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Maternal omega-3 polyunsaturated fatty acids reduced plasma and hepatic lipids during pregnancy and sustained higher number of fetuses in C57BL/6 mice

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Maternal dyslipidemia during pregnancy is associated with adverse pregnancy outcomes and the offspring health in later years. Omega (n)3 polyunsaturated fatty acids (PUFA) prevent dyslipidemia; however, the effects of n-3 PUFA on maternal lipids during pregnancy, and the impact on pregnancy outcome are not known. Female C57BL/6 mice (7 weeks old, n=8 per group) were fed semi-purified diets (20% w/w fat) containing 10% (high) or 1% (low) n-3 PUFA (n-6:n-3 ratio of 5:1 and 40:1, respectively) for 2 weeks before mating and throughout pregnancy. Animals were sacrificed prior to mating and during pregnancy at day 6.5, 12.5 and 18.5. Plasma and hepatic total cholesterol (TC), triacylglycerol (TAG), plasma progesterone and placental fatty acids were measured. Hepatic mRNA expression of steroidal acute regulatory protein (StAR), acetyl-CoA carboxylase (ACC)-1 and diacylglycerol acyltransferase (DGAT)-2 were measured using real-time PCR. Feto-placental weight and the number of fetuses sustained throughout gestation were recorded. Means were compared using two-way ANOVA to determine main effects of diet and gestation time. A diet high in n-3 PUFA reduced hepatic and plasma TC (p<0.001) at all stages. There was a significant effect of diet (p<0.05) and gestation time (p<0.0001) on plasma progesterone, revealing higher levels in the high n-3 PUFA group, which positively correlates with the mRNA expression of StAR. The mRNAs of ACC1 (p<0.0001) and DGAT2 (p<0.0001) were lower in the high n-3 PUFA group, corresponding to lower plasma and hepatic TAG in a gestation dependent manner (p<0.05). There was a time dependent effect of diet on the incorporation of decosahexaenoic acid and total n-3 PUFA in the plasma of high n-3 PUFA group (p<0.05), which coincides with higher placental weight (p<0.05) and higher number of fetuses at late gestation (p<0.05). Higher incorporation of n-3 PUFA may affect important cytokines during implantation and at late pregnancy thereby affecting pregnancy outcome; these are currently being measured. Our findings demonstrate that a diet high in n-3 PUFA reduces maternal plasma lipids, increases progesterone levels and fetal sustainability. Thus, a maternal diet high in n-3 PUFA is important in pregnancy outcome and perhaps the later health of the offspring. (NSERC.)

The role of dietary n-6 polyunsaturated fatty acid deprivation in a mouse model of neuroinflammation

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Neuroinflammation is an active defensive process characterized by many inflammatory reactions including the production of arachidonic acid (ARA; n-6 PUFA), pro-inflammatory lipid mediators, which in turn regulate inflammatory gene production. As n-6 PUFA are much more abundant in the diet than n-3 PUFA, there are opportunities to decrease n-6 PUFA intake and furthermore their levels in the brain. Earlier studies showed that lowering dietary n-6 PUFA decreased ARA and several of its lipid mediators in the hippocampus. The high levels of ARA and ARA-derived eicosanoids are thought to be part of many inflammatory reactions, therefore, it might be important to reduce n-6 PUFA intake during inflammation to increase its resolution. This study examines the effect of lowering dietary n-6 PUFA on hippocampal gene expression of many inflammatory and immune-related markers in a mouse model of neuroinflammation. C57BL/6 male mice were fed either a deprived 2% n-6 PUFA or an adequate 23% n-6 PUFA diet from weaning to 12 weeks. Animals then underwent intracerebroventricular infusion surgery, in which lipopolysaccharide was injected into the left lateral ventricle of the brain. Hippocampi were collected from non-surgery and surgery animals at different time-points later (1, 3, 7, and 14 days), and a small microarray (n=3 per group) was used to identify candidate markers including inflammation-associated gene ontology categories and expression of their related genes. LPS infused mice had significantly increased expression in gene ontology categories associated with inflammation with a trend (non-significant) for protection in the deprived n-6 PUFA. Results will be validated by real-time PCR in a separate cohort of animals. Hippocampal phospholipids fatty acids and lipid mediators will also be analyzed in this neuroinflammation model to test if this is relevant for neuroinflammation and its resolution. This study will therefore provide mechanistic insight into how n-6 PUFA modulate inflammation in the brain. (Supported by King Abdul Aziz University in Saudi Arabia and Canadian Institutes of Health Research.)

Patients with low saliva rate may be at risk of periodontal disease post bariatric care protocol

