. A negative, dose-response relationship was found between fish intake and T2D. Fish consumptions of 2-3 portions per month and 21/week were inversely associated with T2D with ORs 0.51(95%CI:0.28-0.91) and 0.40 (95%CI:0.19-0.82), respectively compared to no fish intake. Similarly, intake of n-3 FAs showed a beneficial effect on T2D (OR=0.48 (95%CI:0.30-0.77). Exposure to dietary DDE and PCBs were not associated with T2D. Conclusion: Negative associations be- tween fish, n-3 FAs intake and T2D were found. These findings suggest that traditionally harvested fish consumption has a beneficial effect on T2D in Manitoba First Nations. The effect of exposure to POPs via fish is negligible in Manitoba First Nations communities. The results of this study will be useful in developing fish consumption advisories and prevention programs to slow down the increasing incidence of T2D in First Nations. (Funded by Health Canada, H.M. Chan is sup- ported by the Canada Research Chair Program.)

The effect of dairy and non-dairy cultured products added to breakfast cereals on blood glucose control, satiation, satiety, and short-term food intake in young women

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Current evidence suggests potential benefits of foods with high fibre or high protein content on blood glucose control. However studies comparing the effects of fermented dairy products to commercially available non-dairy alternatives are limited. This study compared the effects of dairy and non-dairy cultured products on postprandial blood glucose, insulin response, subjective appetite, and food intake in young women. Methods: in a randomized single-blinded cross-over design, 24 women (22.7 ± 2.5 yrs; 22.1 ± 1.5 kg/m2) consumed, to satia- tion, one of three treatments including: (1) Greek yogurt with granola (150kcal, 9.2g protein, 2.6g fat, 2.6g dietary fibre, and 21.5g available carbohydrate/100g), (2) a cultured coconut product with granola (146kcal, 3.2g protein, 3.2g fat, 5.6g dietary fibre, and 21.9g available carbohydrate/100g), or (3) water control. Serum blood concentrations of glucose and insulin and subjective appetite were measured over 2 hours, immediately before and after consumption of the treatments. Energy intake was measured twice: at treatment consumption and at an ad libitum pizza meal after 2 hours. Results: Blood glucose was lower after the dairy treatment (P<0.0001) while overall insulin re- sponse was higher (P<0.0001) compared to the non-dairy treatment over two hours. No differences in food intake were observed between the caloric treatments consumed to satiation and 2 hours later with a pizza meal, however both resulted in reduced food intake with pizza

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meal compared to the control (P<0.003). Subjective appetite was sup-
pressed after the caloric treatments compared to the control (P<0.0001). Treatments formulated with dairy and non-dairy fer-
mented products did not differ in pleasantness, taste, and texture. The reduced blood glucose after the dairy treatment can be explained by its higher protein content compared to the non-dairy treatment which had a high fibre and low protein content. Conclusion: the breakfast meal formulated with the dairy fermented product resulted in reduced post-
prandial glycaemia without an increase in subsequent energy intake and can be recommended as a functional breakfast for improved blood glu-
cose control. (This research was funded by Dairy Research Cluster pro-
gram and Dairy Farmers of Canada. Kathleen Mather has received support from CIHR professional award and Scotia Scholar award.)

A pulse-based diet improves blood lipid profiles in women with polycystic ovary syndrome: a randomized clinical trial
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Polycystic ovary syndrome (PCOS) is the most common endocrine disor-
der in women of reproductive age, with clinical symptoms including
menstrual irregularities and insulin resistance. The metabolic complica-
tions of insulin resistance are higher in women with PCOS and include
metabolic syndrome and dyslipidemia. Pulse-based diets (e.g., beans,
chickpeas) can lead to lower insulin and LDL-cholesterol and we hypo-
thesized that a pulse-based diet would have a positive effect on serum lipid
profiles, reproductive measures and body composition as analyzed by
dual energy X-ray absorptiometry. Sixty-one women with PCOS aged
18-35y were randomly assigned to groups receiving a pulse-based diet (n =
30) or the National Cholesterol Education Program therapeutic lifestyle
changes (TLC) diet (n = 31) for 16-wks while participating in an exercise
program. Following the intervention, there was a significant time main
effect (p < 0.02) and group x time interaction (p < 0.05) in cholesterol ratio
total cholesterol/HDL-cholesterol and LDL-cholesterol, with a signifi-
cantly lower cholesterol ratio and LDL-cholesterol level in the pulse-
group following the intervention. Significant group x time interactions
were also found in HDL-cholesterol (p = 0.009) and triglyceride (p = 0.04),
with lower HDL in the TLC-group (-0.08 mmol/L) and lower triglyceride in
the pulse-group following the intervention (-0.2 mmol/L). There was a
time main effect for lower total cholesterol (p = 0.003) and fasting insulin
(p = 0.04), with no differences between groups. We also found a signifi-
cant time main effect for lower BMI (p = 0.006), % fat (p = 0.0002), as well
as higher % appendicular skeletal muscle mass (p = 0.0006), with no
difference in whole body lean mass. Both groups also had a lower antral
follicle count in the right ovary (p=0.003) and left ovary (p < 0.001) following
the intervention. Lifestyle modifications are currently the first-line treat-
ment recommended for women with PCOS; however, there are currently
no specific diet recommendations. Our results demonstrate that a pulse-based
diet is more effective than the TLC-diet for improving cholesterol ratio, LDL-
cholesterol and triglycerides in women with PCOS. (Funding: Agriculture
and Agri-Food Canada, Saskatchewan Pulse Growers, the Canada Founda-
tion for Innovation, and Saskatchewan Health Research Foundation.)

The More 2 Eat project: acute care patient quality of life
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Patient reported outcomes are becoming of greater importance to re-
searchers and stakeholders as health care philosophies shift to become

more patient-centered. Quality of life is an important patient reported
outcome in acute care, as it reflects a patient’s overall physical, mental
and social wellbeing. Knowledge of what contributes to patients’ self-
perceived quality of life in acute care is essential for developing and
improving health care interventions. The More 2 Eat (M2E) project fo-
cuses on improving nutrition care in hospitals across Canada. Data for
the M2E project were collected in 5 hospitals, in four provinces. Among
that data are: measures of frailty including handgrip strength (HGS) and
five-meter timed walk (5m); nutritional assessment (SGA; A=well nour-
ished, B=mild/moderate, C=severe malnutrition); and quality of life (QOL)
(SF-12). These measures were collected on eligible patients (no delirium or
dementia, admitted from the community). The purpose of this analysis
was to describe patient characteristics associated with their QOL in hos-
pital. The mean physical and mental component scores (PCS and MCS) of
SF-12 were 34.95 (SD=10.44) and 46.36 (SD=11.76) respectively with higher
scores indicating better QOL. Of those who required an SGA (N=311), the
mean PCS was significantly different by category (p<0.0001): A=38.47
(SD=11.03), B= 32.58 (SD=9.48), C= 29.93 (SD=8.25). Of those who com-
pleted the 5m assessment, −62% (260/421) were considered frail based frail on
the >6 second cut-point. The average PCS score was significantly different
(p<0.0001), with better quality of life seen in the non-frail group (41.76
(SD=9.96) vs. 35.86 (SD=10.42)). Similarly, continuous HGS variables were
positively significantly associated with PCS (p<0.0001), but not with MCS.
These data indicate that weakness, slow gait speed and malnutrition are
all associated with lower physical QOL in hospital patients, but not men-
tal aspects of QOL. QOL is an important patient outcome and should be
used in interventions designed to improve frailty and malnutrition in
acute care hospital patients. (This research is funded by CFN (Canadian
Frailty Network))

The More-2-Eat project: associations between measures of
frailty and nutritional status in patients at nutritional risk
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There is increasing awareness of the detrimental health impact of frailty as well as malnutrition on older adults. However, considera-
tion of this overlap in research and practice is just beginning. The purpose
of this analysis was to examine the relationship between measures of
frailty and nutritional status in a sample from the More-2-Eat project
(M2E). M2E focuses on improving nutrition care in hospitals across
Canada. Data was collected in 5 hospitals, in four provinces. All data
were collected by trained clinicians, seconded for the project. Due to
the nature of the M2E project, subjective global assessment (SGA) was
only completed on patients identified to be at nutritional risk (~30%) on
admission and this analysis is limited to these patients. Measures of
frailty were handgrip strength (HGS) and the five-meter timed walk
(5m). Nutritional status was measured by the SGA. These measures were
collected over an 18-month period. A chi-square was used to test the
associations between SGA (A vs. B/C) and 5m (>6 seconds(s)) and a
Kruskal-Wallis test was used to compare SGA to continuous HGS
(n=276) and 5 m values (n=123). The median HGS and 5m scores were
19.0 kg (SD=12.4) and 6.7 s (SD=6.2) respectively. Of all the at nutri-
tional risk patients, 59% (185/316) were identified to be malnourished
(B/C), and ~43% (312/733) were found to be both malnourished and frail
based on walking speed. 5m, either using the >6 s cut-point or contin-
uous values, was not significantly different across SGA categories

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The More-2-Eat project: using theory to explain behaviour change techniques in a hospital setting

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The More-2-Eat (M2E) project focuses on improving nutrition care in hospitals across Canada by implementing the Integrated Nutrition Pathway for Acute Care (INPAC). This algorithm recommends screening (Canadian Nutrition Screening Tool; CNST), assessment (subjective global assessment; SGA), food intake monitoring, standard and advanced care practices, and discharge planning, to promote quality nutrition care. Changing practice requires implementation strategies and techniques to embed new care activities into the routine. The purpose of this analysis was to use the Behaviour Change Wheel (BCW), particularly Capability, Opportunity, Motivation (COM-B), to categorize behaviour change interventions used by 5 hospitals, in four provinces in Canada as they implemented INPAC, to better understand how improvements can be made in nutrition care. Sites tracked implementation activities to change staff behaviour on written scorecards (n=190) and reported key activities at monthly teleconferences (n=11, audio recorded). A behaviour change matrix was created to summarize these implementation activities by site, month, and INPAC practice. Behaviour change interventions were then categorized by their function (education, persuasion, incentivisation, coercion, training, enablement, modeling and environmental restructuring) in line with the BCW. Environmental restructuring was the technique used most often (n=117, ex. adding CNST into existing forms) by sites to change staff behaviour. Education (n=110, ex. teaching sessions for staff about accurately monitoring food intake) and enablement (n=61, ex. audits on effectiveness of weight tracking) were also used frequently. Interventions to promote screening were the focus early in the implementation phase. As screening became embedded into routine, techniques began to decline as sites worked on other INPAC practices. Behaviour change of staff to improve nutrition care is required, however, this is not an easy task. A theoretical understanding of the components of behaviour change, and a systematic approach to identifying and quantifying behaviour change interventions can help to make complex improvements feasible and identify where best to focus change efforts. This analysis provides insight into the behaviour strategies and techniques, which resulted in improved practices, and can be used as an example for other hospitals wishing to improve nutrition care. (This research is funded by CFN (Canadian Frailty Network.)

Local food environment favorable to a healthy diet and body weight: an umbrella review

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Food and access to nutritious and affordable food are essential resources for health. Although multiple systematic reviews have been conducted on food environment correlates of dietary behavior and health, a clear overview is lacking. The aim of this study is to review evidence on the association between local food environment and diet and body weight in the general population. Eligible reviews published in 10 databases: Embase, Medline, PubMed, Sociological Abstracts, Web of Science, Scopus, Francis, Greenfile, DARE, Cochrane Database of Systematic Reviews. The study selection process and the methodological quality assessment (with the AMSTAR checklist) were independently conducted by two reviewers. Results were synthesized narratively across exposures within the community nutrition environment (e.g., availability and accessibility of food outlets), consumer nutrition environment (e.g., availability, variety and price of food options) and perceived nutrition environment for diet and adiposity outcomes respectively. 3028 unique references were retrieved and ultimately 20 systematic reviews were included: 3 were of high quality, 11 of medium quality and 6 of low quality. The majority of primary studies included in these reviews were conducted in US using cross-sectional design, with a few longitudinal and intervention studies. The most common food environment exposure(s) examined in the reviews were related to the community nutrition environments including geographic accessibility and availability of supermarkets, fast-food outlets and convenience stores. Altogether, reviews of the food environment correlates of adiposity and dietary behaviors provide mixed evidence. Among reviews reporting significant results, association between greater access and availability to supermarkets and better dietary and poorer adiposity outcomes outnumbered those reporting reverse associations. Also, the evidence of a relationship between greater access and availability of fast-food outlets and poorer dietary and adiposity outcomes appears to be more consistent. Greater access and availability of convenience stores is related to poorer adiposity outcomes only. There was significant heterogeneity across various aspects of the primary studies reported in these reviews, thus limiting what can be learned from this body of evidence.

Dietary docosahexaenoic acid (DHA) cycling in rats yields the same DHA blood and tissue levels using half the DHA required from chronic feeding

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Dietary docosahexaenoic acid (DHA, 22:6n-3) plus eicosapentaenoic acid (EPA, 20:5n-3) recommendations are frequently stated at 500mg per day. Estimates suggest these recommendations result in a commercial EPA/DHA production deficit of up to one million metric tons per year. Pilot work suggests that acute DHA intake in rats can increase the capacity for synthesis of EPA and DHA. As a result, the present study assesses the blood and tissue DHA response to a 2-week 2% alpha-linolenic acid (ALA, 18:3n-3) only diet followed by a 2-week 2% DHA + 2% ALA supplementation period repeated over three cycles (“DHA cycling”) for 12 weeks. Comparisons are made to a chronic 12-week, 2% DHA + 2% ALA supplementation period and a 12-week 2% ALA only supplementation period. Brain and liver fatty acid concentrations (µmol/g) and weight percent was determined in addition to all blood fractions including whole blood, plasma and erythrocyte fatty acid profiles. In whole blood, both the DHA cycling and the chronic DHA group yielded significantly higher DHA concentrations (471 ± 28 and 524 ± 47, respectively) compared to the ALA only control (246 ± 20), while the two DHA dietary groups were not different from each other (p > 0.05). Similarly, liver DHA concentrations were not different between the DHA cycling (11.4 ± 0.5) and chronic DHA (12.6 ± 0.9) with both higher than the ALA control group (7.0 ± 0.4). Weight percent of DHA in the brain was statistically equal at 11.7 ± 0.2 and 11.7 ± 0.1 with DHA cycling and chronic DHA, respectively, and were higher than ALA only control (11.1 ± 0.1), while no differences were seen in concentration (p > 0.05). In conclusion, a dietary DHA strategy is pre-
sented requiring only half the dietary DHA while achieving the same tissue and blood DHA status in rats. Implementation of such dietary strategies could reduce the gap between high global dietary omega-3 recommendations and relatively low commercial production rates. (Supported by NSERC.)

Diet quality of preschool children is low with inverse relationships between intakes of healthy and unhealthy dietary components

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Background: Among other behavioural factors, low diet quality remains a key risk factor for obesity development and is therefore a target for prevention efforts. Despite the current childhood obesity rates in Canada (one-third are overweight or obese), there has been little assessment of Canadian preschoolers’ diet quality. Objectives: Primarily, to evaluate the diet quality of preschoolers in the Guelph Family Health Study (GFHS) and secondarily, to evaluate whether intake of healthy foods was inversely related to intake of unhealthy foods. Methods: Three-day food records were completed by parents for their preschool children (n=45; 2 to 5 years old) participating in the GFHS. Diet quality was measured at baseline using the Healthy Eating Index (HEI)-2010 consisting of adequacy components (dietary components to increase) and moderation components (dietary components to decrease). Total HEI-2010 scores were calculated from the sum of HEI adequacy and moderation component scores. Spearman’s rank correlation coefficients were used to relate HEI adequacy to moderation components in a sample excluding siblings (n=38). Results: Mean total HEI-2010 score was 66.9 out of a possible total score of 100 (range: 33.4-87.2) and was not significantly different between boys (69.6±2.86; n=19) and girls (64.8±2.28; n=26). HEI adequacy components were significantly inversely related to HEI moderation components. Specifically, whole grain and dairy intakes were inversely associated with empty calorie intake. Whole fruit intake was inversely associated with sodium intake. Finally, intake of a higher ratio of polyunsaturated and monounsaturated fatty acids to saturated fatty acids was inversely associated with sodium and refined grain intakes. Conclusions: Canadian preschoolers’ diet quality needs improvement. Obesity prevention efforts should target diet quality to both increase intakes of healthy foods and decrease intakes of unhealthy foods. (Supported by the Health for Life Initiative, University of Guelph.)

Fish oil-derived n-3 polyunsaturated fatty acid supplementation attenuates obese inflammation-driven mammary tumorigenesis

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A clinical consequence of obesity is the increased risk of cancer development, including breast cancer (BC), wherein chronic low-grade inflammatory signaling promotes mammary tumorigenesis. Interestingly, dietary interventions such as n-3 polyunsaturated fatty acids (PUFA) that can attenuate obese adipose tissue-derived inflammatory adipokine production may play a role in obesity-associated BC prevention. Therefore, we utilized the MMTV-neu(ndl)-YD5 BC model which mimics human epidermal growth factor receptor-2 (HER2) overex-pression and recapitulates the tumor phenotype reflective of 20-25% of human BC cases. Female mice were fed one of two isocaloric high fat diets ($88 kcal) containing an equal amount of saturated fat (as lard) but differing compositions of n-6 and n-3 PUFA derived from corn oil (CO) or menhaden fish oil (FO) sources, respectively for 16 weeks (lifelong exposure from 4-20 weeks of age). The diet compositions were as follows: n-6 PUFA-enriched high fat (HF) control diet contained 40% kcal lard + 18% kcal CO and the n-3 PUFA-enriched high fat (HF+FO) diet contained 40% kcal lard + 13% kcal FO + 5% kcal CO. The HF+FO diet contained 4.5% kcal as EPA and DHA combined, which is similar to intakes reported in the traditional Greenland Inuit diet. In this model HF+FO supplementation delayed tumor onset and at sacrifice (20 weeks of age) reduced tumor number/mouse by 33% compared to HF control (P<0.05). Mammary tumor tissue gene expression of inflammatory and tumor-promoting mediators TNFα, IL-6 and leptin were reduced in the HF+FO group compared to HF control (P<0.05), whereas tumor expression of the anti-inflammatory cytokine IL-10 was increased in the HF+FO group (P<0.05). N-3 PUFA supplementation also improved the serum obese adipokine profile by reducing circulating levels of the inflammatory mediators leptin (decreased by 34%), resistin (decreased by 39%) and plasminogen activator inhibitor-1 (PAI-1, decreased by 30%) while concomitantly increasing circulating levels of the non-inflammatory and insulin-sensitizing adipokine adiponectin (increased by 72%) compared to HF control. Collectively, these data demonstrate the ability of n-3 PUFA to attenuate obesity-related mammary tumor development and the inflammatory phenotype, thereby supporting their utility in life-long BC prevention.