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Background: Obesity and diabetes promote periodontal disease (PD). Suggested mechanisms are increased salivary glucose level from hyperglycemia and hyposalivation, with both affecting the oral microbiome. Bariatric care protocol which includes a pre-surgery very-low-calorie diet (VLCD) and bariatric surgery is an effective treatment for obesity and diabetes. Aim: This study aims to determine the effect of the bariatric care protocol on oral inflammatory load (OIL), a surrogate marker for PD and salivary flow rate (SFR) in obese subjects. Methods: Patients were recruited from the Toronto Western Hospital. Sample collection took place at three 3-points: pre-VLCD, post-VLCD (surgery day) and 1-month post-surgery. A 30-second mouth rinse was collected to assess neutrophils count using hemocytometer. Salivary flow rate was measured by chewing on a piece of parafilm in a preweighed tube. Blood tests included fasting insulin, glucose, and HbAlc. Weight and body mass index (BMI) were measured. Results are expressed as mean ± SD or median (minimum, maximum). Results: Twenty-six patients [24 females, 5 male] were recruited of which 7 were diabetic. Mean age was 49 ± 9.2 years, and BMI was 46.7 ± 5.8 kg/m2. The mean VLCD duration was 17.6 ± 3.5 days. At baseline, 5 patients had high OIL,1,790,000 (2,000,000, 4,000,000); normal range <1 million neutrophils/10 ml, suggestive of PD, and 15 patients had low SFR 0.6 (0.8); normal range ≥ 1 ml/min. After the bariatric protocol, BMI (P <0.001), Glucose (P<0.001), insulin (P<0.001), HbAlc (P<0.001) improved. The changes in oral measurements were not significant (OIL, P = 0.271; SFR, P= 0.248). However, patients with low SFR at baseline tend to have an increase in SFR (P=0.074) and showed a significant increase in OIL (P=0.033). Conclusion: These preliminary results suggest that both VLCD and bariatric surgery improve glucose metabolism and weight, but the bariatric care protocol does not significantly impact oral parameters. However, those with low SFR are more prone to have an increase in OIL after surgery which can suggest a higher risk of developing PD. (Funded by CHIR and Taibah University Scholarship program.)
Is the increase in the LDL-C response to high-dose supplementation with either DHA or EPA consistent, and should we worry about it? The compared study

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Although supplementation with high-dose docosahexaenoic acid (DHA) increases serum LDL-cholesterol (LDL-C) concentrations more than a similar dose of eicosapentaenoic acid (EPA), there seems to be important intra- and inter-individual variations in the response to either treatment. The objective of this study was to examine the magnitude of the intra- and inter-individual LDL-C response to either DHA and EPA. In a randomized, double-blind, crossover study, 154 individuals with abdominal obesity and subclinical inflammation were randomized to a sequence of three 10-week supplementation phases: 2.7g/d DHA, 2.7g/d EPA and 3g/d corn oil (bg DHA+EPA), separated by nine-week washouts. Blood samples were collected after a 12-h overnight fast at screening, beginning and end of each phase. Intra-individual variations in LDL-C concentrations, which accounts for measurement error as well as biological variability, was calculated as the standard deviation from the mean of four samples taken at screening and before each phase, and was equal to ±0.30 mmol/L. Variation in LDL-C was within the ±0.30 mmol/L range in half of participants (52% and 50% of individuals after DHA and EPA respectively). The increase in LDL-C was greater than ±0.30 mmol/L in 34% of participants after DHA (mean increase: +0.68 mmol/L, 95%CI 0.56 to 0.81) and in 30% of participants after EPA (+0.61 mmol/L, 95%CI 0.50 to 0.72). A lower proportion of individuals had their LDL-C reduced by more than −0.30 mmol/L after DHA than after EPA (14% vs. 20%, P=0.004). However, the mean reduction in LDL-C in both groups was similar [DHA: −0.51 mmol/L, 95%CI −0.99 to −0.43; EPA: −0.46 mmol/L, 95%CI −0.53 to −0.40]. Although on average the increase in LDL-C was greater after DHA than after EPA, between 66% and 72% of individuals showed no change or a reduction in LDL-C after either supplement. We have also previously shown that the increase in LDL-C after DHA was associated with larger LDL particles and with an increased LDL turnover compared with EPA. These changes in LDL features and metabolism suggest minimal cardiovascular harm in the 30-34% of individuals among whom LDL-C increases after supplementation with DHA and EPA. (Canadian Institutes for Health Research, MOP-123494.)

Development and face validity of an online survey to assess eating disorders, muscle dysmorphia, and exercise addiction among competitive male bodybuilders

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Eating disorders are classified as a continuous disruption of eating behaviour that alters intake and absorption of food, negatively affecting physical and mental health. Muscle dysmorphia is the preoccupation with leanness and muscularity and obsessive drive to exercise. Bodybuilding culture encourages behaviours characteristic of muscle dysmorphia and exercise addiction, including recurring cycles of drastic weight loss and regain, which have been linked to disordered eating. This is especially of concern as muscle dysmorphia, exercise addiction, and disordered eating among men are associated with depression, anxiety, and substance abuse. However, there is a paucity of research examining the comorbidities of muscle dysmorphia, exercise addiction, and disordered eating among men. The aim of this research was to develop an online tool to assess eating disorder risk among male bodybuilders with respect to extreme dietary and exercise practices associated with the sport. This tool was developed to assess these three health conditions among competitive male bodybuilders ≥19 years living in Nova Scotia, and to obtain face validity of this survey. The tool was tested among seven competitive Nova Scotian male bodybuilders between the ages of 24 and 55 years with varying degrees of experience in the sport of bodybuilding. Four of the seven participants provided written feedback for the improvement of the survey tool. Mean±SD time to complete the survey was 9.86±3.24 minutes, and no participants expressed issues with survey length, difficulty, level of comfort completing the survey, or question repetitiveness. Participant feedback highlighted a need for more detail in questions concerning calorie intake and macronutrient distribution during contest preparation, as well as more room to express the mental and physical difficulties experienced during competition preparation. One limitation of this pilot face validity study was that all participants had completed some form of post-secondary education, thus may not be representative of all competitive male bodybuilders in Nova Scotia. The survey has been updated based on participant feedback. Next, the tool will be assessed for criterion validity and implemented in a larger cross-sectional study to determine if relationships exist between eating disorders, muscle dysmorphia and exercise addiction in this population.

How much dietary methionine is required to maximize synthesis of protein and transmethylated products in neonatal piglets

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Methionine is an indispensable sulfur-containing amino acid required for synthesizing protein as well as other critical metabolites. Methionine acts as a precursor for >50 transmethylation reactions to produce metabolites such as creatine, phosphatidylcholine (PC), and methylated DNA. In neonatal piglets, because a lower fraction of dietary methionine is incorporated into protein (−1/3) compared to methylated products (−2/3), both protein and non-protein demands need to be considered when determining the methionine requirement. Our major objective is to quantify how much dietary methionine is required to maximize synthesis of protein as well as key transmethylated products (creatine, PC, methylated DNA). We hypothesized that a higher level of dietary methionine will be needed to maximize creatine and PC synthesis, with lower levels required to maximize protein synthesis. Twenty surgically altered Yucatan miniature piglets (8 d old; −1.6 kg) were fed complete diets for 5 d and then randomized to 20 test diets with methionine intakes ranging from 20%−220% of requirement (0.05−0.55g/kg/d). After 24 h of test diet, [3H-methyl]-methionine was infused for 6 h to measure methyl incorporation into transmethylated products. After the constant infusion, a 3H-phenylalanine flooding dose was given to measure tissue-specific protein synthesis. Break-point analysis using dual linear regression is used to identify the methionine required to maximize product synthesis. Plasma methionine increased above 0.3 g methionine/kg/d, reflecting the whole body requirement. 3H-PC synthesis maximized at −0.2 g/kg/d, while 3H-DNA did not change with increasing methionine intakes. Plasma homocysteine concentration positively correlated with dietary methionine levels (r2=0.787; P<0.001). Synthesis of creatine and tissue-specific proteins will be forthcoming. These data could suggest that more methionine is required to not only accommodate protein synthesis demands, but also non-protein demands for methionine. (Supported by NSERC.)

Understanding adolescents’ beliefs regarding milk and milk product consumption and reasons for under consumption

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Introduction: Milk and milk product consumption contributes significantly to the quality of the adolescent diet, and yet, the consumption among this age group has been declining. To improve intake, a deeper understanding of why adolescents avoid or limit consumption is necessary. This study aims to investigate adolescents’ beliefs regarding
crease in improvement from baseline, which indicates that including knowledge had a positive impact. Nutrition habits showed no or a decrement from baseline. This indicates that providing specific nutrition knowledge for topics specifically addressed by the SNC had an improvement.

Skipping meals increased from 25% to 44%. In conclusion, the nutrition label choices were provided. In addition, there was one round of individual consultations addressing individual needs and concerns. The second survey results were compared to the initial survey to assess the success of any model supporting systematized, integrated inpatient malnutrition care appears predicated on application of robust implementation and Evaluation (SIMPLE). Preliminary findings for 5 sites (AC-III) compared nutritionally at-risk patients audited at baseline (n=168) with at-risk patients audited 5-6 months after SIMPLE implementation (n=174). Significantly improved inpatient food and nutrient delivery (67.9 versus 83.9%; X2(1) 12.081, p=0.001) and coordination of care (45.8 versus 57.5%; X2(1) 4.636, p=0.031) processes were observed following early implementation of the new model. A non-significant improvement was observed for nutrition education processes (44.0 versus 52.9%; X2(1) 2.666, p=0.103). Mixed-methods data demonstrated the need for local stakeholder engagement and context analysis, adaptation to fit, data feedback, iterative change, and reflexivity to support successful implementation. Conclusions: Preliminary findings indicate that the wicked problem of malnutrition in Australian hospitals may be managed by a SIMPLE adaptation of INPAC. However, the success of any model supporting systematized, integrated inpatient malnutrition care appears predicated on application of robust implementation processes in local sites.

Comparison of dietary intakes between adults with normal fasting glucose, impaired fasting glucose or self-reported type 2 diabetes: results from the PREDISE study

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Diet plays a key role both in the development and treatment of type 2 diabetes (T2D). The objective of this study was to compare dietary intakes of individuals with normal fasting glucose (NGF; n=899), im-

Adapting the Canadian Integrated Nutrition Pathway for Acute Care (INPAC) to fit Australian hospitals: preliminary findings of the SIMPLE approach multi-site implementation

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Aim: Healthcare climate changes demand a paradigm shift in how inpatient malnutrition care is managed. This study describes the process for developing, implementing, and evaluating a locally adaptable model for managing malnutrition in Australian hospitals. Methods: A 2-year, multiphase mixed-methods, action research implementation program applying a separate-sample before-and-after design. Action cycle-1 (AC-I) focused on problem identification and building a case for change, including a cross-sectional survey of 21 Queensland public hospitals. Diverse stakeholders were engaged to identify and adapt existing frameworks to produce a model for implementation in Australian hospitals through informal and structured interviews (AC-II). Facilitated implementation, iterative adaptation and evaluation processes were consequently undertaken across 6 diverse Queensland Hospitals, purposively sampled for maximum variation (AC-III). Multiphase mixed-methods evaluation is targeted for completion by April 2018 (AC-IV) with all phases on schedule. Results: AC-I demonstrated inconsistent, fragmented approaches to malnutrition care across metropolitan (n=11), regional (n=8), and rural/remote (n=2) settings.