Substituting lentils for white potato significantly reduces postprandial blood glucose response and glycemic index

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Poor diet is one of the main contributors to the etiology of chronic diseases such as type 2 diabetes (T2D). Lentils, a type of pulse, have a healthful nutritional profile, low-glycemic index (GI), and reduce postprandial blood glucose response (PBGR) when consumed in place of white rice. More data using this replacement approach for other starchy foods is needed to provide broader insight on the effects of lentils on PBGR. The objective of this study was to compare PBGR and GI following consumption of white potato with and without lentils. Twenty-four healthy adults (Age 27.4 ± 1.2; BMI 24.0 ± 0.5 kg/m²) completed this randomized crossover clinical trial that included four 3-hour study visits separated by washout periods of 3-7 days. Participants consumed 50 g available carbohydrate (AC) of potato (control) or meals containing a combination of 25 g AC from potato and 25 g AC from three lentils (large green, small green, split red). Fasting and timed postprandial blood samples were collected by finger prick for analysis of blood glucose and plasma insulin. Repeated measures ANOVA and post hoc Tukey’s tests compared incremental area under the curve (IAUC) and peak glucose and insulin, as well as GI. Compared to white potato alone, glucose and insulin IAUC were significantly decreased (p<0.0001) when large green (34% and 34%, respectively), small green (32% and 36%, respectively) or split red (35% and 38%, respectively) lentils were combined with white potato. Peak blood glucose and plasma insulin were also significantly decreased when all 3 lentil treatments were combined with white potato compared to white potato alone (p<0.0001). GI of potato (93.5±8.4) was significantly decreased (p<0.001) by addition of each lentil: (large green (60.5±11.8), small green (86.5±9.3) and split red (59.6±7.9). These results show that replacing half of the AC from white potato (a high-GI, starch-rich food) with lentils can significantly reduce GI and attenuate

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the rise in postprandial blood glucose. (Funded by AAFC Growing Forward 2 and Pulse Canada Cluster.)

Impact of gestational weight gain on neonatal vitamin D status
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Introduction: Low vitamin D status is common in pregnant women and neonates. It is unknown if newborn vitamin D status is dependent on maternal gestational weight gain (GWG) due to its liposolubility and/or volume dilution effects in larger individuals. Objective: To test for relationships between maternal GWG and newborn vitamin D status. Methodology: Healthy mother-infant pairs (n=40) were recruited at 24-hours post-partum from greater Montréal area (clinicaltrials.gov: NCT02563015). Surveys captured demographics, sun exposure and supplement use. Dietary vitamin D intake during pregnancy was assessed using a food frequency questionnaire. Blood samples were collected to assess serum 25-hydroxyvitamin D (25(OH)D) concentrations. Maternal height, pre-gravid weight, and delivery weight were obtained from obstetrical records. Maternal body composition was obtained using dual-energy x-ray absorptiometry. Data were analyzed in 3 groups: mothers who met (n=14), exceeded (n=14) or fell short (n=12) of Health Canada weight gain recommendations. A mixed model ANOVA and a linear regression were performed (SAS, v9.3). Data are mean +/- standard deviation unless otherwise specified. Results: Maternal pre-gravid body mass index was 24.2+/-4.5 kg/m², infant birth weight-for-age Z-score was 0.17+/-.0.66 and infants were 58% (23/40) male. Infant 25(OH)D level was 47.2+/-20.2 nmol/L with 15% < 30 nmol/L and 65% < 50 nmol/L; maternal 25(OH)D status was 66.0+/-24.3 nmol/L with 3% < 30 nmol/L and 35% < 50 nmol/L. Vitamin D status of mothers and infants were not different amongst GWG categories and infant status did not differ between sexes. An interaction between sex and GWG was significant (p=0.03), with female infants having higher 25(OH)D status than males from moms who met GWG recommendations (p=0.01), and lower 25(OH)D status compared to females in the highest GWG category (p=0.01). In regression models (R²=0.57), neonatal 25(OH)D level was 12.8 nmol/L higher when born from white compared to non-white mothers, 3.4 nmol/L higher for each 10 mmol/L increment in maternal 25(OH)D and 4.5 nmol/L lower for each 5 kg increment in maternal fat mass. Conclusion: These results suggest that female infants, infants born to non-white mothers and mothers who gained more weight than recommended during pregnancy, may be more likely to have vitamin D insufficiency. (Funding: CIHR.)

Would product packaging be a worthwhile target for the regulation of food and beverage marketing to children in the Canadian food supply?
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Reducing the marketing of unhealthy foods to children has been acknowledged by the World Health Organization as an effective obesity reduction strategy, however, the standards in the Canadian Children’s Food and Beverage Advertising Initiative (CAI) do not currently apply to the advertising to children that occurs on product packaging. This study aimed to examine whether products with on-package marketing to children meet the CAI Uniform Criteria, which do not currently apply to food labels. Data was obtained from the University of Toronto Food Label Information Program (FLIP) 2013 database, which provides nutritional information on 15,342 packaged foods. Products in FLIP were classified as being either: a) from CAI participating companies, or from non-participating companies; and b) marketed to children, or to a general audience. Products were further classified into their relevant CAI category and subcategory, and evaluated based on the CAI Uniform Nutrition Criteria specific to each subcategory. In total, 10,626 products were included in our analysis. Products from CAI food category companies represented 11.8% (n=1,251) of the total products. Of those, 16.9% (n=221/1,251) were determined to be marketed to children. A third (33.5%; n=71/212) of children’s products from CAI participating companies met the CAI’s Uniform Nutrition Criteria. These results suggest that approximately two thirds of products from CAI companies with marketing to children on their labels do not meet the Uniform Nutrition Criteria. Including product packaging under the CAI standards could have an important impact on the nutritional quality of foods that target Canadian children. However, in order to maximize their influence, the CAI should also attempt to gain volunteer commitments from more companies, so that a greater portion of the food supply falls under their regulations. (Supported by: CIHR Postdoctoral Fellowship (MEL); Earle W. McHenry Endowed Chair & Burroughs Wellcome Fund-Innovation in Regulatory Science (MRL).)

Longitudinal changes in sodium levels in restaurants, 2010–2016
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Background: High sodium intake is linked to hypertension and heart disease, and calls have been made to reduce sodium in the food supply. Restaurants are a major source of dietary sodium for Canadians. However, no tracking is being done to see if conditions are improving, or if recommendations are being followed. Objective: The purpose of this study is to compare sodium levels in Canadian chain restaurant items in 2016 to levels from three and six years ago to determine if levels have improved. Different restaurants and food categories were compared. Methods: Data was collected from publicly provided nutritional information on restaurant chain websites. Only chains with 20 or more Canadian outlets were included. In total, 1391 food items from 61 chains were matched to counterparts from both 2010 and 2013. Desserts and baked goods were excluded. Sodium levels were analyzed per serving and per 100 grams. Results: Overall, sodium levels significantly decreased from 2010 to 2016 (P<0.001) from 999±18mg to 968±18mg per serving, an average decrease of 31 mg (0.3%). However, only 40% of foods decreased in sodium, with their average decrease 234 ±12mg (23%). 36% did not change over the six years, and 23% increased in sodium with an average increase of 272±25mg (27%). Both food category and restaurant chain were significant predictors of sodium level (P<0.001). The standard deviation for longitudinal sodium change was large, and the four restaurants with the highest sodium levels per serving in 2010 showed an increase in sodium in 2016. Conclusion: Overall sodium levels in restaurant foods have marginally decreased, however progress varies between chains and by food category. Clear sodium reduction targets and monitoring for restaurants are urgently needed to reduce sodium levels and the associated health risks to the public.

Structure related bioactivity of major phenolic compounds in canola extracts
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Canola (Brassica napus) has been nominated as the major oil crop of Canada, which accounts for more than 20% of the global production. Due to its elevated bioavailability of phenolic content and antioxidant capacity, lately interest towards canola by-products as a natural source of antioxidants as well as a rich source for nutraceuticals has gained its attention. Extraction of phenolic compounds from canola continued for extended period of time with different extraction systems. However, extraction of phenolic compounds through accelerated solvent extraction (ASE) at high temperature and high pressure
seems to improve its antioxidant properties as well as total phenolic content. High selectivity, short extraction time, less solvent usage and green technology could be attributed with this novel method of extraction. Furthermore, it is believed that the increases in the total phenolic compounds as well as antioxidant properties are related with the structure alterations take place during processing. Thus, very limited amount of studies have been conducted in the above field. Therefore, this study will be focused specifically on canola meals, and its structure and function relationship towards high pressure and high temperature processing. We speculate that canola meal, subjected to ASE extraction, will yield novel compounds with relatively higher antioxidant properties where, these novel antioxidant compounds would impart an important role in the nutraceutical industry. Bioavailability and the cytotoxicity of these novel antioxidant compounds will be further evaluated using a cell based model system with human intestinal cells. Moreover, functional properties of these novel compounds in relation to blood glucose regulation will be confirmed through an animal model system of diabetes zucker-fa/fa rats. Up to our acquaintance this is the foremost study to cater knowledge on anti-diabetes properties of canola extracts processed through ASE, authenticating a health allegation for canola phenolic compounds en route for blood glucose homeostasis. (Funded by NSERC Discovery and Tri-Council GETS scholarships.)

Plasma 25-hydroxyvitamin D and n-3 fatty acids associate with muscle mass in head and neck cancer patients

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Mucositis and loss of muscle are two common toxicity effects of cancer treatment. The aim of this study was to determine whether severity of these toxicities is related to depletion of plasma vitamin D and n-3 fatty acids during treatment for head and neck cancer. In this prospective longitudinal cohort study, dietary intakes (3 day food record) and plasma levels of vitamin D and n-3 fatty acids were assessed at baseline (at diagnosis) and post-treatment (after 6 weeks radiation therapy with or without chemotherapy). Quantification of plasma 25-hydroxyvitamin D (vitamin D) was assessed by liquid chromatography tandem mass spectrometry (LC-MS/MS). Plasma fatty acids were extracted using Folch and phospholipids isolated using thin layer chromatography followed by gas chromatography for fatty acid amount and composition. Muscle mass was estimated from computed tomography images acquired at baseline and post-treatment. Both study time points were completed by 28 patients (age 60±10 y). Only 2 patients had a vitamin D level that would be considered sufficient (≥30 ng/ml) at both time points. Dietary intake of vitamin D increased significantly from baseline to post-treatment (P=0.04), although this had little effect on plasma level. Patients who experienced mucositis had significantly lower plasma vitamin D compared to patients without mucositis (P<0.001). After adjusting for age, sex, type of treatment and stage of disease, vitamin D was correlated with mucositis severity (P=0.006) at post-treatment. Vitamin D was also associated with muscle cross sectional area at baseline (P=0.01) and post-treatment (P=0.02). Patients had progressive loss of eicosapentaenoic acid (EPA, 20:5n-3) during treatment (P=0.006) which independently associated with muscle loss. This study revealed that poor vitamin D status is associated with mucositis and low muscle mass in HNC patients. Depletion of EPA during cancer treatment may contribute to accelerated rates of muscle loss. (Funded by Food and Health Innovation Initiative, faculty of ALES, University of Alberta.)

Supplementing docosahexaenoic acid in diets of mice bearing patient derived breast cancer xenografts enhances the anti-proliferative effects and reduces tumour growth

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Docosahexaenoic acid (DHA) has been shown to reduce growth of breast cancer cell lines in vitro and in vivo. Docetaxel (TXT) is a chemotherapy drug used in breast cancer therapy that binds to microtubules, inhibiting mitotic cell division, leading to reduced proliferation and cell death. Our lab has shown that pre-treatment of MDA-MB-231 cells with DHA prior to chemotherapy results in decreased cell growth, cell cycle arrest at the G2M phase and a decrease in protein expression of cell cycle markers including Cyclin B1, cdc25C and Wee1 in vitro and in vivo. Because immortalized cell lines do not represent the heterogeneity seen in human tumours, we sought to confirm this work using patient derived xenografts (PDX). NSG (NOD/SCID/IL2γ receptor null) mice (6 week old female) bearing subcutaneous triple negative PDx tumours (of 100 mm3) were randomized to one of two nutritionally adequate high fat diets (20% w/w ±5% DHA). Half the animals in each group were treated IP twice weekly with TXT (5mg/kg) for 6 weeks (n=6 in each of the 4 groups). Extracted tumours from the DHA+TXT diet group were significantly smaller than the Control+TXT tumours (1.7 ± 0.1g vs. 5.2±0.5g, p<0.01). Phospholipid content of tumours in the DHA+TXT group contained 5.5 ± 0.0% DHA compared to 2.6±0.3% in the control tumours (p<0.05). Immunohistochemical staining of tumours for Ki67 confirmed reductions in proliferation in the DHA+TXT tumours (p<0.05). This study confirms, for the first time in patient derived xenografts, that feeding a diet supplemented with DHA increases the content of DHA in cell membranes and facilitates the anti-cancer effect of TXT. This is consistent with our work in vitro in MDA-MB-231 cells and the results suggest the effects, including reduced tumour size, could be due in part, to reduced proliferation. (Supported by CIHR.)

Is the Healthy Eating Index-Canada 2010 (HEI-C 2010) a valid and reliable measure of diet quality?

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Background: Diet quality indexes measure adherence to pre-defined dietary patterns for a comprehensive examination of the relationship between diet and health outcomes. The Healthy Eating Index-Canada is one such diet quality index adapted from the USDA’s Healthy Eating Index for use in Canada. Objective: We aimed to develop and assess the validity and reliability of a revised Healthy Eating Index-Canada, the HEI-C 2010, using cross-sectional data from a nationally representative sample of Canadian adults. Design: The HEI-C 2010 was developed by adapting the USDA’s Healthy Eating Index for use in Canada. The HEI-C 2010 was confirmed multidimensionality of the index, with four dimensions contributing 63% of the total variance. Low to medium correlations were observed between energy intake and component scores (r between 0.03 and 0.67), indicating the index’s overall ability to assess diet quality independent of diet quantity. Internal reliability of the HEI-C 2010 was confirmed with Cronbach’s α = 0.79. Those in the highest quartile of the HEI-C 2010 score with the best adherence to the guidelines of the index were more likely to consume fibre-dense foods and
beneficial micronutrients while consuming less sodium, added sugar and saturated fat (P-trend < 0.0001 for all observations). Conclusions: The HEI-C 2010 provides a valid and reliable assessment of the diet quality of Canadian adults. Strong associations between adherence to the index and lower consumption of nutrients of concern (sodium, added sugar and saturated fat) indicate the potential for the HEI-C 2010 to be used as a national nutrition surveillance tool. (Supported by the Burroughs Wellcome Fund Innovation in Regulatory Science Award.)

Longitudinal evolution of weight in post-lung transplant patients
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Background: According to the Conference Board of Canada, between 2009 and 2011, 63.1 Canadians per 100,000 population died each year of pulmonary diseases (e.g. chronic obstructive pulmonary disease (COPD), interstitial lung disease (ILD), cystic fibrosis (CF)). Lung transplant remains the only definitive treatment available for end-stage lung diseases. Mounting evidence demonstrates that an optimal post-transplant nutritional status maximizes chances of transplant success and improves quality of life. Post-transplant weight evolution has been previously studied over short periods of time and regardless of the type of organ transplanted. This study is the first to document post-lung transplant weight evolution over a period of 15 years. Objective: The main objectives of this study were to: 1) document longitudinal weight trajectories of lung recipients from transplant up to 15 years post-transplant, and 2) determine whether sex, transplant BMI and the underlying lung disease influenced those trajectories. Methods: This is a retrospective cohort study including 515 lung transplant patients from the “Programme de Transplantation Pulmonaire du Centre Hospitalier de l’Université de Montréal (CHUM)”. Gender, transplant BMI and underlying lung disease were extracted from medical records. Weights were collected at various timepoints post-transplant (6 months, 1, 2, 5, 10 and 15 years). Weight variations were calculated between weight at transplant and weight at 15 years and annualized. Results: Men and women had an annualized weight gain of 1.13kg and 0.60kg respectively. Patients with a BMI <18.5 kg/m2 experienced an overall decline in weight (-1.7kg/yr). In contrast, patients with a BMI 18.5-24.9 and 25-29.9 kg/m2 experienced an overall weight gain of 0.40kg and 1.13kg respectively. Patients with a BMI >30 kg/m2 experienced an overall decline in weight (-1.7kg/yr). (Supported by the Canadian Lung Association and the Canadian Institutes for Health Research [MOP-119750, 172569].)

Health effects of inulin-type prebiotic use by children and adolescents: an evidence mapping review
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Background: Modifying the gut microbiota during childhood and adolescence via the intake of prebiotics may impact health during this life stage and lifespan. Objective: To conduct a systematic evidence mapping review of inulin-type prebiotics and health outcomes in healthy children and adolescents. Methods: We searched MEDLINE, EMBASE, and the Cochrane Library from inception through December 16, 2016, supplemented with manual searches. Human intervention trials and human observational studies were included that assessed the relationship between inulin-type prebiotics and any health outcome in healthy children and adolescents, aged 2 to 18 years. Relevant study data were extracted by two independent reviewers. The evidence was tabulated. Results: We screened 784 reports. Seven randomized and non-randomized controlled trials (666 participants) met the eligibility criteria. No other eligible study designs in healthy children were identified. Two trials evaluated galacto-oligosaccharides (GOS), 2 trials assessed fructo-oligosaccharides (FOS), and 3 trials investigated inulin or inulin-type fructans. Outcomes included bone health (mainly assessed via calcium absorption; 5 trials), diarrhea (1 trial), measures of body weight and adiposity (1 trial), acute respiratory infection (1 trial), and immune response (1 trial). Changes in microbiota composition were assessed in only 1 trial. Conclusion: There are a limited number of studies assessing use of inulin-type prebiotics on health outcomes in healthy children and adolescents. More studies are warranted to investigate additional benefits and provide guidance for prebiotic use in these age groups. (Supported by CIHR, NSERC, FRQ-S.)
The effects of docosahexaenoic acid supplementation on global gene expressions in rat fetal brains with ethanol exposure during pregnancy

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Maternal nutrition status is critical for fetal development and may protect the fetus from the external insults, such as alcohol. Prenatal alcohol exposure is known to affect genes involved in neurological development in fetal brains. Docosahexaenoic acid (DHA) is known to be a major membrane structural component of brain. Alcohol consumption is associated to decrease in DHA levels in brain and its supplementation might be beneficial in cases of alcohol exposure during pregnancy. However, how DHA impacts global gene expressions in fetal brain is not well known, especially with prenatal ethanol exposure. This study investigated whether, DHA supplementation during pregnancy affects global gene expressions in fetal brain with chronic prenatal ethanol exposure. Pregnant Sprague Dawley rats were raised on one of the 3 experimental diets; control, DHA (1.4%, w/w, total fat) without ethanol, and DHA with ethanol (EtOH, 3g/kg BDWT, twice a day via gavage) throughout the gestational period. No EtOH groups were gavaged with dextrose (isocaloric to EtOH). The diet was semi-purified, nutritionally rich and energy dense (4.3g/kg diet). Global gene expression in the fetal brains (n=5 each group, 1-2 from each dam) at gestational day 20 were analysed by microarray. Quantitative real-time polymerase chain reaction (qRT-PCR) was used for validating microarray results. Protein expressions were analysed by Western blot. No significant differences were identified in the fetal brains and body weights between the groups. Microarray analysis revealed that none of the transcripts were significantly altered in fetus brain (Log2(fold change) ≤ 2 and P > 0.05). qRT-PCR, agreed with microarray data in fold changes (FC<2 or FC>5.0). EtOH significantly (p<0.05) increased the expression of protocadherin beta 6 (PCDH6β) whereas, DHA decreased it to the levels in control group. EtOH also decreased WD repeat domain 92 (WDR92) regardless of a DHA supplementation in comparison to the control. Western blot revealed that protein expressions were also not significantly different among the groups. In this study, moderate ethanol exposure or DHA supplementation during pregnancy have minor impact on rat fetal brain gene expressions. The nutrient dense diet provided in this study may have mitigated the effects of ethanol. (Supported by the Canada-Israel International Fetal Alcohol Consortium and the Government of Manitoba, Dept. of Innovation, Energy & Mines.)

Effects of ruminant trans fatty acids on expression of genes involved in glucose metabolism in hepatocytes

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Introduction: Current evidence shows that ruminant trans fatty acids (tFA) and industrial tFA have distinct effects on health. Specifically, studies showed detrimental effects of industrial tFA compared to potential beneficial effects of ruminant tFA on glucose homeostasis. Ruminant tFA occur naturally in meat and dairy products meanwhile industrial tFA are generated through industrial and cooking processes. In our recent study, we observed an interaction between dairy product consumption and key genes of the glucose-sensing enzyme glucokinase (GCK). Specifically, glucose utilization was enhanced with the activation of GCK, potentially due to the activation of hepatic enzymes such as fatty acid synthase (FASN) and insulin receptor substrate-1 (IRS-1). Therefore, we hypothesized that dairy nutrients such as ruminant tFA may influence glucose utilization through the GCK pathway. Objective: To compare the in vitro effects of ruminant tFA on FASN and IRS-1 gene expression related to glucose metabolism in hepatocytes. Methods: Human hepatocellular carcinoma (HepG2) cells were incubated for 24h in a medium containing 25 mM of glucose supplemented with ruminant tFA, namely trans-vaccenic acid (tVA) or trans-palmeltoic acid (tPA), at concentrations of 25, 50 and 150 μM. Gene expressions of IRS-1 and FASN were determined by real-time qPCR. Fatty acid composition of cell membranes was obtained by gas chromatography. Results: Ruminant tFA were highly incorporated into cell membranes, representing 3-4% of total fatty acids. tVA 25, 50 and 150 μM had no effect on gene expression, neither on FASN (0.95±0.14 (mean fold change ±SD), 0.97±0.11 and 0.97±0.17 respectively, P=NS), nor on IRS-1 (0.97±0.095, 0.99±0.09 and 1.12±0.18 respectively, P=NS). Similarly, no effect has been observed with tPA 25, 50 and 150 μM, neither for FASN (0.99±0.14, 0.95±0.14 and 1.09±0.21 respectively, P=NS), nor on IRS-1 (1.22±0.25, 1.17±0.27 and 0.94±0.3 respectively, P=NS). Conclusion: Ruminant tFA do not seem to increase glucose utilization in hepatocytes through IRS-1 or FASN expression of the GCK pathway. Additional in vitro studies are needed to assess the effects of ruminant tFA on other genes involved in glucose homeostasis, and to understand whether other dairy nutrients either individually or in combination are involved in the beneficial changes in glucose metabolism. (Supported by FRQS.)

An analysis of health Canada’s proposed front of pack (FOP) labelling requirements on prepackaged foods to identify ‘less healthy’ products

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Introduction: With growing rates of obesity and diet-related diseases, it is essential that Canadians have tools that help them select healthier foods. However, many consumers find it difficult and time-consuming to identify healthier foods using only the Nutrition Facts table (NFt) found on food packages. Health Canada recently released a Healthy Eating Strategy which proposes new, mandatory Front of Pack (FOP) warning nutrition symbols on prepackaged foods exceeding predetermined thresholds for sodium, sugar and/or saturated fat. Health Canada’s warning symbol for FOP labelling is currently under consultation. This study quantified the number and proportion of Canadian foods that would have to display such FOP labels, overall and for each nutrient (of public health concern). Methods: Study used the University of Toronto 2013 Food Label Information Program (FLIP) database of 15,342 products (‘unique’ packaged foods/beverages by brand name). The number of products that would be required to display a warning sign was analyzed by Schedule Reference M categories overall and for each threshold. Results: Analysis of the food supply overall indicated that 47.4% of packaged foods would carry at least one warning sign, with 14% required for saturated fat, 22% for sodium, and 20% for sugar. In addition, only 4% of products would have warning signs for both saturated fat and sodium, 3.5% for saturated fat and sugar, and 1% for sodium and sugar. Further analysis indicated that only 0.12% would display warning signs for all three nutrients. It should be noted, however, that this analysis does not take into account the proposed exemptions from FOP labelling. Conclusion: This project is the first to quantify the implications of Health Canada’s FOP warning labels on prepackaged foods. FOP labelling has the potential to transform the way Canadian consumers make healthier dietary decisions and can allow provide incentives for manufacturers to reformulate and create healthier products. (Financial support: CIHR Fellowship (MEL), OGS (MA), Earle W. McHenry Endowed Chair (MRL), and Burroughs Wellcome Fund – Innovation in Regulatory Science (MRL).)
Weight misperception and health habits among young adults
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Introduction: A disconnect between actual and perceived weight status may affect dietary or physical activity (PA) behaviors. However the relationship between weight status misperception and lifestyle behaviors has not been fully explored. The objective of this study was to determine if weight-status misperception (i.e., underestimating or overestimating one’s weight status) relates to level of PA or motivation to be physically active. Methods: A two-step cluster analysis of 676 young adults participating in an ongoing longitudinal study was conducted to identify homogeneous subgroups based on shared weight-related characteristics. We then compared clusters with respect their dietary habits, level of PA and their PA motivations using ANCOVA, controlling for age, sex and whether the participant was trying to lose weight. Results: Three distinct clusters of weight misperceivers were identified (i) normal weight accurate perceivers, (ii) normal weight over-estimators, (iii) overweight under-estimators, which were distinct in terms of level of PA (Cluster 3 reported less vigorous PA), PA motivation (Cluster 1 reported higher self-determined motivation towards PA) and some dietary habits (Cluster 1 reported often being very hungry in the morning, cluster 2 reported smoking to control their weight and cluster 3 reported higher use of diet pills). Conclusion: Weight misperception may affect health behaviours such as diet and PA and is an important issue to assess in young adults to ensure that their own decision-making with respect to healthy lifestyle habits takes “reality” into account. Clinicians may need to assess weight misperception with their young adult patients to inform their patient counseling, and public health interventions may also need to consider weight misperception in tailoring weight control interventions.

Polyphenols prevent carcinogenesis by ameliorating mitochondrial dysfunction and inducing mitochondrial biogenesis
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Naturally occurring polyphenols in fruits and vegetables have been shown to exhibit anticancer characteristics. Although a role of polyphenols in cancer prevention has been previously described, an involvement of mitochondrial mechanisms has not previously been investigated. Mitochondrial dysfunction has been identified in several cancer cells and is correlated with poor prognosis. We hypothesized that polyphenols may inhibit carcinogenesis by increasing the number of healthy and functional mitochondria. In this study, we investigated the role of different classes of polyphenols in cancer prevention through induction of mitochondrial biogenesis and amelioration of mitochondrial dysfunction in an in vitro model of carcinogenesis induced by benzo[a]pyrene (B[a]P). B[a]P has 42 mouse fibroblast cells were pre-treated with 5 μM polyphenols (resveratrol, quercetin, catechin, cyanidin, cyanidin-3-glucoside (CSG), and berberine) for 2h followed by treatment with 4 μM B[a]P for 24h and 72h. B[a]P significantly decreased SIRT1 gene expression and activity by 37% and 13%, respectively, while quercetin and resveratrol strongly inhibited. B[a]P significantly decreased expression of transcription factors involved in mitochondrial biogenesis such as estrogen related receptor α (ERα) and mitochondrial transcription factor A (TFAM) by 30%, while some polyphenols completely inhibited these effects. B[a]P also decreased mitochondrial content after 24h by 46% and after 48h by 30%, however different polyphenols protected against this reduction and increased the number of mitochondria. B[a]P also induced mitochondrial dysfunction by decreasing nDNA- and mtDNA-encoded respiratory subunits by up to 35%, mitochondrial membrane potential (MMP) by 25% and ATP levels by 28%. However, polyphenols completely inhibited these effects of B[a]P and increased some mitochondrial respiratory subunits and MMP to a level of higher than untreated cells. The study showed that B[a]P impaired mitochondrial biogenesis and induced mitochondrial dysfunction whereas different polyphenols attenuated these effects. The results shed new light into the mitochondrial mechanisms by which polyphenols may prevent cancer initiation. Keywords: polyphenols, mitochondrial biogenesis, mitochondrial dysfunction, Benzo[a]pyrene (Financial support: Saskatchewan Health Research Foundation (SHRF)).

Prenatal supplements allow pregnant women to meet the recommended dietary allowance for vitamin D, but may elevate iron and folate intakes above the tolerable upper level
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Maternal age, socioeconomic status and dietary intake during pregnancy affect maternal and infant nutritional status. This was a preliminary data analysis of healthy mothers (n=40 infant/mother pairs) in Greater Montréal (NCT02563015) from March 2016 to January 2017. The objective was to compare maternal nutrient intake data during pregnancy to current recommendations and explore relationships of intakes with maternal characteristics. At baseline visits (51 month postpartum), family history, demographic and physical activity surveys were completed and a validated food frequency questionnaire (Harvard FFQ) reflecting intake during pregnancy was administered. The FFQ nutrient database was developed from the 2015 Canadian Nutrient File. Average total energy expenditure during pregnancy was estimated using Institute of Medicine equations. Data were analyzed descriptively (mean±SD) and using Spearman correlations. At baseline, mothers (age 32.3±5.1 y) were 60% white (24/40) and 68% had a family history of gestational diabetes. Maternal age at delivery was inversely correlated with gestational weight gain (r=−0.32, p=0.04). Family income was not associated with protein or iron intake (p>0.05). The ratio of energy intake to expenditure did not correlate with gestational weight gain (r=−0.26, p=0.11), which may in part be due to over- and under-reporting on the FFQ. Maternal intakes of protein, carbohydrate and fat as a percentage of total energy were normally distributed. Intake recommendations for calcium (1301±474 mg/d; RDA: 1000 mg/d), iron (19.5±8.8 mg/d; RDA: 27 mg/d), folate (596±308 μg DFE/d; RDA: 600 μg DFE/d) and vitamin D (354±254 IU/d; RDA: 600 IU/d) from diet alone were met by 68%, 13%, 35% and 0% of mothers, respectively. When including intakes from vitamin and mineral supplements, 88%, 85%, 90% and 63% of mothers met calcium (1641±530 mg/d), iron (60.02±37.4 μg/d), folate (2357±1507 μg DFE/d) and vitamin D (675±290 IU/d) recommendations, however, 58% and 90% of women were consuming above the tolerable upper level (UL) for iron and folate, respectively. These results suggest that vitamin and mineral supplements may be required to meet the vitamin D RDA and play an important role in meeting calcium, iron and folate RDAs, but may contribute to excessive iron and folate intake in pregnant women. (Funding: CIHR.)
Development and validation of a novel method for the analysis of essential elements in dried blood spots

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Dried blood spots (DBS), capillary blood collected on specialized filter paper by pricking an individual’s finger or heel, are a minimally invasive and cost effective alternative to venipuncture for elemental analysis. Nutritional assessments using DBS can help overcome logistical challenges faced by researchers, particularly in terms of data collection efforts in resource-limited regions and newborn screening programs. Although previous studies have used DBS for elemental measurements, technological and practical hurdles remain (e.g. detection limits, sample volume) and there is currently no widely accepted standard method of analysis. The objective of this research is to develop and validate a novel method of quantifying select essential elements (copper, zinc, selenium and iron) in DBS using Total Reflection X-Ray Fluorescence (TXRF). A TXRF-based method for elemental analyses was established by analyzing DBS from different human blood standard reference materials (SRM, Institut National de Santé Publique du Québec, INSPQ; n=7) with varying and known concentrations of elements. Percent recoveries, calculated by comparing DBS to known values, and coefficients of variation were analyzed for accuracy and precision. Stability of analyses was assessed by comparing results over 16 batch runs. The method was validated by quantifying essential elements in capillary whole blood and DBS collected from 49 healthy adults in the Montréal region. Percent recoveries for copper, zinc, and selenium using an entire 25 ul DBS of SRM were 106.7+/−10%, 97.9+/−11.9%, 105.3+/−9.2%, respectively. Percent recoveries for copper, zinc, and selenium using a 3mm diameter DBS sub-sample of SRM were 99.5+/−3.4%, 102.6+/−4.4%, 100.2+/−6.9%, respectively. These results indicate that elemental analysis of DBS using TXRF can accurately quantify select elements using both entire and sub-sampled DBS. These results can help establish a cost-effective method of collecting and quantifying essential elements in nutritional research.

Is the Med-Pass program the answer to malnutrition in geriatric patients? A systematic review

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Background: Malnutrition is common in frail older adults, and ensuring optimal energy and protein intakes is a crucial element of its treatment and prevention. The Med-Pass program has been developed to increase nutritional intake in geriatric patients with or at risk of malnutrition in hospitals or nursing homes, in order to counter malnutrition. This program recommends offering a small volume of oral nutritional supplement during medication administration rounds. Although many clinical studies report beneficial effects of the Med-Pass program on the nutritional status of older adults, this program remains scarcely used. Objective: To perform a systematic review of the literature to determine whether the Med-Pass program is an efficient, safe and practical method to manage malnutrition in older adults in hospitals and nursing homes. Methods: This systematic review is conducted following the core principles of the Centre for Reviews and Dissemination, and reported in accordance to the PRISMA statement. A combination between MeSH and free term searches are used to find relevant studies in peer-reviewed journals and grey literature in geriatrics. The quality of each study and the strength of evidence are assessed. Results: In total, 21 studies from 6 countries have been identified, including 13 conducted in hospital settings and 8 in nursing homes. One of these identified studies is qualitative, 4 are retrospective and 16 are clinical trials. Overall, studies’ designs are of poor quality and short duration. Nonetheless, they reported consistently high levels of adherence to the Med-Pass program, and weight gain or maintenance in most patients enrolled in the program. Data also suggests that the program is cost-effective by reducing oral supplement waste and is well accepted by the nursing staff. Data are inconsistent or insufficient to conclude on any beneficial effect of the Med-Pass program on skin integrity, functional status, mortality rate or care trajectory. Discussion: The potential beneficial effects of the Med-Pass program are poorly investigated so far. However, available data strongly suggests that this program might improve the nutritional status of hospitalized and institutionalized older adults. High-quality clinical trials should be conducted to investigate its long-term benefits, particularly on skin integrity and immunity.