Limited systematic, interdisciplinary or delegated malnutrition care processes were identified; most remained focused towards highly individualized, dietitian delivered care. AC-II failed to identify a consistent model of care integrated into practice across sites. The INPAC was identified as a key model for adaptation to fit when developing a Systematized, Interdisciplinary Malnutrition Pathway for implementation and Evaluation (SIMPLE). Preliminary findings for 5 sites (AC-III) compared nutritionally at-risk patients audited at baseline (n=168) with at-risk patients audited 5-6 months after SIMPLE implementation (n=174). Significantly improved inpatient food and nutrient delivery (67.9 versus 83.9%; X2(1) 12.081, p=0.001) and coordination of care (45.8 versus 57.5%; X2(1) 4.636, p=0.031) processes were observed following early implementation of the new model. A non-significant improvement was observed for nutrition education processes (44.0 versus 52.9%; X2(1) 2.666, p=0.103). Mixed-methods data demonstrated the need for local stakeholder engagement and context analysis, adaptation to fit, data feedback, iterative change, and reflexivity to support successful implementation. Conclusions: Preliminary findings indicate that the wicked problem of malnutrition in Australian hospitals may be managed by a SIMPLE adaptation of INPAC. However, the success of any model supporting systematized, integrated inpatient malnutrition care appears predicated on application of robust implementation processes in local sites.

Efficacy of a student nutrition coach for improving healthy eating habits in varsity athletes at a Canadian university

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Acadia University Athletics Department and School of Nutrition and Dietetics have been strengthening their relationship to further support the vision of delivering uniquely personalized high-performance athletics. The purpose of this study was to investigate the efficacy of a student nutrition coach (SNC) for improving nutrition knowledge and healthy eating habits in varsity athletes throughout the school year. The women’s volleyball team consisting of 16 athletes took part in this study. A ten-item paper survey was issued by the SNC to the athletes during the introduction meeting, and again after nineteen weeks working with the athletes. During the nineteen weeks, the SNC met with the women’s volleyball team five times providing post-workout snacks. Each meeting had a different theme and the reasoning for the snack choices was discussed. There were two informational presentations held with the subject of the importance of hydration and how to read and understand nutrition labels. An information package detailing ways to eat for performance while traveling, and best restaurant snack choices was discussed. There were two informational presentations addressing individual needs and concerns. The second survey results were compared to the initial survey to assess if there was a difference in nutrition knowledge or eating habits. Knowledge-based questions such as: being able to understand nutrition labels increased from 44% to 88%; and being able to make healthy choices while traveling increased from 44% to 88%. Questions based on eating habits such as feeling nutritionally fueled before training showed no difference in responses. Respondents reported an increase in regularly skipping meals increased from 25% to 44%. In conclusion, the nutrition knowledge for topics specifically addressed by the SNC had an improvement from baseline. This indicates that providing specific nutrition knowledge had a positive impact. Nutrition habits showed no or a decrease in improvement from baseline, which indicates that including specific tips to overcome barriers such as demanding schedules, or an increase in individual counseling to facilitate healthy habit changes may need to be implemented into the program. (This study is unfunded.)
paired fasting glucose (IFG; n=53) or self-reported T2D (n=50), in a representative sample of adults (18-65 years old; 50.2% women) from the Province of Quebec, Canada. Dietary intakes were assessed with three web-based 24-hour food recalls in the cross-sectional PREDISE study. Sociodemographic data were collected with a questionnaire, body mass index (BMI) was calculated and blood samples were collected to measure fasting glucose in order to identify NFG and IFG participants. Since between-group differences were observed for age (42.4±13.4, 44.8±15.0 and 52.5±10.0 yrs for NFG, IFG and T2D respectively, p<0.0001) and BMI (27.0±5.8, 29.9±5.7 and 34.1±7.5 kg/m² respectively, p<0.0001), statistical analyses were systematically adjusted for age, BMI and sex. No between-group differences were observed in the Healthy Eating Index, which is a score reflecting global diet quality (p=0.885). Similarly, the number of daily servings of vegetables and fruits was similar among NFG, IFG and T2D individuals (p=0.212). With regards to total energy intake, individuals with T2D reported significantly lower daily energy intake than NFG individuals (2334±851 vs. 2425±745 kcal, p=0.012). Individuals with T2D also consumed less energy from foods not included in the Canada’s Food Guide than individuals with NFG (46±488 vs. 740±466 kcal/day, p=0.004). However, this difference became non-significant after adjustment for total energy intake (p=0.103). It was also observed that participants with T2D consumed less energy from alcohol than individuals with NFG (2.2±3.0 vs. 3.6±4.9%, p=0.055). Finally, participants with IFG had a higher percentage of energy from fat in their diet than participants with NFG (36.7±6.5 vs. 34.6±5.4%, p=0.008). In this sample, very few differences were observed in variables related to diet quality between individuals with either self-reported T2D, IFG or NFG. Further analyses will be needed to evaluate other aspects that can be used to characterize diet healthiness such as eating patterns and eating behaviors. (Funded by CIHR.)