Hepatic encephalopathy and health-related quality of life among cirrhotic patients: scope of nutritional status

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Malnutrition is an important prognostic factor potentially influencing clinical outcome of patients suffering from chronic liver disease (cirrhosis; CLD). Malnutrition may increase the risk of developing other complications including hepatic encephalopathy (HE). Malnutrition in cirrhosis may also affect patient’s functional status and health-related quality of life (HRQOL). Management strategies focusing on nutritional status in relation to complications of cirrhosis are an unmet clinical need. We hypothesize sub-optimal nutritional status in cirrhotic patients increases the risk of developing HE and decreases HRQOL. Hospitalized and outpatients (CHUM’s Liver Unit in Montréal, Canada) with liver cirrhosis of different etiologies and healthy controls were assessed for 1) Nutritional status (Subjective Global Assessment (SGA)); 2) HE (Clinical HE Staging Scale (CHESS)); 3) HRQOL (Short-Form-36 (SF-36) questionnaire). This on-going prospective study included 33 cirrhotic patients (58% men) of various etiologies (%: 30 alcohol, 33 virus, 27 NAS and 33 others), Child-Pugh (13A, 9B, 5C and 6N/A), mean age 55.7±12.9 as well as 13 healthy controls (46% men, mean age 49.4±14.9). SGA analysis revealed that 27% of cirrhotic patients were malnourished. Furthermore, cirrhotic malnourished patients showed decreased HRQOL compared to well-nourished cirrhotic patients (p<0.01). Cirrhotic patients, when compared to controls, displayed a lower score in physical functioning (p=0.03) and general health (p=0.03). CHESS analysis revealed none of the cirrhotic patients had HE while 21% of them had an HE diagnosis in medical chart, suggesting CHESS would not be sensible enough to screen HE. Our preliminary results suggest that nutritional status does influence particular domains of HRQOL in cirrhotic patients irrespective of their etiology. Further patients are required to statistically confirm the impact of nutritional status on HE and HRQOL in cirrhotic patients. Identifying factors associated with nutritional status, HRQOL and HE in cirrhotic patients may help improve patient care and guide future research.

Knockdown of angiopoietin-like 2 mimics the benefits of intermittent fasting on weight loss and insulin sensitivity in mice

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Obesity is known to be a risk factor for type 2 diabetes but the mechanisms involved are not clear. Angiopoietin-like 2 (ANGPTL2), a circulating pro-inflammatory glycoprotein mainly secreted by adipose tissues, is considered as a key mediator linking obesity to insulin resistance. Accordingly, high plasma levels of ANGPTL2 in humans are associated with obesity and the development of diabetes; in Angptl2/-

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mice exposed to a high fat diet, body fat is lower and insulin sensitivity is better than in wild-type (WT) mice. Various strategies have been developed to prevent weight gain and insulin resistance such as intermittent fasting, an efficient but strenuous lifestyle intervention that involves alternating cycles of fasting and eating. Our objective was to investigate whether the knockdown of ANGPTL2 in mice reproduces the benefits of intermittent fasting in WT mice on weight and insulin sensitivity. Intermittent fasting (one day of fasting/one day of free access to food) for 4 months reduced (p<0.05) Angptl2 mRNA expression by 53% in adipose tissue from WT mice. Both intermittent fasting for 4 months and knockdown of ANGPTL2 similarly decreased (p<0.05) feeding efficiency (55%), weight gain (55%), liver (38%) and adipose (55%) tissue weights and similarly increased (p<0.05) insulin sensitivity (measured by the insulin tolerance test). All measured parameters were similar between WT mice fed with an intermittent fasting regimen and ANGPTL2 knockdown mice fed ad libitum, suggesting that knockdown of ANGPTL2 reproduces the benefits of intermittent fasting on weight loss and insulin sensitivity. Finally, in post-acute coronary syndrome patients exhibiting high plasma ANGPTL2 levels, basal lipid oxidation was lower and carbohydrate oxidation was higher than in age-matched healthy controls. Thus, the benefits of ANGPTL2 knockdown on weight and insulin sensitivity could be potentially related to higher fatty acid oxidation rates, over carbohydrates in order to improve metabolic fuel use. We, therefore, propose that lowering ANGPTL2 associated with dietary recommendations could be a useful and promising strategy to prevent obesity and insulin resistance. (Supported by Canadian Institutes of Health Research Grant, the Grant in Aid from the Heart and Stroke Foundation of Canada, and the Foundation of the Montréal Heart Institute.)

Investigation of alternative and emerging pasteurization techniques for human milk preservation

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Provision of pasteurized human milk is an integral part of the care of vulnerable infants including those born preterm or to HIV-infected mothers in low-income countries. Donor milk, for North American hospitalized preterm infants is pasteurized using the Holder method (62.5 degrees C for 30 minutes) to prevent transmission of potential pathogens. However, this method negatively affects heat-sensitive milk vitamins and bioactives, including immunoglobulins. In developing countries, a low-tech, flash-heating technique of mother’s own milk is used to prevent the transmission of HIV. Our aims were to assess the effectiveness of four pasteurization methods on attaining post-pasteurization bacterial loads c<10^3 CFU/mL and retaining heat-sensitive vitamins and bioactives using folate and activity of bile-salt stimulated lipase as proxies. Holder, flash-heating, UV-C irradiation (252nm, 25min) and high hydrostatic pressure (HHP) (500mPa, 8min, 4 degrees C) were assessed. Seventeen milk samples containing >5x10^4 CFU/mL were collected from the Rogers HIV-1 Ontario Human Milk Bank and each underwent the four pasteurization methods. Pairwise comparisons were used to examine composition before and after each pasteurization. Preliminary results are expressed as medians and interquartile ranges. A total of 6, 7, 7 and 3 samples, out of 11 tested, had a bacterial load >1x10^3 CFU following Holder, flash-heating, UV-C and HHP respectively. Holder reduced (p=0.04) the pre-pasteurization level of folate from 161 (158-183) to 138 (109-154) nmol/L. Folate levels were not significantly reduced following flash-heating [144 (112-184) nmol/L], UV-C [155 (131-171)], or HHP [166(139-182) nmol/L]. Post-pasteurization bile-salt stimulated lipase activity [54 (46-58) U/mL], was completely abolished following Holder, [0.3 (0.15-0.95) U/mL], and flash-heating, [0.7 (0.55-0.9) U/mL] (p<0.0001); however, fully retained following HHP, [51 (38-63) U/mL] and partially retained following UV-C irradiation [24 (23-36) U/mL]. Overall, HHP may be a suitable alternative technique to pasteurize human milk. Further analysis is warranted to fully elucidate its impact on human milk biochemistry. (Funded by CIHR (FDN#143233)).

Reliability and validity of several novel body composition methods in healthy adults

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Cost-effective and efficient methods that are reliable and valid in assessing body fat are necessary to help identify those at risk of obesity and obesity-related chronic diseases. The objective of the present study was to evaluate body fat (% and kg) from field-based techniques of skinfold thickness using calipers and ultrasound, as well as the novel Fit3D ProScanner, for their reliability and validity. Forty-nine healthy adults (n=17 males, n=32 females) (age: 31.8±10.8 y; BMI: 23.6±3.1 kg/m²) fasted 2h and refrained from strenuous exercise for 24h prior to duplicate body fat estimates. Skinfold thickness was obtained at seven sites using Lang skinfold calipers and BodyMetrix ultrasound, and population-specific equations were used to estimate body fat (% and kg). Body circumferences were measured via Fit3D ProScanner, and its beta software estimated body fat (% and kg). Reliability was assessed using Bland-Altman plots, and expressed in both absolute (paired t-test mean[CI], SEM) and relative (ICC2,1) terms. Validity was assessed using Bland-Altman plots with both absolute and relative (ICC2,1) terms. Reliability was assessed using Bland-Altman plots with BODPOD as the reference standard. Body fat % estimated from skinfold thickness using calipers was not statistically reliable (T2-T1: 0.480 [0.177 to 0.782], 1.027, p=0.003; ICC2,1=0.987, p<0.001), but ultrasound (0.145 [-0.270 to 0.560], 1.202, p=0.486; ICC2,1=0.977, p<0.001) and Fit3D (0.154 [-0.246 to 0.554], 1.161, p=0.441; ICC2,1=0.977; p<0.001) showed good reliability. Body fat mass (kg) reliability was similar, and Bland-Altman plots supported these findings. Regarding validity of ultrasound, visual inspection of Bland-Altman plots revealed low variability, and fairly equal distribution of body fat % differences (BODPOD – ultrasound) above and below 0 indicating minimal bias (0.312; 95% limits of agreement [LOA]: 8.869 to -8.244). Fit3D analyses also showed good validity for body fat % (bias: -1.167; 95%, LOA: 7.594 to -9.929). Our findings indicate that estimating body fat from seven-site skinfold thickness via calipers should not be used as a field technique; it is possible that reliability and validity may improve with ISAK accredited technicians. Ultrasound may be a reliable and valid field-technique that requires little technician expertise. The Fit3D beta software shows promise for estimating body fat as an alternative to BODPOD. (Funded by Nutrition & Exercise Testing (NEXT) Lab.)

Comparison of applying two WHO nutrient profiling models (Americas and Europe) for the purpose of restricting marketing of less healthy foods to children in Canada

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In 2010, the World Health Organization (WHO) Member States endorsed recommendations on the restriction of marketing of foods high in saturated fat, trans fat, free sugars, or salt to children. In response to this commitment, nutrient profiling (NP) models were developed by the Regional Offices for the Americas [Pan American Health Organization (PAHO) model] and Europe [EURO model]. The objective of this study was to compare the effects of applying two WHO NP models developed for restricting the marketing of less healthy foods to children in a Canadian context. Data were obtained from the 2013 University of Toronto Food Label Information Program (FLIP), which contains nutrition information on 15,342 pre-packaged foods from the four largest national grocery retailers. The NP criteria of the PAHO and EURO models were applied to determine the propor-
tion of foods that could be marketed to children (“healthier” foods). Fairwise agreement between the models was assessed using the Kappa statistic. Sub-group analyses were conducted for the 22 main food categories specified in Schedule M of the Food and Drug Regulations. When all products were analyzed, the proportion of foods (95% CI) that could be marketed to children was lower using PAHO compared to the EURO model [15.9% (15.3–16.4%) and 20.2% (29.5–30.9%), respectively. Similarly, fewer foods were classified as “healthier” using PAHO compared to the EURO model for 12 food categories (fruit/fruit juices, nuts/seeds, sugars/sweets). Pairwise agreement between the models was fair ($k=0.37$). Overall, these findings suggest that the two WHO models would allow for different pre-packaged products within the Canadian food supply to be marketed to children, with PAHO as the more stringent of the two models. These results may assist regulators in the selection of the NP model that underpins the policy on the marketing of foods to children in Canada. (Supported by: Burroughs Wellcome Fund-Innovation in Regulatory Science (TP, MRL); CIHR Fellowship (MEL); Earle W. McHenry endowed Chair (MRL)).

**Time trends of vitamin B12 deficiency in older adults: a population-based cohort study**

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**BACKGROUND:** Vitamin B12 deficiency has serious consequences such as neurologic damages. Prevalence is the highest in older adults (5-15%). These rates may have increased over years due to the growing use of drugs known to alter vitamin B12 absorption (eg, metformin, proton pump inhibitors). However, time trends in the epidemiology of vitamin B12 deficiency and incidence rates at the population level remain unknown. OBJECTIVE: To assess trends in incidence and prevalence rates of diagnosed vitamin B12 deficiency in older adults from 1995 to 2010. METHODS: The cohort includes a random sample of 367,500 residents of Québec, Canada, aged >65 years between 1995 and 2010, and registered to the Public Drug Insurance Plan for 21 years. Medico-administrative data used were related to drug claims, medical services and hospitalisations, including diagnoses recorded based on the codes of the International Statistical Classification of Diseases and Related Health Problems. Individuals with one of the following were deemed as diagnosed with vitamin B12 deficiency: prescribed vitamin B12 therapy, diagnosis of vitamin B12 deficiency anemia, or diagnosis of B vitamin deficiency without evidence of vitamin B9, B6, or B2 deficiency within 56 months of the record date. Crude prevalence and incidence rates were calculated by sex and age groups for each calendar year. Age- and sex-adjusted rates were computed using the 2009 population data. Poisson regression was used to estimate the incidence rate ratios (IRR) for sex, age, and calendar year. RESULTS: In total, 21,635 incident cases of vitamin B12 deficiency were identified. The overall adjusted incidence rate was of 0.87/100 person-years. Incidence increased sharply with age, from 0.42-0.47 in men and women aged 66-69 years to 1.9-2.1 in those aged ≥85 years (IRR 4.5, CI:4.3-4.8). Adjusted annual incidence rates varied from 0.66 to 1.00 with no consistent trend over years. Adjusted prevalence rates increased steadily from 2.3% in 1995 to 5.6% in 2010. CONCLUSION: The high incidence and the increasing prevalence suggest vitamin B12 deficiency as a public health issue in older adults, especially in the oldest-olds. Research is needed to define the role of drug exposure in the epidemiology of vitamin B12 deficiency.

**Validation of a personal electrical impedance myography device for body composition**

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**Background:** In order to properly monitor effects when changing nutrition and health behaviours, accurate identification of adiposity is key. Dual-energy X-ray absorptiometry (DXA) is commonly used as a reference method for body composition. However, the expense and radiological exposure make this device impractical. Accurate Impedance Analysis (BIA) is an inexpensive alternative. The “Skulpt”, is a relatively new personal device using Electrical Impedance Myography (EIM) to determine adiposity but its validity is unknown. Objectives: Evaluate the agreement between BIA and DXA based on weight status. Methods: In a sample of 82 healthy adults (48 women and 34 men), fat percentage was measured with DXA, two BIA (Impedimed SF87 and BodyStat Quadscan 4000) devices and an EIM (Skulpt Chisel) device. Based on body mass index (BMI), weight status was classified as Normal (18.5<BMI<25), Overweight (25<=BMI<30) and Obese (BMI>=30). Statistical analyses included intraclass correlation coefficients (ICC), Bland-Altman plots and paired t-tests, stratified by sex. Results: Compared with DXA, the ICC was moderate-to-high (IMP ICC=0.90, Q5 ICC=0.87, EM ICC=0.77). As BMI increased, accuracy decreased: differences between DXA and EIM were [-7.2%, -14.1% and -11.14%) among normal-weight [p=0.03], overweight [p=0.1] and obese [p=0.03] women respectively; and [+1.38%, +10.1% and +13.4%) among normal-weight [p=0.7], overweight [p=0.004] and obese [p=0.03] men, respectively. Compared with DXA, BIA IMP differed by [+8.0%, +16.0% and +12.8% among normal-weight, overweight and obese women, respectively (all p<0.01), and differed by [-9.2%, +11.8% and +15.1% among normal-weight [p=0.09], overweight [p=0.004] and obese [p=0.03] men, respectively. Lastly, BIA Q5 differed from DXA by [+2.8%, +6.4% and +4.4% among normal-weight [p=0.38], overweight [p=0.006] and obese [p=0.08] women, respectively, and differed by [+11.1%, +14.7% and +15.1% among normal-weight [p=0.05], overweight [p=0.00] and obese [p=0.0002] men, respectively. The differences between DXA and each device were weakly correlated with one another (r<0.4). Bland Altman plots revealed IMP and EIM displayed a positive bias as BMI increased, while Q5 displayed a negative bias. Conclusion: The devices should not be used interchangeably. As the ICC was lowest between the Skulpt and DXA, further research is needed on the Skulpt’s utility in clinical practice.

**The short- and long-term effectiveness of a school- and web-based dairy intervention in modifying knowledge and behaviour of grade 7 youth**

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Despite the health benefits of dairy products and alternatives, their consumption continues to decline, particularly in pre-adolescents and adolescents. Previous work has highlighted components of successful interventions, including in-person and web-based delivery with fun, interactive games. However, there is limited research evaluating how websites, or other Internet-based technologies, can be supportive components of in-person health interventions. The objective of the present study was to assess the effectiveness of a school-based nutrition intervention with a supportive web-based component at changing adolescents’ knowledge and behaviour regarding dairy products and alternatives in the short and long-term. Grade seven students in six elementary schools in Southwestern Ontario participated in the
Determination of dietary threonine requirements in healthy school-aged children

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Background: Threonine (THR), an essential amino acid, is required for whole body protein synthesis. In particular, THR is necessary for mucosal protein synthesis because THR forms a major constituent of intestinal mucus. The current dietary reference intakes (DRIs) for THR in school-aged children are based on a factorial estimate and have not been directly determined. Objective: Our objective was to determine the requirement for THR in healthy 6-10 y children using the minimally invasive Indicator Amino Acid Oxidation (IAAO) method. This method measures the oxidation of [1,3-13C]-phenylalanine to breath 13CO2 (F13CO2), and compares changes in response to altered test amino acid intakes.Methods: 4 healthy children (2 boys: 2 girls) aged 7.5 ± 1.3 y randomly received 6-9 test THR intakes, ranging from 0 - 50mg/kg/d, along with an amino acid mixture designed to give a total intake of 1.5g/kg/d protein. The diets were supplemented with carbohydrate, fats, vitamins and minerals and provided 1.7x the resting energy requirement as determined by indirect calorimetry. On each study day, the test diets were provided as isocaloric, isonitrogenous meals, with breath sample collection before and during isotopic steady state. 13C enrichment in breath samples was measured using an isotope ratio mass spectrometer. THR requirement was determined using a two-phase linear regression crossover model to identify a breakpoint in 13CO2 production, which represents the mean THR requirement. Results: Preliminary results suggest that the mean THR requirement in school-aged children is 20.63 mg/kg/d. Whether THR, an amino acid important for gut mucosal integrity, is affected by parasitic infestation needs to be determined. (Supported by a Canadian Institutes of Health Research grant.)

Protection by different classes of dietary polyphenols against palmitate-induced mitochondrial dysfunction and endoplasmic reticulum stress in a cell model of non-alcoholic fatty liver disease

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Diets high in saturated fats have been widely implicated in development of nonalcoholic fatty liver disease (NAFLD). NAFLD is a public health burden with clinical and histological abnormalities that can progress to non-alcoholic steatohepatitis (NASH), cirrhosis, fibrosis, and hepatocellular carcinoma. Mitochondrial dysfunction and endoplasmic reticulum (ER) stress induced by dietary saturated fats have recently been implicated in the initiation and progression of NAFLD. Dietary polyphenols found in many fruits and vegetables have promise in amelioration of NAFLD but the mechanisms and effectiveness of different classes of polyphenols are largely unknown. In an in vitro model of steatosis using human HepG2 hepatocytes, we investigated the effect of selected polyphenols (resveratrol, quercetin, catechin, cyanidin, cyanidin-3-glucoside, and berberine) on palmitate-induced steatosis, ROS production, mitochondrial impairments, and endoplasmic reticulum stress. The cells were treated with 10 μM polyphenols for 2 h, exposed to 500 μM palmitic acid for 24 h, and then evaluated for intracellular fat accumulation (Nile Red staining), ROS, mitochondrial content (MitoTracker Green), mitochondrial membrane potential (TMRE staining) and relative mRNA (removed using RT-qPCR) of mitochondrial respiratory complex subunits and ER stress markers. Palmitic acid increased steatosis, decreased mitochondrial membrane potential, induced expression of INOS and markers of endoplasmic reticulum stress, produced mitochondrial membrane potential collapse and decreased mitochondrial biogenesis. This shows that different polyphenols protected against these effects, induced mRNA for respiratory complex subunits encoded by nuclear DNA (NDUF5, UQRC1, and ATP5G1) and mitochondrial DNA (MTND1, MT_CYB, MTCOX1, and MTATP6), and decreased expression of iNOS and genes responding to endoplasmic reticulum stress (GRP/94, GRP78, ORP150, ERdj4, ATF4, and CHOP). Although there were some differences between the effects of different polyphenols, no polyphenol emerged as being more or less protective than the others. Together, the results showed that different polyphenols all similarly protected against steatosis and oxidative stress, but differed in affecting ER stress, mitochondrial membrane potential, and mitochondrial biogenesis. Accordingly, dietary polyphenols can protect against these aspects of NAFLD and should be studied further as possible dietary treatments for NAFLD. (Financial support: Saskatchewan Health Research Foundation (SHRF).)

The effect of prenatal alcohol exposure and docosahexaenoic acid supplementation during development on male reproductive function in a rat model

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Although male fertility problems are diagnosed in adult life, evidence suggests that it might have a fetal origin. Both alcohol and dietary docosahexaenoic acid (DHA) are known to be testicular lipid modulators, which affect normal sperm and testosterone production, thereby affecting fertility. This study investigated whether dietary DHA and prenatal alcohol influence testicular development and function in a rat model. Forty pregnant Sprague-Dawley rats randomly assigned to receive either ethanol (3g/kg, twice a day by gavage) or dextrose, isocaloric to ethanol, throughout pregnancy. Half of each group was fed either control or DHA supplemented diet (1.4%, w/w fatty acids). Both alcohol and dietary DHA supplementation during pregnancy decreased male reproductive function. (Supported by the Saskatchewan Health Research Foundation (SHRF).)

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G20 and improved normal sperm morphology at P90. DHA diet showed a positive effect on testicular histological markers until puberty (P49), while there was a significant reduction in the height of seminiferous epithelium at P90. Compared to the control groups, pre-natal ethanol exposure delayed serum testosterone surge during development from P4 to P90. Prenatal alcohol induced a significant increase in expression of genes involved in testicular polynsaturated fatty acids and seminolipid synthesis at P90. There were no significant changes in sperm motility and function in both treatments at P90. In conclusion, the results indicate that providing early dietary DHA can be a positive factor for male fertility with impacting on sperm morphology in adulthood, likely by influencing the testosterone levels in fetal period. Prenatal alcohol exposure affects minimally on sperm parameters in adult life. (Supported by the Canada-Israel International Fetal Alcohol Consortium and the Government of Manitoba, Dept. of Innovation, Energy & Mines.)

Efficacy of nutrition risk screening with NutriSTEP® among toddlers and preschoolers
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Toddlers (ages 18 to 35 months) and preschoolers (ages 3 to 5 years) are at a critical age for developing eating behaviours and food preferences. Nutrition screening tools can be an inexpensive and effective means of identifying children at nutritional risk and can also facilitate nutritional intervention and referral for assessment and treatment. The NutriSTEP® questionnaires are valid and reliable 17-item, community-based, parent-administered questionnaires that identify attributes of nutritional risk in toddlers and preschoolers. The objective was to evaluate the efficacy of the NutriSTEP® program among parents of toddlers and preschoolers. The study was a wait-listed, cluster, randomized controlled trial with a post-test 3-months post-intervention. A convenience sample of 137 parents/primary caregivers were recruited from 17 Ontario Early Years Centres within 150 km of Guelph, Ontario. The intervention was the NutriSTEP® program (administration of the nutrition risk screening tool (NutriSTEP®) and the accompanying nutrition education materials). The primary outcome was parental nutrition-related knowledge. Secondary outcomes included parental psychosocial correlates (attitudes, self-efficacy, and intentions) and child nutrition risk scores. Data analysis was with SPSS; Generalized Estimating Equations were used to examine the effect of the intervention. Compared to parents in the control group, parents of both toddlers and preschoolers who received the intervention had significantly increased nutrition-related knowledge (p=0.04) and attitudes scores about nutrition-related behaviours (p=0.03). Parents of preschoolers also had significantly increased self-efficacy (p=0.02) and intentions (p=0.01) scores. Using a post-test-only design for the NutriSTEP® risk scores, there was no significant difference (p=0.05) between control and intervention groups. These results suggest that the NutriSTEP® program serves as an efficacious parent-targeted assessment tool and education intervention which can change determinants of child nutrition risk behaviours. (Supported by the Canadian Foundation for Dietetic Research.)

Evidence of anti-obesity protective effects from dietary medium chain triglycerides
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Context: Obesity is associated with the metabolic syndrome and its multiple comorbidities including NAFLD, insulin resistance, type 2 diabetes, low grade inflammation and cardiometabolic risks. The prevalence of obesity results from the generalization of Western diet highly enriched in carbohydrates and long chain saturated fatty acids and sedentary lifestyle. These nutrients, when consumed in excess, are converted into triglycerides and stored in white adipose tissue. The excess of fat is accumulated in ectopic sites such as liver leading to hepatic failure. Here, we propose to investigate for anti-obesogenic effects of medium chain triglycerides (MCT) previously shown to promote lipid catabolism better than anabolism. Hypothesis: We hypothesize that an experimental diet enriched with MCT will prevent from the development of an obesity-induced metabolic syndrome in comparison with a classical high-fat diet which mimics a Western-diet. Methods: C57BL/6 mice were fed with either a high-fat diet (HFD, with 45% Kcal from lard), a low-fat diet (LFD, with 10% Kcal from lard) and two modified high-fat diets containing either 20% Kcal from MCT (MCT-20) or 40% Kcal from MCT (MCT-40) for a period of 10 weeks. The four diets were isocalorically designed. Mice were weighed and their fasting glycemia measured weekly. At the end of the diet protocol, mice were subjected to Insulin Tolerance (ITT) and Glucose Tolerance (GTT) tests. Liver and white adipose tissue samples were collected to evaluate triglycerides accumulation, lipogenic and catabolic genes expression. Blood samples served to evaluate the circulating levels of metabolic hormones (insulin, ghrelin, leptin and adiponectins), as well as hepatic AST and ALT. Results: Preliminary data show that MCT-20 and MCT-40 administration significantly reduced, at a dose-dependent manner, long-term HFD-induced weight gain, fasting glycemia, and abdominal obesity, confirming antiobesity effects from MCT. Moreover, MCT-20 and MCT-40 groups significantly improved glucose tolerance and insulin sensitivity in comparison with HFD group, suggesting protective effects from MCT against obesity-induced diabetes. Consistently hepatic p-Akt (Ser473) levels were 3-fold higher in MCT-20 and MCT-40 groups relative to HFD. Qualitative observations showed that MCT-20 and MCT-40 dose-dependently reduced visceral adiposity and hepatic weight in comparison with HFD. Overall, MCT diets prevented obesity.

Feeding a maternal diet containing a mixture of choline forms during lactation modulates choline breast milk composition and improves T cell function in suckled offspring
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Previously, we reported on the beneficial effect of feeding phosphatidylcholine (PC) to lactating dams on the offspring’s immune system development, compared to feeding free choline (FC). However, it is not representative of human dietary pattern for which a mixture of choline forms are consumed. The objective of this study was to determine the impact of feeding a mixture of choline forms in the maternal diet during lactation on the development of the immune system in the suckled offspring. At parturition, dams (n=6/diet) were randomized to 1 of 3 nutritionally complete, fatty acid balanced diets, providing 19 g/kg of total choline: Control (100% FC), Mixed Choline (MC) (50% PC, 25% FC, 25% glycerophosphocholine (GPC)), or High GPC (HGPC) (75% GPC, 12.5% PC, 12.5% FC). At 3 weeks, the choline moieties from pups’ stoma- chach contents (reflective of the dams’ breast milk), splenocyte phenotypes and ex vivo cytokine production after Concanavalin A (ConA) stimulation, were measured. Breast milk MC-fed dams contained a higher proportion of PC and a lower proportion of phosphocholine, while HGPC-fed dams had a higher proportion of GPC and lower proportions of FC and phosphocholine vs. Control-fed dams (all P<0.05). Pups from dams fed MC and HGPC diets produced less IFN-γ and TNF-α compared to Control pups (both P<0.05). MC pups also produced less IL-6 vs Control pups, while no change was observed in the production of IL-2 (proliferation marker) and IL-10 among diet groups. MC and
A systematic review and critical qualitative meta-analysis of lifestyle interventions for the prevention and management of diabetes

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Background: Prominent scholars have called attention to widespread myths and presumptions regarding the relationships between diet, exercise, weight, and disease incidence. Rarely are these taken-for-granted assumptions rigorously investigated, and the reliance on conjecture may hinder progress in the area of non-communicable disease prevention, in an era of spiraling type II diabetes rates. It is unclear to what extent researchers contribute to presumptions concerning weight, lifestyle, and diabetes, and how often these relationships are thoroughly, distinctly delineated. We sought to explore how researchers 1) rationalize their studies, 2) interpreted their findings, and 3) prioritized their findings in the conclusions and abstract. Methods: We completed a search of several electronic databases for records published in English between 2007 and November 2016. Selection criteria included: randomized controlled trials with a follow-up period of 12 months; adult participants ≥18 years of age with type 2 diabetes or pre-diabetes; lifestyle interventions classified as dietary, exercise, and/or behavioural; primary study outcomes are incident diabetes, mortality, cardiovascular disease, diabetes complications, and quality of life; and secondary outcomes are glycemic control, hypertension, and blood pressure. All eligible articles were subject to thematic content analysis to explore the research questions. Results: A total of 30 articles were identified for inclusion. Obesity and weight loss figured prominently in the rationale and outcomes of the majority of the articles, despite intentional exclusion of ‘weight loss’ and ‘obesity’ as search terms in the initial search. There was ambiguity over whether weight loss was classified as inclusive to the intervention or an outcome. Results from intervention and control groups were pooled in numerous studies to test the relationship of weight loss to outcomes. This led several authors to conclude that weight loss should be recommended to patients at-risk of developing diabetes rather than, or not specifically, the actual intervention under investigation. Conclusions: Researchers need to be aware of their biases and assumptions in interpreting findings regarding lifestyle interventions for diabetes prevention and management. The research community may have inadvertently perpetuated the message that weight loss should be recommended for diabetes prevention, even if results are actually attributable to diet and/or exercise.

Evaluating changes in omega-3 fatty acid intake after receiving personal FADS1 genetic information: a randomized nutrigenetic intervention

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Nutrigenetics research is anticipated to lay the foundation for personalized dietary recommendations; however, few randomized nutrigenetic interventions have been conducted to date. Therefore, it remains unclear if providing individuals with their personal genetic information actually encourages meaningful changes in dietary behaviours. The objective of this study was to evaluate changes in omega-3 fatty acid (FA) intake and blood levels after providing young adults with personal genetic information for a common variant in the fatty acid desaturase 1 (FADS1) gene (rs174537). There were 57 females (18-25 yrs.) randomized into Genetic (intervention) and Non-Genetic (control) groups and measurements were taken at Baseline and Final (12-weeks). Dietary intake of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) was assessed using a validated omega-3 food frequency questionnaire. Red blood cell (RBC) FA content was quantified by gas chromatography. Implications of participation in a nutrigenetics study, awareness of omega-3 FA terminology, and opinions of receiving genetic information were assessed with separate online questionnaires. Upon completion of the study, EPA and DHA intake increased significantly (p<0.001) from below recommended dietary intake levels to those meeting Dietary Guidelines of Canada recommendations (≥300mg EPA and DHA/day) in both the Genetic and Non-Genetic groups. This change was reflected by small increases in RBC %EPA in...
both groups (p=0.02). Participants in the Genetic group showed increased awareness of omega-3 terminology by the end of the study, reported that the dietary recommendations were more useful, and rated cost as a barrier to omega-3 consumption less often than those in the Non-Genetic group. In conclusion, providing participants with FADS1 genetic information did not appear to differentially influence omega-3 intake (or corresponding RBC levels) in the short-term; however, this information did improve awareness of omega-3 terminology, utilization of nutritional information, and minimized the notion of cost as a barrier to consumption of omega-3 foods or supplements compared to controls. (CIHR.)

**Timing of pre-exercise basal insulin infusion rate reduction to prevent exercise-induced hypoglycemia in adults with type 1 diabetes using insulin pump therapy**

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Regular exercise should be encouraged in most patients with type 1 diabetes (T1D) but is mainly limited by fear of hypoglycemia. To reduce the risk of exercise-induced hypoglycemia, two types of adjustment may be considered: insulin dose reduction and/or carbohydrate supplements. Insulin pump therapy (CSII) offers flexibility using temporary insulin infusion rate reduction. Few studies have investigated the pre-exercise optimal timing at which patients should implement insulin infusion reduction to prevent exercise-induced hypoglycemia. The objective of this study was to compare the efficacy of different pre-exercise timing for an 80% insulin infusion rate reduction to prevent exercise-induced hypoglycemia in adults with T1D using CSII. Participants performed an afternoon 45-minute exercise at 60% of VO2peak on an ergocycle 3 hours after a standardized lunch. In a random order, insulin infusion rate was reduced at the time of exercise, 20 minutes before exercise or 40 minutes before exercise. Capillary glucose levels were measured at the onset of exercise, 15 minutes after the onset of exercise and then every 5 minutes until the end of exercise. 15 participants ≥18 years old with type 1 diabetes ≥1 year, and treated with insulin pump >3 months were recruited. There was no significant difference between the three strategies for time spent below 4 mmol/L, time spent between 4 and 10 mmol/L and decrease in glucose levels. When insulin infusion rate was reduced 40 minutes before exercise, 20 minutes before exercise and at the time of exercise, the number of hypoglycemic events below 3.5 mmol/L was 5, 9 and 7 respectively and the starting glucose levels were 7.9 ±3.1 mmol/L, 6.9 ±2.0 mmol/L and 6.9 ±2.5 mmol/L (means ±SD) respectively. Conclusion: Earlier timing and/or larger insulin infusion rate reduction should be tested in a larger group of patients. (Support: J.A. De Sève Chair of Excellence.)

**Chlorogenic acid and its microbial metabolites exert anti-proliferative effects, S phase cell cycle arrest and apoptosis in human colon cancer Caco-2 cells**

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Dietary polyphenols such as chlorogenic acid (CGA) are indicated to exert anti-cancer effects by decreasing the viability of cancer cells mediated by cell cycle arrest and activation of proteases that induce apoptosis. CGA, however, is poorly absorbed as it undergoes extensive biotransformation by colonic bacteria to generate microbial metabolites, notably caffeic acid (CA), 3-phenylpropionic acid (3-PPA) and benzoic acid (BA). This study investigated the effects of the above four compounds on cell proliferation, cell cycle progression and caspase-3 cleavage in Caco-2 cells. Caco-2 cells were cultured with CGA, CA, 3-PPA and BA, both individually and as a mixture containing an equal amounts of the four compounds, at concentrations of 25, 50, 100, 250, 500 and 1000 µM. Cell viability and cytotoxicity were measured by the MTT (3-(4,5-dimethyl-2-thiazolyl)-2,5-diphenyl-2H-tetrazolium bromide) and lactate dehydrogenase (LDH) assays, respectively. Cell cycle distribution was determined by flow cytometry. Caspase-3 cleavage was assessed by Western blot. Antioxidant activity was measured by the ferric reducing ability of plasma (FRAP) assay. CGA, CA and the mixture showed a significant increase in antioxidant activity in a dose-dependent manner starting at 25 µM (p<0.05) whereas 3-PPA and BA showed no antioxidant activity. CGA, CA and the mixture decreased cell viability significantly (p<0.05) by B, V and 57%, respectively at the 500 µM concentration and increased LDH release (p<0.05) after 24 h. A decrease in cell viability by 20% and 37% was shown by 3-PPA and BA, respectively at the 1000 µM concentration but those agents did not affect LDH release. S-phase cell cycle arrest was induced by both CA and the mixture at a lower concentration (100 µM) in comparison to CGA (250 µM) and 3-PPA (500 µM). BA did not affect cell cycle distribution. Activation of caspase-3 was induced by CGA, CA and the mixture. These data demonstrate that CGA, CA, and the mixture exert anti-proliferative effects on colon cancer cells via cell cycle arrest and apoptosis. We conclude that CA, a major metabolite of CGA generated by colonic microbial catabolism, is associated with anti-cancer effects at lower concentrations than the original parent compound. (Supported by NSERC.)