Differences in the nutrient composition of products reformulated to be lower in sugars
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Food reformulation has been suggested as an equitable approach to meeting recommendations to limit free sugars intake. During reformulation, various ingredients are needed to replace the functional properties of sugars, however, the effect this has on levels of calories and “nutrients to limit” has not been examined on a large-scale. This study aimed to identify changes in nutritional composition of foods reformulated to be lower in sugars. Methods: This study was a repeated cross-sectional analysis of prepackaged foods and beverages using the 2013 and 2017 collections of the University of Toronto’s Food Label Database. Products in 2013 and 2017 were matched by barcode (n=6695 matches, after exclusions). Sign tests were used to evaluate difference in sugars contents. Wilcoxon signed rank test was used to evaluate differences in nutritional composition (i.e. calories, fat, saturated fats, sodium, carbohydrates, protein, and fibre) of products with lower sugars content in 2017. Results: Twenty-two percent of products (n=1492) had changes in sugars contents between 2013 and 2017. In 2017, 10% (n=669) of products were higher in sugars by 39% (3.5 ± 5.0g per 100g/mL, p<0.0001) and 13% (n=882) were lower by 30% (-2.5 ± 2.8g per 100g/mL, p<0.0001). Products that had lower sugar levels in 2017, also had significant reductions in calories (-5.4 ± 22.2 kcal per 100g/mL, p<0.0001), and sodium (-34.5 ± 186.9mg per 100g/mL, p<0.0001), and significant, but negligible, differences in saturated fats (0.0 ± 1.26g per 100g/mL, p=0.0435), total fats (-0.1 ± 1.7g per 100g/mL, p=0.0247), and carbohydrates (-0.8 ± 3.4g per 100g/mL, p<0.0001). There were no significant differences for other nutrients. Conclusion: Efforts to lower sugars contents through reformulation between 2013 and 2017 were limited. Although products reformulated to be lower in sugars were also significantly lower in calories, fats, carbohydrates, and sodium, the very small magnitude of these changes may not be sufficient to affect dietary intakes. (CIHR PICDP (JTJ, TGF-53893); CIHR Training Program in Public Health Policy (JTJ); OGS (JTJ); CIHR Strategic Operating Grant (201103SOK-118150); Canadian Stroke Network (201103SOK-01194-000) (MRL); CIHR Sugars and Health (SA2-1525865) (MRL); Earle W. McHenry Research Chair unrestricted grant (MRL); One Sweet Film Inc. (MRL).)

Substituting peas for potatoes significantly reduces post-prandial glycaemic response and glycemic index
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Diabetes is a common chronic disease affecting Canadians and choosing foods that produce a low post-prandial glycaemic response 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 potato with peas may limit the rise in blood sugar after a meal. The objective of this study was to compare the post-prandial glycaemic response following consumption of instant potatoes with and without 3 common market classes of peas. Twenty-four healthy adults (9 men/15 women, age 26 ± 4.9; BMI 23.2 ± 3.0 kg/m², % body fat (men) 18.8 ± 9.9, % body fat (women) 28.2 ± 6.8) completed the randomized controlled cross-over clinical trial at the I.H. Asper Research Institute in Winnipeg, MB. Each participant attended six 2.5-hour study visits separated by wash-out periods of 3-17 days (average = 7 days). At the first and sixth visits, participants received 50g available carbohydrate (AC) from white bread. At visits 2-5, participants received in random order 50g AC from instant potatoes or 20g AC from instant potatoes + 30g 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) among treatments. Compared to instant potatoes alone, glucose IAUC was significantly decreased (p=0.0005) by 29-36% and insulin IAUC was significantly decreased (p=0.036) by 32-43% when peas were combined with instant potato. The GI of instant potato (84±4.7) was significantly decreased (p=0.0001) by addition of each pea: yellow whole (53±4.7), yellow split (56±4.8) and green split (58±4.7). These results show that replacing 60% of the AC from instant potato (a high-GI, starch-rich food) with peas supports a Function health claim related to the reduction in post-prandial glycaemic response. (Funded by AAFP Growing Forward 2 and Pulse Canada Cluster.)

Poor adherence to dietary guidelines by the majority of adults in the province of Quebec – the PREDISE study
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Background: Knowledge of dietary intakes at the population level is essential to establish nutrition-oriented public health policies. Unfortunately, large nutritional surveys are seldom conducted. Technological advances and web-based questionnaires facilitate the undertaking of such population surveys due to greater efficiency of administration compared with traditional methods. Objective and methods: The aim

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was to measure dietary intakes of an age-representative sample of participants from 5 administrative regions of the Province of Quebec using a new validated web-based 24-hour recall (W24R). In a cross-sectional multicenter investigation, a random sample of men and women completed three W24Rs within a period of 21 days (d). Intake data of interest were contrasted across participants divided according to their body mass index (BMI) category, level of education, income quartile, and sex. Results: Among the 1149 participants recruited (50.0% women), 94.4% completed three W24Rs, mean(SD) age was 42.6 (13.5)y, range 18-66y, and mean(SD) body mass index was 27.4 (6.2) kg/m², range 16.3477 to 35.97. Median intake of vegetables and whole fruits (V&F) was 4.3 servings/d [95% confidence interval (CI) 4.1 to 4.5] and was lower in obese compared with overweight and normal-BMI participants (-0.5 and -0.8 servings/d respectively, P < 0.001); lower in participants with a high school degree or less vs. a college education or more (1.4 servings/d, P < 0.001); and also lower in participants with the lowest income level vs. the highest (1.1 servings/d, P = 0.003). Most participants failed to consume more than 5 servings/d of V&F (prevalence 61.2%, 95%CI 58.3 to 64.0%). Mean sodium intake was high (3394 mg/d, 95%CI 3314 to 3475) with more men than women consuming more than the 2300mg/d tolerable upper intake level (89.0%, 95%CI 86.2 to 91.5% vs. 71.8%, 95%CI 67.9 to 75.4%). Mean saturated fat (SFA) intake was 12.0%E (95%CI 11.8 to 12.1%) and almost three quarters of participants reported consuming more than 10%E as SFA (prevalence 73.2%, 95%CI 70.4 to 75.9%). Conclusion: Reported dietary intakes using a new web-based 24-hour recall in this sample reveal low levels of compliance with current Canadian nutritional guidelines, emphasizing the importance of targeted public health initiatives to address this issue. (Canadian Institutes of Health Research.)