**Effects of the iron chelator curcumin in the DSS-induced colitis mouse model**

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Inflammatory bowel disease (IBD) patients have a major increased risk for colorectal cancer (CRC). Curcumin, an active ingredient in dietary spice turmeric, has been shown to reduce inflammation and colonic tumor burden in mouse models of IBD. However, curcumin has also been shown to chelate iron and is sufficient to induce iron deficiency in vivo. The iron chelating properties of curcumin may thus contribute to the development and severity of iron deficiency in IBD settings. To evaluate the effects of curcumin on systemic iron balance, colitis was induced by administration of dextran sodium sulfate (DSS) (1% W/V) in drinking water to C57Bl/6 or Balb/c mice fed an iron sufficient diet (50 ppm iron) with or without supplemented curcumin (2% w/w). We found that curcumin supplementation in the DSS mouse model of colitis causes mild anemia, depletes splenic iron storage, results in aggravated diarrhea and decreases survival in C57Bl/6 mice. Furthermore, The anemia observed in mice fed the diet supplemented with curcumin and subjected to DSS may be due to the chelation of iron by curcumin concomitantly with the use of the iron sufficient diet (50 ppm of iron). Our finding that curcumin decreases survival in DSS-treated mice is in contrast with previous data wherein curcumin was shown to improve the survival of DSS challenged Balb/c mice. A contributing factor to this discrepancy may be the high iron content of diets used in other studies (>250 ppm of iron) compared with the iron sufficient diet (50 ppm of iron) used here. These findings suggest that curcumin use as a supplement may exacerbate the iron deficiency anemia in IBD patients. (CIHR.)
Vitamin B6 status of older adults living in residential care facilities in metro Vancouver

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Vitamin B6 (B6), in the biologically active form of pyridoxal 5’-phosphate (PLP), functions as a coenzyme in more than 160 reactions involving the metabolism of amino acids, carbohydrates, and neurotransmitters. Suboptimal B6 status, defined as serum PLP concentration of 20-30 nmol/L, and B6 deficiency, i.e., serum PLP concentration < 20 nmol/L, have been linked with top causes of morbidity and mortality, such as cardiovascular disease and cancer. In this study, we aimed to measure serum PLP concentration as a direct biomarker of B6 status in older adults living in residential care facilities who are more prone to adverse health outcomes of B6 inadequacy due to their increased risk of co-morbidities. Non-fasting blood samples and demographic data were collected from a convenience sample of 237 female (75%) and male (25%) seniors aged 65-103 y (median: 85 y) living in Fraser Health-operated residential care facilities. Median serum PLP concentration was 27.0 nmol/L (IQR: 18.4–42.9). The prevalence of B6 deficiency was 31% and 26% of participants had suboptimal B6 status. Multivitamin supplement users (n = 51) had significantly higher median serum PLP concentration compared with non-users (33.4 versus 25.6, respectively; P = 0.05). Serum PLP concentration was negatively associated with body mass index (P = 0.014) and positively associated with serum albumin concentration (P = 0.025) after adjustment for demographic factors and disease status. No significant association was found between diabetes, psychiatric disease, dementia, cardiovascular disease and musculoskeletal disease with serum PLP concentration. The proportional odds of having deficient B6 status versus the combined sub-optimal and adequate B6 status categories was 1.25 times greater (P = 0.030) for each increase of 4 kg/m² in BMI, assuming that other predictor variables are held constant. Only 6% of the variance of serum PLP concentration was explained by demographic, lifestyle, and disease predictors. The combined 57% prevalence of B6 deficiency and suboptimal B6 status in this elderly population is substantially higher compared to other population groups. Further research is warranted to identify determinants of B6 inadequacy in this vulnerable population group and investigate effective prevention strategies. (Funded by FNH Vitamin Research Fund.)

Trimester specific dietary intakes assessed by a web-based 24h recall in comparison to current nutritional recommendations in pregnant women – preliminary results

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Background: Nutritional status during pregnancy affects both the mother and the child’s health. Assessing dietary intakes accurately during this crucial period is essential to identify potential macro- and micronutrient excesses or deficiencies. Aims: 1) to measure changes in macronutrient intakes throughout trimesters and 2) to compare macro- and micronutrients intakes with current nutritional recommendations. Methods: Preliminary results include 28 pregnant women recruited (n=84 expected) in the 1st trimester (9.2±0.7 weeks) who completed, at each trimester, 3 web-based 24h dietary recalls combined with a web questionnaire on dietary supplements to obtain total nutrient intakes. Results: Participants were aged 33.0±3.4 years and had an average pre-pregnancy BMI of 25.6±5.0 kg/m². Changes in energy, protein, carbohydrate and lipid intakes were not significantly different across trimesters. Average energy intakes significantly exceeded estimated energy requirements (EER) in the 1st (2443±1559.4 vs 2025.5±189.1 kcal, p<0.001) but not in the 2nd (2382.6±497.1 vs 2348.7±174.2 kcal, p=0.97) or in the 3rd (2390.0±484.0 vs 2475.1±166.4 kcal, p=0.39) trimesters. Average protein intakes were above the average estimated protein requirements (106.7±22.0 g vs 97.1±8.5 g <P<0.05) in the 1st; 101.7±22.6 g vs 94.7±8.5 g (p=0.07) in the 2nd, and 104.6±22.0 g vs 94.7±8.5 g (p<0.05) in the 3rd trimester. Total vitamin D intakes (food and supplements) were below the Estimated Average Requirement (EAR) for 21% (1st and 2nd trimesters) and 29% (3rd trimester) of the participants. Across trimesters, a majority of the women were below the EAR when considering intakes from food sources only (89%, 82% and 75%). Total calcium intakes were equal or above the EAR for more than 95% of the participants throughout pregnancy. Across trimesters, only a few women were below the EAR (11%, 14% and 4%) when only food sources were considered. Total vitamin B12, iron and folic acid intakes were equal or higher than the EAR for more than 82% of the participants across trimesters. Conclusion: Macronutrient intakes throughout pregnancy did not change across trimesters but all macronutrient intakes were higher than their estimated requirements. Vitamin D intakes from food sources only were below the EAR for most women, which raises questions regarding the necessity of a vitamin D supplement during pregnancy.

Inhibition of intestinal glucose absorption by phenolics extracted from whole wheat grown at different temperatures

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Polyphenols as secondary plant metabolites play major roles in abiotic stress responses associated with heat tolerance. Compelling evidence reveals that global increase in mean air temperature influences secondary plant metabolite production; higher amounts of polyphenols were reported in different plants subjected to the increased temperature. On the other hand, polyphenol-rich foods are known to be efficient in lowering blood glucose levels in diabetic individuals. We have previously observed a significant increase of flavonoid and phenolic acid contents in different wheat grains following the increase of the growing temperature. Thus, our objective was to investigate whether this increment of polyphenols would enhance their glucose uptake inhibition potencies. The inhibitory effect of phenolic acids and flavonoids, extracted from six wheat varieties including; AC Crystal, AC Navigator, Carberry, Kennedy, Fangos0, and EGA Gregory, grown in controlled temperature regimes (20°C, 25°C and 30°C), on intestinal glucose uptake was investigated using human Caco-2E cells. Free and bound phenolic acids and total flavonoid extracts of all wheat genotypes were effective inhibitors of glucose uptake. However, wheat genotype Kennedy grown at 30°C showed the maximum glucose uptake inhibition by 49.5%, 51.1%, and 61.2% for free phenolic acids, bound phenolic acids and flavonoids extracts, respectively. Extracts from wheat grains grown at 30°C inhibited the glucose uptake significantly more than those grown at 25°C and 20°C (P < 0.05). The inhibitory effect of free and bound phenolic acids was mainly dependent on their ferulic acid (FA) content. The correlation coefficient of the ferulic acid content and glucose uptake inhibition for free and bound phenolic acids were R²=0.97 and R²=0.91, respectively. Similar to temperature, genotype variation also shown to influence the glucose uptake inhibition significantly (P < 0.05). Extracts from Kennedy and AC Crystal had higher glucose uptake inhibitory effects than others. In conclusion, genotype and growth temperature influenced the glucose uptake inhibitory of wheat grains. This enables the selection of particular wheat grains to be used as nutritious food source to control postprandial hyperglycemia in diabetic patients. (Supported in part by

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Effects of consuming dairy diets rich in saturated fatty acids from dairy, versus other oils on plasma and red blood cell (RBC) fatty acid profiles

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To understand the long term effects of consuming dairy fats on the risk of cardiovascular disease, a multi-centre randomized crossover full-feeding clinical trial was conducted at the Institute of Nutrition and Functional Foods (INAF), Laval University and Richardson Centre for Functional Foods and Nutraceuticals (RCFFN), University of Manitoba to assess the effects of consuming diets rich in saturated fat from cheese and butter versus other dietary oils on human plasma and RBC fatty acid levels. This trial consisted of 5 isocaloric diets including: 1) a diet rich in saturated fatty acids (SFA) from cheese, 2) a diet rich in SFA from butter, 3) a diet rich in monounsaturated fatty acids (MUFA), 4) a diet rich in polyunsaturated fatty acids (PUFA), and 5) a low-fat high carbohydrate diet (CHO). Intervention periods of 4-wk were followed by 4-wk wash out periods in this crossover design. Participants (n=92) completing at least one treatment were included in the analyses. Total plasma SFA levels after cheese diet were higher (p<0.05) than after MUFA, PUFA and CHO diets, whereas total plasma SFA levels after butter diet were only higher (p<0.05) than after MUFA and PUFA diets. However, the impact of diet on RBC tissue FA concentrations was relatively minor. Both plasma and RBC myristic acid (C14:0) and pentadecanoic acid (C15:0) levels after cheese and butter diets were higher (p<0.05) than all other diets. Additionally, plasma heptadecanoic acid (C17:0) level after butter diet was higher (p<0.05) than MUFA, PUFA and CHO diets, whereas level after cheese diet was only higher (p<0.05) than after MUFA and PUFA diets. Plasma and RBC oleic acid (C18:1n-9) levels after MUFA diet were higher (p<0.05) than after all other diets. Similarly, plasma and RBC linoleic acid (C18:2n-6) levels after PUFA diet were higher (p<0.05) than after all other diets. In summary, changes of specific FAs in plasma and RBC, particularly the odd chain SFA from dairy and myristic acid, reflect an excellent means of establishing compliance level of study participants in human intervention studies. (Dairy Research Cluster Initiative: Dairy Farmers of Canada, Agriculture and Agri-Food Canada, Canadian Dairy Commission, Canadian Dairy Network.)

A scoping review of enteral nutrition and necrotizing enterocolitis and systematic review of hydrolyzed formulas

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Introduction: Premature and critically ill neonates with poor gut and immune functions are at risk of necrotizing enterocolitis (NEC), a serious inflammatory disease of the gut. In Canada, 5.1% of infants born <33 weeks gestational age develop NEC. Researchers have found that bovine milk-based formulas may cause more infants to develop NEC compared to human milk. Reasons for this finding are still unclear. A diet including donor human milk products may be better than standard infant formula, but it is a costly approach and does not prevent all cases of NEC. An area that has not been thoroughly explored is hydrolyzed formulas. These formulas facilitate digestion and absorption, which may reduce stress and pro-inflammatory processes in the gut. Objectives: (1) To identify and map studies evaluating different types of enteral feeds and NEC events using scoping review methods; and (2) to systematically review the effect of hydrolyzed formulas on NEC. Methods: Five databases, 2 conference proceedings, 3 regulatory agencies and 1 trial registry were searched. Screening was completed by two independent reviewers. Quantitative studies comparing different types of feeds that reported on NEC events in neonates fed before day of life 30 were included. Eligible studies will be mapped to describe the evidence on the type of enteral feeds and the effect on NEC. Homogeneous data on hydrolyzed formula will be pooled in a meta-analysis or a network meta-analysis. Results: After removal of duplicates, 4922 titles/abstracts were screened and 212 records proceeded to full-text screening. Sixty-six studies have been included for analysis and screening decisions are pending for 10 studies. The majority of studies are observational and compare bovine milk-based products to human milk. Two observational studies on hydrolyzed formula have been identified. Conclusions: This review will synthesize evidence comparing hydrolyzed formulas, bovine milk-based products and human milk on NEC. There is a paucity of high quality studies evaluating the use of hydrolyzed formulas on the incidence of NEC in neonates. Hydrolyzed formulas may mediate stress on the gut and facilitate absorption of nutrients, which may result in lower events of NEC. (Supported by WCRI, CIHR, AbsPORU KT Platform.)

High oleic canola oil and olive oil result in similar plasma fatty acid and glucose levels as well as lipoprotein profile in golden Syrian hamsters fed atherogenic diets

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Background: Consumption of various types of fatty acids (FAs) from dietary fats and oils profoundly influences health and nutritional status. Considerable interest has been focused on monounsaturated fatty acids (MUFAs) and their impact on coronary heart disease (CHD) risk. However, little is known about the relative effects across different sources of MUFA rich oils, such as high oleic canola oil (HOCO), olive oil (OO), and regular canola oil (RC) on blood lipid parameters. Objective: To compare the response of HOCO versus OO relative to other dietary oils on circulating levels of FAs, glucose, and lipoprotein profile in hamster model when atherogenic diets were fed differing in dietary fatty acid composition. Method: An animal trial (n=115) using different dietary oils was carried out. Animals consumed atherogenic diet for two months (i) HOCO, (ii) OO, (iii) RC, (iv) corn+safflower (C+S), (v) flaxseed+safflower (F+S), (vi) HOCO+DHA (H+DHA), or (vii) HOCO+EPA (H+EPA). The total dietary fatty acid profile was assessed using GC-FID. Plasma glucose, total cholesterol (TC), triglycerides (TG), and HDL-C were analyzed using automated enzymatic methods on a Vitros-350 chemistry analyzer. Non-HDL-C was determined as the difference between measured TC and HDL-C. Results: No differences were observed between plasma FAs profile of HOCO and OO treatments. Furthermore, HOCO and OO treatments equally modified (p<0.05) plasma glucose, TC, TG, HDL-C, and non-HDL-C when compared with other dietary treatments. OO feeding decreased (p<0.0142) plasma glucose levels when compared with RC and H+DHA treatments, however, no differences were observed between RC and HOCO diets. Although plasma TC did not differ (p=0.185) among several treatment groups, hamsters fed RC had reduced (p<0.0025) TG levels when compared with H+DHA, H+EPA, and OO. Diets C+S, F+S, and OO elevated (p<0.0001) HDL-C in comparison with H+DHA and H+EPA. No significant differences in non-HDL-C were observed when a comparison was made among HOCO, OO, and RC treatments. Conclusion: The present study provides evidence that a similar beneficial influence of HOCO and OO diets exist on plasma glucose and lipoprotein profiles. Therefore, it is concluded that incorporation of either HOCO or OO could provide equivalent cardio-protective effects against CHD. (Supported by NSERC.)

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**Increased lipid oxidation during exercise in obese pre-pubertal children with excess abdominal fat: a quality study**

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**Research**

Research examining the effects of obesity on lipid oxidation during exercise prior to puberty is limited. The purpose of this study is to investigate the influence of total and regional fat mass (FM) distribution on lipid oxidation during exercise in normal weight, overweight, and obese pre-pubertal male and female children. Participants in this study were from the Québec Adipose and Lifestyle Investigation in Youth (QUALITY) cohort. The sample included 183 pre-pubertal males (108 normal weight (NW), 33 overweight (OW), and 42 obese (OB)) and 135 pre-pubertal females (64 NW, 33 OW, 38 OB). After a period of rest, the children performed an incremental maximal cycling test that was conducted on an upright cycle ergometer using the McMaster protocol. The % lipid oxidation (LO) and lipid rates (mg/min) were measured at each stage of the test. Overall, LO decreased as exercise intensity increased. OB children oxidized more lipids at higher exercise intensities than NW and OW children. Despite the fact that overweight and obese males and females had similar total, leg, and trunk FM, a relationship between these FM depots and LO is observed in OW and OB males starting at lower intensities; whereas in females, an association between LO and these FM depots is only found in those who are OB while exercising at higher intensities. Our results demonstrate that OB children were able to oxidize relatively more lipids at relatively higher exercise intensities than NW and OW children. Whole-body lipid oxidation was related to adipose tissue localization, especially in males.

**Women’s experiences with gestational weight gain: a qualitative investigation of Canadian women’s thoughts, experiences and current practices**

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During pregnancy, maternal dietary choices and gestational weight gain can have lasting effects on the health of both mother and infant. However, research shows that approximately 50% of Canadian pregnant women gain excess gestational weight. The objective of this study is to explore pregnant women’s experiences with their pregnancy weight gain, eating habits, and to better understand their interactions with their prenatal healthcare providers. A qualitative methodology was used. Fifteen first-time mothers were recruited using snowball sampling. Study staff conducted a single one-on-one semi-structured interview with each participant. Analysis was completed using thematic analysis. The study found that women think about nutrition and gestational weight gain, and place particular importance on eating healthy during pregnancy for both their health and their babies’ health. Additionally, it was found that the women practiced healthy eating behaviours and utilized strategies to assist them with these behaviours. The interviews also reveal that their experiences with pregnancy weight gain and eating are complex, unique, and change across pregnancy. In addition, the study describes women’s experiences with their healthcare providers in regards to healthy eating, weight gain and pregnancy and identified four main gaps occurring within prenatal care according to the results of the study: 1) Prenatal care is not individualized, 2) A client-centered approach is not used, 3) No first-trimester or post-partum education, and 4) Minimal guidance on eating and weight gain. Data reveals opportunities to optimize prenatal and maternal care to best support future outcomes for mom and baby.

**Antibiotics and probiotic Lacidofil® strong have antibiotic effects on the expression of selected fecal microRNAs in healthy humans**

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The intestinal miRNome is affected by the microbiota and recent studies suggest that probiotics impact the expression of selected microRNAs (miRNAs). Interestingly, intestinal epithelial cells-derived miRNA are recovered in the feces and they are currently considered to be used as biomarkers of intestinal diseases such as colorectal cancer. The aim of this work was to assess if selected fecal miRNA respond to altered composition of the microbiota. Sixty healthy subjects received 875 mg of amoxicillin and 125 mg of clavulanic acid twice a day for 7 days, plus (probiotic group, n=30) or minus (placebo group, n=30) probiotic Lacidofil® STRONG (a 95:5 mixture of Lactobacillus rhamnosus R0011 and L. helveticus R0052). Fecal samples collected before and after antibiotic treatment were used for global miRNA profiling (miRNome) using NanoString Technology. Among the 102 miRNAs detected in the feces (False Discovery Rate 20%), six were significantly changed after antibiotic treatment in the placebo group, showing that the fecal miRNome responds to antibiotics. Selected miRNA include down-regulated miR-378B (0.580.3 fold change, p=0.01) and up-regulated miR-320e (1.8 ±0.5 fold change, p=0.001), as confirmed by digital droplet PCR (ddPCR). The expression of miR-378B did not change in subjects receiving the probiotic, while miR-320e upregulation was repressed in this group (0.4 ±0.4 fold change, p=0.0062) (ddPCR). This shows that Lacidofil® STRONG modifies the response of fecal miRNA to antibiotics. Thus, fecal miRNA may be used as biomarkers of an altered microbiota composition in health and disease. (Funding: Natural Sciences and Engineering Research Council of Canada (NSERC), Lallemand Health Solutions, Lawson Family Chair in Microbiome Nutrition Research.)