Metabolic availability of lysine from rice assessed in school-aged children
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Background: Rice is one of the most commonly consumed cereal grains around the world. Although it is an excellent source of carbohydrates and energy, the protein quality of rice is low due to deficient lysine; an essential amino acid (AA). AA content of foods is not the only indicator of protein quality. AA loss from digestion, absorption, and utilization determines metabolic availability (MA) of AA. MA is the amount of absorbed AA that is available and used for protein synthesis, and provides a more comprehensive assessment of protein quality. Objective: Our objective was to measure the MA of lysine from rice in healthy 6-10y children using the Indicator Amino Acid Oxidation (IAAO) method. This method measures the oxidation of L-[1-13C]- phenylalanine in response to graded intakes of lysine from rice compared to the oxidation of L-lysine from a reference protein (crystalline amino acid mixture patterned after egg protein). Methods: Using a repeated-measures design, five healthy school-aged children randomly received four crystalline L-lysine intakes (2, 6, 10, 14mg/kg/day), cooked warm long grain white rice and cooked cold rice intake at 14mg/kg/day (Western Rice Mills). All diets provided protein at 1.5g/kg/day, calories at 1.7x the participant’s measured resting energy requirement. All test diets were isocaloric and isonitrogenous. Every study day, breath samples were collected at baseline and isotopic steady state and 13C enrichment measured using an isotope ratio mass spectrometer. MA of lysine from rice was determined as [13C]-phenylalanine oxidation of rice/13C-phenylalanine oxidation of L-lysine*100. Results: Preliminary results suggest that lysine MA from rice measured in school-aged children is 95.0%. This value was corroborated with a repeated rice study (94.4%). The consumption of cooked cold rice significantly reduced the MA to 81%. Conclusions: Based on our preliminary analysis, lysine MA from rice measured in children provides similar results to that obtained from adult males (97%), suggesting similar rates of lysine absorption and utilization at different life stages. The IAAO method’s repeatability within the same sample population was addressed and corroborated; as well as the method’s sensitivity to detect lysine MA changes due to different food temperatures. (Support: Canadian Institute of Health Research.)

Habitual plain water intake and long-term risk of incident coronary heart disease in two prospective cohorts
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Background: Plain water consumption is commonly promoted as a heart-healthy practice. However, studies to-date have reported contradictory findings regarding plain water consumption and long-term health outcomes such as coronary heart disease (CHD) mortality, and they have not included non-fatal CHD cases or stratification by potential intermediary health conditions such as hypertension and body mass. Objective: To assess the relation between plain water intake and risk of incident CHD (non-fatal myocardial infarction and CHD death) in two large prospective cohorts. Methods: We followed participants from the Nurses’ Health Study (NHS, n=62,769 women) and the Health Professionals Follow-up Study (HPFS, n=40,405 men) who were free of hypertension, cardiovascular disease, or cancer at baseline. During 24 years of follow up, 2278 and 3101 incident CHD cases were documented in the NHS and HPFS respectively. Cox proportional hazards models were used to estimate relative risks (RR) and 95% confidence intervals (CIs) for CHD, adjusted for age, medication use, alcohol intake, diet quality, total intake of beverages other than water, physical activity, smoking status, family history of CHD before the age of 60, and other CHD risk factors. Results: Compared to the reference group who reported drinking 2-3 cups of water daily, there was no significant difference in CHD risk for those who drank only 1 cup or less than 1 cup; however, those who drank 4-5 cups or 6 or more cups had respective CHD risks of 1.08 (95% CI 0.96, 1.34) and 1.18 (1.04, 1.34) in the NHS and 1.13 (1.03, 1.25) and 1.12 (1.00, 1.26) in the HPFS. Among participants with hypertension, the pooled RR (95% CI) of CHD was 1.16 (1.06, 1.28) for those who consumed 4.5 cups/day and 1.22 (1.09, 1.37) for those who consumed 6 or more cups/day, while no significant association between plain water intake and CHD risk was observed in participants without hypertension. Conclusions: Drinking 6 or more cups of plain water, compared to 2-3 cups, was positively associated with risk of CHD in individuals with hypertension, and we report no association in participants without hypertension. Further investigation is required to determine the cause of our findings.

Associations between liking for savory and sweet foods and diet quality – the PREDISE study
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Food liking and preferences are important determinants of food choices, but there is a lack of evidence regarding their associations...
with diet quality. The research purpose was to investigate how liking for savory or sweet foods is associated with diet quality in a French Canadian population, and how these associations differ between women and men. As part of the PREDISSE study, women (n=521) and men (n=526), aged 18 to 65 years (mean: 42.6±13.6 y), living in the Province of Quebec, Canada, were recruited to complete online questionnaires. The Food Liking Questionnaire, developed and validated for the French-Canadian population, assessed liking for a variety of savory (high-salt/high-fat) and sweet (high-sugar/high-fat and high-sugar/low-fat) foods. Three web-based 24-hour food recalls were also completed over a three-week period, and were used to compute the Healthy Eating Index (HEI), an indicator of the global diet quality based on the Canadian guidelines for healthy eating. Women had higher mean HEI score than men (60.6±13.0 vs. 53.6±14.4 respectively, p<0.0001), and lower liking for savory (5.96±1.34 vs. 6.61±1.15, p<0.0001) and for sweet (5.52±1.35 vs. 5.75±1.24, p=0.0095) foods. Liking scores for savory and for sweet foods were negatively associated with age (r=-0.21 and r=-0.20, respectively; p<0.0001). Given significant gender interactions in the associations between liking scores and HEI, subsequent analyses were stratified by gender. Multivariate linear regressions (including liking for savory and sweet foods, and age) support that liking for savory foods was inversely associated with HEI in men (β=-3.59, p<0.0001) and in women (β=-1.78, p=0.0005). Age and liking for sweet foods were not significantly associated with HEI. These results suggest that a stronger liking for savory foods may be a barrier to healthy eating, especially in men, for whom the mean liking score is higher. Building on these results, future longitudinal and experimental studies should investigate the potential of interventions designed to improve the healthiness of food habits in individuals with strong liking for savory foods. (Funded by CIHR.)