**Total dairy intake is positively related to cognitive status in free-living older adults**

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**Background:** Dairy products may exert a role in cognition via their unique nutrient composition comprised of bioactive peptides, vitamin B12, calcium and fermented products. Few cohort studies have related total dairy intake (DI) to cognitive status, but its impact on age-related cognitive decline remains unknown. Objective: To determine the association between total DI and cognition at baseline and as a 3 y-change in free-living older adults. Methods: Analyses were conducted on 702 men and 797 women of the Québec longitudinal study on nutrition and aging (NuAge) aged 67-84 y at entry. Mean daily DI was calculated from averaging 3 non-consecutive 24-h food recalls collected at year1 and 3 at year3. Dairy products serving sizes were calculated as per Canadian Food Guide. Cognition was assessed yearly by the Modified Mini-Mental Examination State (3M5). Cross-sectional associations were assessed using multivariate regression models adjusted for sex, age, education, depression (GDS) and diet quality (modified Canadian–Healthy Eating Index, C-HEI excluding DI score). Longitudinal associations were investigated using linear mixed mod-
els. Results: Baseline 3MS score was 93.2 ± 4.6 in men and 94.6 ± 4.1 in women (p<0.001), and total DI 1.43 ± 0.84 and 1.38 ± 0.76 servings/d (p=NS). Over 3 years, the 3MS score decreased by 2.2 ± 5.5% (p<0.001) with a greater decline in men (2.6 ± 5.5%) than women (1.9 ± 5.4%; p<0.001). Total DI was not associated with the rate of cognitive decline over 3 years. Conclusions: The association of DI with cognition, independently of the level of education and the quality of the rest of the diet, point to potential unique dairy component’s role on cognitive health. The absence of an association between DI and cognitive decline may be explained by the modest 3-year decline in this healthy cohort. Longer follow-up investigation of cognitive domains, and in cognitively impaired older adults, is warranted. (Dairy Farmers of Canada.)

Specificity of proteolytic enzymes on deactivation of antigenic epitope for inclusion in hypoallergenic dairy whey protein
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Whey protein is a by-product of cheese manufacturing with a nutritive source of bioactive peptides. However, it is an important cause of food allergy in many patients allergic to bovine milk. An enzymatic hydrolysis is an approach that has been used for the production of hypoallergenic products. Many researchers have explored the application of various enzymes for suppression of whey antigenicity but there are still many reports on antigenic reaction after consumption of hypoallergenic products. In addition, there is a paucity of information on the specificity of enzymes on suppressing antigenicity of whey protein and the influence of enzymatic activities on physiochemical properties of the hydrolysate. The impact of hydrolysis with various enzymes on immunological properties, hydrophobicity, particle size was studied. 12 different enzymes have been used in which papain and pancreatin hydrolysate showed the highest IgE inhibition of 47% and 45% among all hydrolysates. The electrophoretic pattern of papain and pancreatin did not reflect trace of α-lactalbumin or β-lactoglobulin after hydrolysis. The degree of hydrolysis did not have a correlation with immunoreactivity which indicated that extensive hydrolysis is not always accompanied with antigenicity suppression. A strong negative correlation between the degree of hydrolysis and hydrophobicity observed. The peptidomics result of papain hydrolysate was analyzed and enzymatic cleavage site determined from released peptides. The predicted cleavage pattern of enzymes was mostly matched with the actual cleavage in the one with 99% of specificity prediction. The antigenic epitopes were mostly degraded which can approve the antigenic inhibition in the papain whey hydrolysate. These finding will provide information on the application of three enzyme groups and their specificity on lowering whey protein antigenicity and production of hypoallergenic whey product.

Familial resemblances in human whole blood transcriptome
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Gene expression is increasingly studied in the context of chronic diseases to better understand their pathophysiological processes. The study of the heritability of gene expression is then highly relevant to better understand the origin of these diseases. A few studies have investigated the heritability of human whole blood transcriptome but none has considered the contribution of both genetic and common environmental effects to familial resemblances in gene expression levels. The objective is thus to quantify the contribution of genetic and common environmental effects in familial resemblances on genome-wide expression levels using a family based sample of 48 French Canadians from 16 families. We used HumanHT-12 v4 Expression BeadChip (Illumina Inc) to measure expression levels of >47 000 probes (>31 000 annotated genes) in all 48 subjects. The heritability has been assessed using the variance components method implemented in the QTDT software, which partitions the variance into polygenic (G), common environmental (C) and non-shared environmental (E) effects. A total of 18 160 probes among the 47 323 probes on the microarray (38.4%) showed significant gene expression in blood and were used for heritability analysis. We computed maximal heritability, genetic heritability, and common environmental effect for all probes (n=18 160) and identified an average contribution of 21.9%, 15.1%, and 6.8%, respectively. Among probes that showed a statistically significant familial effect (n=1391), these three factors contributed respectively to 71.1%, 46.9%, and 24.2% of familial resemblances in expression levels. In conclusion, familial resemblances in expression levels are mainly attributable to genetic factors when considering the average of all the probes across the genome, but common environmental effect plays an important role when considering probes that showed a significant familial effect. Further genome-wide studies on larger sample size combining multiple GWAS data are needed to better understand the genetic factors underlying gene expression. (This work was supported by the Canada Research Chair in Genomics Applied to Nutrition and Health.)

Epigenetic predictors of the plasma triglyceride response to an omega-3 fatty acid supplementation in adults
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Beneficial effects of omega-3 polyunsaturated fatty acids (n-3 FAs) on cardiometabolic risk factors are likely to be mediated by alterations in gene expression. For the present study, we selected genes from four key molecular pathways previously identified by our group as being regulated by n-3 FAs; (1) mechanism of gene regulation by PPARs, (2) PPAR/RXR activation, (3) Nrf2-mediated oxidative stress response, and (4) NF-κB signaling. The objective was to investigate the potential of epigenetics markers to predict the plasma triglyceride response to an n-3 FA supplementation. Thirty-four subjects completed a 6-week intervention with n-3 FAs (1.9-2.2g EPA and 1.1g DHA). Methylation levels were measured in pre- versus post-supplementation using the Infinium HumanMethylation450 array (Illumina Inc) and analyzed using GenomeStudio software v2011.1. Methylation levels of all 56 differentially expressed genes being part of the four molecular pathways of interest were measured on the array (n=1119 CpG sites). From these CpG sites, 48 were differentially methylated in pre- versus post-supplementation suggesting that changes in expression levels during an n-3 FA supplementation are, at least partly, attributable to changes in gene methylation levels. We then assessed whether post-supplementation methylation levels can predict the responder and non-responder status. Subjects were divided into two groups: responders (lower their triglyceride levels, [n=23]) and non-responders (did not lower their triglyceride levels [n=21]). A total of 406 CpG sites had significant differences in methylation levels between the two groups. To further discriminate responders and non-responders groups, hierarchical clustering was performed using the 406 differentially methylated CpG sites. CpG sites partially differentiated between groups although four non-responders subjects were classified in the responders group. Such an analytical scheme can then lay the foundation for the identification of biomarkers of the plasma triglyceride response to be used in personalized preventive nutrition. (This work was supported by a CIHR grant (MOP-110975).)
Lunch-time food source is associated with dietary intakes and diet quality among Canadian children
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Background. There is a paucity of research on the dietary behaviors of Canadian children at school and no nationally representative study has examined where students obtain food from during school hours, or whether lunch food source is associated with diet quality. Objective. To examine associations between lunch food source and diet quality. Design. A cross-sectional study from a nationally representative sample. Participants. Canadian children age 6-17 years (n=4,589).

Outcome measures. Dietary outcome measures derived from school day 24-hour dietary recalls included school hour (9:00-14:00) and school day dietary intakes and School Healthy Eating Index (S-HEI) scores, a measure of diet quality adapted for school hours. Statistical analyses. Survey-weighted covariate-adjusted linear models tested for differences in dietary outcomes associated with lunch-time food source. Results. The majority (72.8%) of children reported bringing lunch from home while far fewer students obtained lunch from off-campus locations (11.6%), schools (9.6%), or reported eating no lunch (5.9%). Average school hour diet quality required improvement for all age groups. Compared to lunches obtained off-campus, home-packed lunches were significantly higher in fiber, vitamin A, D, C, thiamin, magnesium, iron, grains, vegetables and fruit servings but lower in total calories, fat and calories from minimally nutritious foods. Dietary differences persisted by lunch food source group for whole day intakes of carbohydrates, fat, fiber, vitamin D, magnesium, iron and calories from minimally nutritious foods. While no differences in S-HEI scores were found by lunch food source among children age 6-8 years, children age 9-17 years reporting home-packed lunches had significantly higher mean S-HEI scores compared to students obtaining lunch off-campus locations. Children who obtained foods from school sources had similar school hour diet quality than children who obtained foods off-campus. Conclusions. The nutritional quality of home-packed lunches was higher than lunches from off-campus locations and school lunches were similar in quality to foods from off-campus sources. Efforts are warranted to increase the quality of foods consumed at school.

Eating pleasure: a promising approach to promote healthy eating?
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Eating pleasure has sometimes been associated with less desirable eating behaviors and patterns, and sometimes with more desirable ones. Is pleasure an ally or an obstacle to healthy eating? This issue suggests that enjoying hedonic characteristics of foods is not associated with harmful dietary habits. Even more, in women, eating pleasure is associated with a better diet quality and favorable eating behaviors. Results also showed that eating pleasure orientation is associated with intrinsic motivation, which has been previously shown to foster adoption of healthy dietary behaviors and long-term adherence. Thus, focusing on experiences of pleasure might be a promising approach for promoting healthy eating. (Funded by CIHR.)

The More-2-Eat project: a case study of how one hospital improved nutrition care
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Malnutrition is common amongst hospital patients in Canada. The Integrated Nutrition Pathway for Acute Care (INPAC) was developed to enhance the nutrition care provided to patients. Five hospitals across Canada tested the implementation of this pathway [More-2-Eat (M2E) project]. Implementation was led by local research associate(s), champion(s) and a site implementation team who decided which aspects of INPAC to focus on. Monthly teleconferences were conducted to assist sites with implementation activities, behaviour change techniques, and to learn from other sites. Implementation and nutrition care activities were tracked over one year to monitor progress. By tracking, we gained a better understanding of how one site (Site A) achieved positive change. Site A had no screening in place prior to M2E. By increasing awareness, training, and adding a tick box to the nursing admission form, screening for malnutrition increased from 0 to 78%. Through training, form updating, and relaying roles/responsibilities of nursing staff and dietitians/diet technicians, a care process was put in place ensuring follow up for at-risk patients. Subjective global assessment (SGA) was conducted by the dietitian or diet technician to identify patients requiring full nutritional assessment. In the final months of implementation, all severely malnourished patients had full nutritional assessments completed, while mild/moderately malnourished patients were treated either by a dietitian or diet technician. The site also improved standard nutrition care strategies by placing laminated posters above patient beds to identify and remind unit staff which patients needed dentition, glasses, etc. Finally, they worked towards effective food intake monitoring. Through meal tray intake assessment posters and information sessions/services, they increased their food intake monitoring from 4% to 93%. Nurses were trained to refer patients to dietetic care when intake was <50%, however, identifying further actions for patients with intakes below 50% continues to be an issue. These few examples demonstrate how one site made positive changes in their nutrition care using a variety of techniques and innovative strategies. During the post-implementation phase, sites will continue to monitor how well these changes are sustained and continue to problem solve to make improvements. (This research is funded by CFN (Canadian Frailty Network).)

The More-2-Eat project: challenges experienced while conducting follow up calls with patients 30 days after discharge from hospital
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Hospital patients who are malnourished often require continuity of nutrition care post-discharge for full recovery. Achieving a better
understanding of what happens after patients leave hospital can help to identify gaps in their nutritional care needs during this transition. The More-2-Eat (M2E) project recruited patients in 5 hospitals to complete detailed evaluations of nutritional status, quality of life, frailty and patient reported outcomes over the course of one year. Follow up information was collected from a subset of these patients at two time points. Hospital staff were asked to recruit 40 patients who had no cognitive impairment, spoke English or French, and were returning back to the community rather than a home or facility. Patients were also asked to provide contact information for themselves and a proxy. A small research team from the University of Waterloo conducted telephone follow up calls with consenting patients approximately 30-days after discharge to ask questions about patient reported health outcomes, nutrition, and health care use. During the first two follow up periods, 355 patients were recruited; 199 (56%) completed the 30-day follow-up data collection. Key challenges in this data collection were: recruiting eligible patients; receiving consent to follow-up post discharge; inability to reach by phone (n=105); no proxy provided (n=193); and refusal after phone contact (n=26). Several challenges with conducting interviews were noted, such as patients being hard of hearing or too unwell to participate. Return to hospital (n=11) and death of participants (n=6) also occurred. Time to complete the survey varied: quick calls lasted approximately 10-15 minutes, while others took up to 45 minutes. Finally, because calls were made by researchers and not hospital staff, interviewers could not address any patient questions about their health. Many challenges were experienced during 30-day post-discharge telephone follow up. While some challenges were unavoidable (i.e. patient refusal to participate), others provided a learning opportunity. For instance, patient follow up calls might be better received from hospital staff rather than researchers. It is important to consider and address these challenges for effective patient follow up in future research. (This research is funded by CFN (Canadian Frailty Network).)

The More-2-Eat project: key nutrition care changes in hospitals implementing the INPAC pathway

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The More-2-Eat (M2E) project aims to optimize nutrition care in 5 Canadian hospital units through the implementation of the Integrated Nutrition Pathway for Acute Care (INPAC). Hospitals spent one year (Dec 2015-Dec 2016) working to make positive changes to nutrition care processes including malnutrition screening, nutrition risk assessment [Subjective Global Assessment (SGA)], food intake monitoring, standard and advanced care strategies and discharge planning. During the one-year implementation phase, hospital staff collected data from patient health records (N=3,838) to track the routine nutrition care activities on the unit. Detailed patient data was also collected on approximately 20 patients per month/hospital to track patients’ health and nutritional status and barriers to food intake (N=1,007). At the end of each month, each site received a feedback report to track their progress and use their local data to help stimulate and maintain positive change. Over the course of the year, all 5 sites saw increases in the number of patients screened for malnutrition. By the end of implementation phase, sites were screening 66-89% of admitted patients. None of the sites were assessing patient nutritional status with SGA prior to implementation. After introducing and promoting the use of this diagnostic tool, the number of patients at nutrition risk who were assessed using SGA ranged from 52 to 70 percent. Three sites worked towards implementing food intake monitoring using a variety of strategies. Monitoring that resulted in actions to improve intake for patients increased from 19% to 54%, 4% to 93%, and 0 to 96% in those sites. Some sites were also able to reduce the average number of mealtime barriers identified by patients. For example, one site that started with an average of 3.23 barriers reduced the average number experienced by patients to 1.2. Using a variety of implementation strategies, all sites saw improvements in a range of INPAC activities. Improved practices are feasible and INPAC can be implemented in Canadian hospitals. Sites are now focusing on sustainability and rolling out those changes in other units. (This research is funded by CFN (Canadian Frailty Network).)

Genotype imputation in loci identified by a genome-wide association study reveals novel polymorphisms associated with the plasma triglyceride response to an omega-3 fatty acid supplementation

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Background: Numerous studies have shown an important heterogeneity in the inter-individual response of triglycerides (TG) to omega-3 (n-3) fatty acid (FA) supplementation, which is partly due to genetic factors. A genome-wide association study (GWAS) conducted by our research group on participants of the Fatty Acid Sensor study identified 13 loci associated with TG levels in response to n-3 FA supplementation. Our group recently conducted dense genotyping in several GWAS-associated genes (IQCJ, NXPH1, PHF17 and MYB) and found gene-diet interactions and genotype effects with numerous single-nucleotide polymorphisms (SNPs). The objective was to conduct fine mapping of GWAS-associated loci by identifying additional SNPs associated with the TG response to n-3 FA supplementation using genotype imputation. Methods: Two hundred eight participants received n-3 FA supplements for six weeks, providing 3g/d of n-3 FA (1.9-2.2g of EPA and 1.1g of DHA). Plasma TG levels were measured prior to and after the intervention. 1000 Genomes project data was used as a reference set (release 1000G Phase 1 v3, updated 26 Aug 2012) for the imputation of genotypes (genotyped from Illumina BeadChip) in previously identified loci. Markers were inferred using algorithms implemented in IMPUTE2. Allele frequency between responders (reduction in TG levels of >0mM) and non-responders (increase in TG levels of ≥0mM) was compared using PLINK. The top ten SNPs in each gene were kept for statistical analyses according to their p value. Results: In a MIXED model for repeated measures, gene-diet interactions were observed with every SNP. Five SNPs in IQCJ, two in NXPH1, eight in PHF17 and none in MYB were still significant after Bonferroni correction. In a stepwise regression, one SNP in IQCJ, two in NXPH1, two in PHF17 and one in MYB appear to be driving these associations. Genotype effects on pre-supplementation TG levels were observed with five SNPs of IQCJ, six of NXPH1, ten of PHF17 and nine of MYB. For all SNPs, genotype frequencies were different between responders and non-responders. Conclusion: The present study shows that mapping refinement in GWAS-associated loci can reveal new SNPs affecting plasma TG levels following n-3 FA supplementation. (Supported by CMDO-FRQS.)

Effects of vitamin D3 and n-3 polysaturated fatty acids on insulin resistance and other features of the metabolic syndrome

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It has been proposed that vitamin D3 (VD3) and n-3 polysaturated fatty acids (n-3 PUFA) prevents inflammation and protects against type 2 diabetes and cardiovascular disease but their combined effects

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have never been explored. The objective was to determine the long-term independent and combined effects of VD3 and n-3 PUFA supplementation on metabolic syndrome in obese mice. C57BL/6j mice were fed a high-fat high sucrose diet (HFHS) for 12 weeks. Two groups received regular 1,400 IU of VD3/kg of food and two groups were supplemented with 15,000 IU of VD3/kg of food. One of each VD3 group was additionally fed with 4.35g/kg of fish oil rich in n-3 PUFA. Another group fed a standard low-fat diet was used as a reference. Food intake was not different between groups. VD3 supplementation significantly increased the plasma levels of 25(OH)D3, specifically the 3-epi-25(OH)D3 form representing 30% of the total 25(OH)D3 versus ≤5% in the group fed with regular VD3. n-3 PUFA increased energy expenditure as shown by indirect calorimetry although it did not translate into lower diet-induced weight gain. Nevertheless, mice fed diets containing n-3 PUFA showed an improved glucose homeostasis during oral glucose tolerance test and lower triglycerides accumulation in liver. VD3 supplementation did not further improve these parameters. These data show that n-3 PUFA treatment can improve features of the metabolic syndrome in HFHS-fed mice. However, combination with VD3 supplementation failed to enhance the beneficial effects of n-3 PUFA. We further plan to investigate the impact of these nutrients on gut health, as the VD receptor is known to be expressed in the intestine. (Supported by a Canadian Institutes of Health Research (CIHR) grant.)

An analysis of action regarding food environment policies in Canada by jurisdiction

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Food environment policies help shape the food environment, and influence diet and related non-communicable diseases (NCDs) and obesity. The current Canadian food environment is dominated by energy dense, nutrient-poor foods that are less expensive, more readily available and heavily marketed to consumers. This study aimed to examine jurisdictional levels of policy implementation in critical food environment domains in Canada. A systematic grey literature search was conducted to examine food environment policies implemented in Canada as of January 2017, using the Government Food Environment Policy Index (Food-EPI) framework. Seven “policy domains” were searched to identify and characterize government actions to influence the food environment (composition, labelling, promotion, prices, provision, trade, and retail). Policy action was classified as federal, provincial/territorial, or shared implementation. Food composition and labelling policies were implemented federally for packaged foods and provincially/territorially in foodservice outlets. The only policy action for food promotion and marketing was provincial. Regarding pricing policies, reductions in excise tax on healthy foods was implemented federally, while there were no federal or provincial/territorial policies regarding taxing unhealthy foods. Nutrition standards in schools and early childhood education centres, public settings such as recreation centres and private sector settings were primarily provincial/territorial in nature, with Federal/Provincial/Territorial guidance for school nutrition standards. Limited food trade policies regarding healthy foods were identified at federal jurisdiction only. No action was identified for food retail or zoning provincially or federally. Overall, provincial and federal governments have implemented policies in some, but not all, identified areas to positively influence food environments. This analysis did not consider municipal level policies, which can influence provincial and federal health policy, and did not consider the strength of the policies implemented. Patchwork provincial policies are not uniform in strength and effectiveness, and can be challenging for industry to implement. Health Canada’s recent Healthy Eating Strategy may contribute to and support consistent food environment policy across Canada; however, continued government action at all levels and in multiple policy domains is needed to improve food environments and reduce rates of obesity and diet-related NCDs in Canada. (Funded by a CIHR Operating Grant and a CIHR Banting Fellowship.)

Optimization of the anti-cancer effect of eicosapentaenoic acid and docosahexaenoic acid in triple negative human breast cancer cells

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The omega-3 long chain polyunsaturated fatty acids (n-3 LCPUFA) eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) have been associated with a reduced risk of breast cancer (BC). We have performed microarray analysis on BC cells and observed that DHA and EPA have both distinct and overlapping biological effects. Current studies evaluating the effect of DHA and EPA on human BC cells have not evaluated the combinations of these n-3 LCPUFA that are typically consumed by the population. In addition, most studies have not studied the anti-cancer effects of DHA and EPA in the presence of fatty acids that are abundant in vivo including oleic acid (OA), linoleic acid (LA), and palmitic acid (PA). The objective of this study was to determine the effect of varying ratios of DHA and EPA on cell viability in the invasive MDA-MB-231 triple negative (ER-, PR-, and HER2-) BC cell line in the presence of physiologically relevant fatty acids (OA, LA, PA). MDA-MB-231 BC cells were exposed to 80 μM OA/LA/PA for 3 days alone or combined with one of the following 100 μM n-3 LCPUFA treatments: DHA; EPA; 1:1 DHA:EPA; 2:1 DHA:EPA. Compared to control (80 μM OA/LA/PA), DHA and EPA significantly decreased cell viability (25% and 21%, p<0.001, respectively) to the same extent. The 1:1 and 2:1 DHA:EPA treatments decreased cell viability but to a lesser extent (16%, p<0.0001 and 15%, p<0.001, respectively). Our microarray findings and our cell viability data with dietary relevant combinations of DHA and EPA suggest that the mechanisms by which DHA and EPA inhibit the growth of MDA-MB-231 cells are not additive or synergistic in aggressive triple negative BC and should be considered separately. Our findings also suggest that DHA and EPA have distinct anti-cancer mechanisms and that mixtures of these n-3 LCPUFA do not have the same activity as the single fatty acids. Our ongoing work will allow us to elucidate the potential anti-cancer mechanisms responsible for the distinct effects of DHA and EPA in MDA-MB-231 BC cells and help define potential interventions for BC prevention trials. (Funded by CIHR and the Alberta Canola Producers Commission.)

Commitments and actions regarding marketing to children on company websites of major packaged food companies in Canada

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Objective: Promotion of unhealthy foods and beverages to children can contribute to poor dietary patterns, elevating obesity and non-communicable disease risk. This study aimed to evaluate the policy commitments and actions of packaged food manufacturers in Canada concerning promotion of unhealthy foods to children on company websites. Methods: A systematic content analysis was conducted for 16 top packaged food manufacturers in Canada, comprising a combined 52% of the national market share. Policy information was sourced from company websites, annual reports, press releases and Children’s Food and Beverage Advertising Initiative (CAI) Participant Commitments. Canadian company and brand websites were scanned for child-directed content and use of marketing to kids (M2K) techniques was recorded. Content was considered “child-directed” if it

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Rosmarinic acid, a rosemary extract polyphenol, increases skeletal muscle cell glucose uptake and activates AMPK
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Skeletal muscle is a major insulin-target tissue and plays an important role in glucose homeostasis. Impaired insulin action in muscle leads to insulin resistance and type 2 diabetes mellitus. 5' AMP-activated kinase (AMPK) is an energy sensor and its activation increases glucose uptake in skeletal muscle cells. Recently, AMPK activators have been viewed as a targeted approach in combating insulin resistance. We previously reported that rosemary extract (RE) activated AMPK and increased skeletal muscle glucose uptake. Rosmarinic acid (RA) is one of the major constituents of RE; however, its direct effects on muscle cells have not been investigated. In the present study, we examined the effects and the mechanism of action of RA in L6 rat muscle cells in vitro. At concentrations found in rosemary extract, RA stimulated glucose uptake in L6 myotubes. At 5.0 μM RA a response (186±24.17% of control, p<0.001), similar to maximum insulin (204±10.73% of control, p<0.001) and metformin (202±14.37% of control, p<0.001) was seen. Akt phosphorylation was not affected by RA while AMPK phosphorylation was increased. The RA-stimulated glucose uptake was partially inhibited by the AMPK inhibitor compound C and was not affected by wortmannin, an inhibitor of phosphoinositide 3 kinase (PI3K). Although compound C blocked the RA-stimulated AMPK phosphorylation, the RA-stimulated glucose uptake was only partially inhibited indicating that AMPK-dependent and AMPK-independent mechanisms are involved in the action of RA. Plasma membrane GLUT4 or GLUT1 glucose transporter levels were not affected by RA while glucose uptake in L6 GLUT4 overexpressing cells was increased and was comparable to L6 parental cells. The current study is the first to show an effect of RA to increase muscle glucose uptake and AMPK phosphorylation. RA deserves further study as it may have the potential to be used as an agent to regulate glucose homeostasis.

Canadian nutrition undergraduates’ knowledge, attitudes and perceptions of carbohydrates
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Communication of evidence-based nutrition information by health professionals plays an important role in improving Canadians’ health. Students gain knowledge from nutrition courses and develop critical thinking skills required for future careers. However, students and health professionals may also be influenced by competing messages on the internet, mainstream media and social media that often communicate opinions not always based on best-available science. The objectives of this study were to assess knowledge and attitudes/perceptions of carbohydrates (including sugars) among students enrolled in undergraduate nutrition courses in Canada. Cross-sectional surveys were distributed in nutrition courses to students at different stages of schooling at seven Canadian universities in 2016. The questionnaire contained 32 questions including student demographics, knowledge of carbohydrates, and perceptions of topics on carbohydrate and health. A total of 784 students taking a nutrition course (58% enrolled in a nutrition degree program) participated in the study between January and April 2016. When asked to list three sources where they obtain nutrition-related information, two-thirds of respondents included at least one internet source (e.g. Wikipedia, Google, YouTube, etc); only 10% of the respondents listed three credible sources (e.g. scientific journals, dietitians, government, etc).
About one-third (35%) of students correctly identified white bread from a list of foods as having the highest glycemic index, while 37% of students incorrectly thought the glycemic index of table sugar was higher than white bread. A modest majority of students (56% and 58%) knew the correct Calories per gram of starch and sugars, respectively; the proportions of students who knew the equivalent answers for fat and protein were higher, both at 70%. Perceptions of sugars-related health topics were generally negative among students, many reflecting misconceptions commonly communicated in online/media sources. In conclusion, knowledge gaps regarding carbohydrates were identified among undergraduate students enrolled in nutrition courses, likely due to a mismatch between undergraduate curriculum vs. media influences. Media misconceptions may have influenced students’ attitudes towards carbohydrates. A greater emphasis on supporting undergraduate nutrition curriculum related to carbohydrates and specifically sugars, as well as further efforts in encouraging students to acquire nutrition information from credible sources are warranted.

**Risk factors for vitamin D deficiency in pregnancy**

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Introduction: Vitamin D plays an important role during pregnancy. Maternal low vitamin D status is common during pregnancy, there are approximately 40% pregnant women with 25-hydroxyvitamin D concentration (25(OH)D) less than 50 nmol/L in Canada. However, the risks factors are unknown. Objective: To evaluate the relationship between low vitamin D status in pregnant women. Method: This was a prospective cohort study from 3D Cohort. Vitamin D deficiency is defined as circulating 25(OH)D concentration less than 50 nmol/L. We explored the associations between maternal characteristics and social economic status and plasma 25(OH)D status in women during pregnancy. Plasma 25(OH)D levels in 467 pregnant women at 20-24 weeks gestation were measured by liquid chromatography–mass spectrometry. Results: Pregnant women who had pre-pregnancy high body mass index (BMI) ≥ 30.0 vs. those BMI less than 30, had increased risk of vitamin D deficiency (28.8% vs. 15.4%, p=0.01). Non-white had increased risk of vitamin D deficiency compared to white pregnant women (28.5% vs. 14.2%, p=0.0004). Low household income (<30,000), compared to those higher household income (≥30,000), had increased risk of vitamin D deficiency (30.8% vs.15.8%, p=0.008). Multiparity (vs. nulliparity) had increased risk of vitamin D deficiency (21.7% vs. 14.4%, p=0.04). Conclusion: Women with obesity, non-white ethnicity, low family income or multiparity are at increased risk for maternal vitamin D deficiency during pregnancy.

Correlations between maternal, breast milk, and infant vitamin B12 concentrations among exclusively breastfeeding mother-infant pairs in Vancouver, Canada and Prey Veng, Cambodia

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Abstracts

Dietary patterns in association with total fat mass, weight, and BMI from childhood to adulthood: a longitudinal study

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Reducing risk of obesity is a major public health goal in North America. We examined the association between dietary patterns (DPs) and total fat mass (TFM), weight and BMI in participants of Saskatchewan Pediatric Bone Mineral Accrual Study (n=130, aged 8-15 years at baseline). Data were collected annually from 1991 to 2011, except for two five-year gaps between 1997 to 2002 and 2005 to 2010. Dietary intake data was collected using sequential 24-hour recalls. TFM was measured using dual-energy X-ray absorptiometry. Height and weight were measured, and BMI was calculated. Principal component analysis was performed to derive DPs from dietary intake data collected at baseline (aged 12-72.2 years). Five DPs were derived, including “vegetarian style”, “fast food”, “high fat, high protein”, “mixed” and “snack” DPs and DP scores were calculated for all annual measurements using their factor loadings for 25 food groups. Data from each participant were classified as childhood (aged 8-13 years) adolescence (aged 13 to 18 years) and adulthood (aged >18 years) measurements. We compared participants in the two extreme quartiles of each DP score during each age period, using MANCOVA adjusted for age and sex. During adulthood, participants who had higher adherence to “vegetarian style” DP were also more physically active and had lower TFM. During adolescence, despite lower total energy intake in the top quartile compared to the bottom quartile of the “vegetarian style” DP, no difference in body composition was observed. During childhood, supplementation is uncommon, infants are at risk of vitamin B12 deficiency because breast milk, the sole source of vitamin B12 for the first 6 mo, is influenced by maternal status. In this secondary analysis, we measured vitamin B12 concentrations in maternal and infant serum/plasma, and breast milk, among two samples of mother-infant dyads in Canada (assessed at 8 wk post-partum) and Cambodia (assessed between 3-28 wk post-partum). Canadian mothers (n=124) consumed a daily vitamin B12-containing multiple micronutrient supplement throughout pregnancy and lactation; Cambodian mothers (n=81) were unsupplemented. Serum/plasma vitamin B12 was measured using an electrochemiluminescence immunoassay on a Roche Elecsys 2010; breast milk vitamin B12 was measured using chemiluminescence on an IMMULITE automated analyzer. Maternal and infant serum/plasma, and breast milk vitamin B12 concentrations were significantly higher among the Canadian sample compared to the Cambodian sample (p<0.05). The maternal, milk, and infant vitamin B12 concentrations (as geometric means (95% CI) in pmol/L) were as follows: Canada, 698 (648, 747), 452 (400, 504), and 506 (459, 552); in Cambodia, 614 (554, 674), 331 (270, 393), and 364 (323, 405). The majority of participants were vitamin B12 sufficient (>221 pmol/L): 99% and 98% of mothers and 94% and 83% of infants in Canada and Cambodia, respectively. In the Cambodian sample, infant age, which ranged from 3 to 28 wk, had a weak negative correlation with breast milk vitamin B12 concentrations (p=0.01), but not maternal or infant concentrations. Among the Canadian sample, maternal, milk, and infant vitamin B12 concentrations were all significantly correlated (p<0.05). In the Cambodian sample only maternal and infant vitamin B12 concentrations were correlated (p<0.001); breast milk vitamin B12 concentrations were not correlated with either maternal (p=0.12) nor infant (p=0.45) vitamin B12 concentrations. The majority of mother-infant dyads in both Canada and Cambodia had sufficient vitamin B12 status, indicating that the unsupplemented Cambodian mothers were consuming adequate animal-source foods, likely fish sauce.
higher adherence to “fast food” DP was associated with higher TFM. Even though participants in the top quartile compared to the bottom quartile of “Fast food” dietary pattern score had significantly lower total energy intake, higher adherence to “fast food” dietary pattern was associated with higher TFM during adulthood. Higher adherence to “high-fat, high-protein” DP was associated with lower weight, lower fat mass, and lower BMI during childhood and adolescence. During adulthood, higher adherence to “high-fat, high-protein” DP was associated with higher energy intake but was not associated with weight, TFM, and BMI. Overall, “vegetarian style” and “high-fat, high-protein” DPs were associated inversely and “fast food” DP was associated directly with risk.

Effects of a low-glycemic index diet combined with physical activity on health-related quality of life of reproductive-age women with polycystic ovary syndrome - a prospective randomized controlled trial

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Polycystic ovary syndrome (PCOS) is a common endocrinopathy among reproductive-age women, with adverse, and often overlooked, effects on health-related quality of life (HRQoL). Our objective was to compare the influence of a pulse-based diet (i.e. a low glycemic index diet including peas, beans, lentils, and chickpeas) with the standard Therapeutic Lifestyle Changes (TLC) diet, combined with aerobic exercise, on PCOS-specific HRQoL. Women with PCOS (18-35 years) were enrolled in a 16-week lifestyle change program, with 30 randomized to a pulse-based diet, and 31 the TLC diet. All participants underwent a supervised aerobic exercise program, and received education and counselling about PCOS and lifestyle modification. Fifty-five women (90.2%) completed a self-administered HRQoL questionnaire. At post-intervention, both groups lost weight (P = 0.005) and showed improved scores in domains of knowledge (P < 0.0001) and concerns about PCOS (P = 0.02), healthcare satisfaction (P < 0.001), lifestyle outcomes comprising physical activity (P < 0.0001) and healthy eating (P < 0.001), and feelings and experiences about participating in the study (P = 0.004). Women had the highest improvements in the healthy eating domain (effect size = 0.68) and selected healthy lifestyle changes as the most helpful and least anticipated management strategy to improve their condition. There were no differences between groups. Both dietary interventions, without calorie restriction, and in combination with aerobic exercise and health-care counselling, yielded substantial improvements in all evaluated domains of HRQoL in women with PCOS. (Funded by Agriculture and Agri-Food Canada through the Growing Forward II Pulse Science Cluster, Saskatchewan Pulse Growers, the Canada Foundation for Innovation, and Saskatchewan Health Research Foundation.)