Polymorphisms in taste receptor genes are associated with psychophysical measures of taste function in healthy adults

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Taste is a fundamental mechanism whereby compounds are detected orally, yet it is highly variable among individuals. The variability in taste that is attributable to genetics is not well-characterized despite its potential role in food selection and therefore eating habits that contribute to risk of overweight and obesity. The primary objective of this study was to elucidate the relationship between single nucleotide polymorphisms (SNPs) in taste receptor genes and psychophysical measures of taste in young, healthy adults. Sweet, salt, umami, fat, sour and bitter taste receptor gene SNPs were genotyped in 49 participants (ages 24.6±1.6 years) who completed testing to determine oral detection threshold, suprathreshold sensitivity and taste preference. Following a Bonferroni adjustment, the rs4790151 SNP in the TRPV1 putative salt taste gene was significantly associated with salt detection threshold (p=0.007), the rs2499729 SNP in the mGlur4 umami taste gene was significantly associated with detection threshold for monosodium glutamate + inosine monophosphate (p=0.01), and the rs4920564 SNP in the TAS1R2 sweet taste gene was associated with the preference for sucrose, but not significantly (p=0.06). In a multiple trait analysis of sour detection threshold, suprathreshold sensitivity, and preference, rs3837841 in the KCNJ2 gene was significantly associated with all outcomes. Overall, these results demonstrate that SNPs in taste receptor genes may contribute to inter-individual differences in psychophysical measures of taste and taste preference. Future studies are warranted to investigate if these findings have consequences for habitual intake of sweet, salty, umami, and sour foods. (Support was provided by the Ontario Ministry of Agriculture, Food, and Rural Affairs.)

Faba bean-enriched durum wheat semolina pasta: effects on glycemia, satiety and metabolic control

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The nutritional benefits of pulse consumption are well-known; however, North Americans are low consumers. Incorporation of pulse flours varying in macronutrient content into familiar carbohydrate foods has been shown to reduce glycemia and increase satiety responses to high glycemic foods. The objective was to investigate the effects of faba bean (FB) flours and fractions added to durum wheat semolina macaroni (DWS), the conventional low glycemic pasta (glycemic index = 47), on postprandial blood glucose (BG), satiety and metabolic control. Five macaroni pastas were prepared and consumed with tomato sauce in isocaloric amounts: [1] control (100% DWS), and pasta containing 25% FB flours and fractions from [2] split bean flour (FBF), [3] high starch fraction at 55% starch (FBS), [4] protein concentrate fraction at 60% protein (FPBC), and [5] protein isolate fraction at 85% protein (FBPI). Using a randomized repeated measures design, their effects were tested in 28 male participants (age: 20–30, body mass index 18.0–25.0). Subjective appetite and BG measures were collected in 15 min intervals after meal consumption, then every 30 min. Second meal food intake (FI) of ad libitum pizza consumed between 120–140 min was measured. An intravenous blood draw was collected at 0, 30, 60, 120, 140 and 200 min. Changes in insulin, glucagon-like peptide 1, C-peptide, ghrelin and peptide tyrosine were assessed. For mean BG, there was time and treatment effect (p<0.0001) but no treatment*time effect. Although DWS pasta is low GI, enrichment with FBPC and FBPI, but not FBF nor FBS, reduced glycemic response compared to control. Mean BG was reduced by 4% post-treatment (0–120min) and the effect was sustained post-meal after the ad libitum pizza meal (140–200min). The PPG response to the high protein pastas was not different. FBS lowered appetite compared to FBF by 12.4% (p=0.0212) and FBPI by 13.0% (p=0.0124), lasting up to 1h after consumption. Average pizza FI was 1220 kcal, not significantly different between treatments. Use of concentrated macronutrients from FB flour in familiar foods has potential to reduce PPG and increase satiety in both low and high glycemic carbohydrate products. (Funding: Supported by Saskatchewan Pulse Growers, Canada.)

The effect of cooked whole navy beans and yellow peas added to a mixed-meal on satiety, food and nutrient intake and physical comfort in children

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Epidemiological data indicate that the regular consumption of pulses is associated with improved body weight control. However, there are no reports regarding the effect of whole pulse consumption on short-term subjective appetite and food intake in children. The purpose of the study was to investigate how whole pulses, providing 44% energy, will affect the satiety, food intake and sensory characteristics when added to the mixed meal containing cooked rice in children aged 12-14 years. Due to the variability of body weight status, children were separated into lighter-to-normal weight and heavier weight groups. Methods: in a single-blinded, repeated measures, within subject, balanced crossover design, 33 children (13.2±1.0 years; 20.3±3.9 kg/m2) attended one screening, three weekend study sessions, one week apart, and consumed one of three randomized iso-caloric (300kcal), 200g treatments at each session: 1) rice with added navy beans, 2) rice with added yellow split pea, and 3) rice (control). Results: There was no effect of treatment on subsequent food intake at the pizza meal 120 min later in all subjects, lighter-to-normal subjects, or heavier subjects. Analysis of subjective appetite measures showed 18% higher

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average appetite scores (P=0.04), and 21% higher hunger scores after consumption of the mixed meal with added navy beans compared to the control (P=0.03) in all subjects. Palatability and gastrointestinal comfort data revealed no differences among the pulse treatments compared to the control. Adding pulses to the mixed meal provided 7.4g and 4.0g more fiber, and 5.9g and 5.1g more protein in the navy bean and yellow pea treatments, respectively compared to the control. Conclusion: the partial replacement of rice with whole cooked pulses in a mixed meal did not lead to a greater satiety or reduced short-term food intake in children, however resulted in acceptable palatability and gastrointestinal comfort level, and improved nutrient intake. This study presented an effective and practical approach to improving dietary intake of fiber, protein, and nutrients by incorporating pulses. (This research was funded by Manitoba Pulse and Soybean Growers Associaiton. Teresa Chiu has received support from CIHR Canada Graduate Scholarship Master’s Award and Nova Scotia Health Research Fund Master’s Award.)

Hormonal contraceptive use is associated with changes in the plasma lipid response to a fish oil supplement in healthy young women

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Studies report that hormonal contraceptive (HC) users have slightly higher plasma levels of LDL-cholesterol (LDL-C) compared to the non-users and this effect is partly attributable to estrogens, commonly found in HC. The consumption of fish oil, rich in omega-3 polyunsaturated fatty acids (n-3 PUFAs), modulates plasma LDL-C, but the results are highly heterogeneous between studies. Estrogens are known modulators of endogenous n-3 PUFA metabolism. Therefore, the objective of this study was to evaluate if HC use is associated with changes in the plasma LDL-C response to a n-3 PUFA-rich fish oil supplement in healthy women. This study is a secondary analysis; 16 HC users and 21 non-users aged 20- to 34-year-old were included. Participants consumed 900 mg/d of eicosapentaenoic acid (EPA; 20:5n-3) and 680 mg/d of docosahexaenoic acid (DHA; 22:6n-3) in the form of ethyl esters for four weeks. Plasma was sampled before and after the intervention for biochemistry and fatty acid analyses. For fatty acid relative quantification within lipoproteins, LDL and HDL were separated on a sucrose gradient by ultracentrifugation and fatty acid profiles were assessed by gas chromatography. At baseline, plasma LDL-C was similar between the two groups. However, plasma LDL-C was reduced by 0.18 mmol/l (7.8%) by the intervention in HC users but not in the non-users (P=0.03 between groups). Moreover, the intervention was associated with a 3.8% decrease in the relative levels of total omega-6 (n-6) PUFAs within LDL, but only in HC users. At the end of the supplementation, plasma LDL-C was correlated with LDL n-6 PUFAs (r²=0.28; P=0.03), but only in the HC group. The results from this study suggest that HC use might be a confounder when designing dietary interventions involving n-3 PUFAs in healthy women. Whether these findings can be replicated in women with dyslipidemia needs to be evaluated since lipid lowering therapies are often recommended in this population. (Supported by Centrum, CIHR, NSERC, and FRQ-S.)

Characterizing the extent and nature of prepackaged foods with small reference amounts in Canada

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Background: Health Canada is considering mandatory front-of-package (FOP) ‘high in’ warning labels for nutrients of public health concern (sugars, sodium and saturated fat) to assist Canadian consumers in making healthier food choices. The proposed threshold to trigger a label is ≥15% of the DV per reference amount (RA). Additionally, a 50g/mL RA threshold has been proposed for foods with small reference amounts (SRA). Traditionally, foods with SRA have been defined in regulations as those with ≤30g/mL. This difference could impact the foods that would be subject to FOP warning labels. Objectives: Determine the proportion and types of foods with RAs: a) <50g/mL; b) <30g/mL; and c) >30 and <30g/mL. Methods: This was a cross-sectional analysis of the University of Toronto’s Food Label Information Program 2013 (n=15,341) database of prepackaged foods. Products were categorized according to Health Canada’s Table of Reference Amounts for Foods (2016) categories. The proportion of products with RAs a) <50g/mL, b) ≤30g/mL; and c) >30 and <30g/mL were determined overall and by food category. Results: Seventeen of 24 major categories and 90 of 172 subcategories had products with a RA <50g/mL. Overall, 35.5% (n=5,453) of products had a RA <50g/mL. 82.0% of which had a RA ≤30g/mL. Categories with the highest proportion of RA <50g/mL were Bakery (20.5%), Dairy (11.1%), Sauces (13.0%), and Sugars and Sweets (12.7%), most of which were ≤30g/mL. Categories with the highest proportion of RA >30 and <50g/mL were Legumes (100.0%), Fruit and Fruit Juices (89.2%), Dessert Toppings and Fillings (75.3%), Cereal and Other Grain (60.3%), and Sugar and Sweets (47.5%). Conclusion: These data provide an assessment of the proportion of foods with SRAs. Products with SRAs comprise a substantial proportion of the Canadian food supply, the majority of which are ≤30 g/mL. These analyses can be used to further examine the specific implications of the above SRA thresholds on the prevalence of FOP warning labels and inform ongoing policy discussions on FOP labelling. It will be important that SRA foods are required to carry FOP warnings when levels of nutrients of public health concern are high. (OGS [JTB]; CIHR Strategic Operating Grant [201103SOK-118150]).

Products with nutrition-related marketing are more expensive than those without in most foods categories

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Background: The presence of nutrition-related marketing on Canadian prepackaged foods is pervasive. Nutrition-related marketing is preferentially used by consumers, has been shown to direct product purchasing, and there is evidence to suggest that it is differentially displayed on products that are sold at higher prices. Previous work, however, has drawn on specific product categories (e.g. margarines, breads) and has not captured the scale and complexity of nutritional claims present in the current Canadian marketplace. Objective: The aim of this study was to comprehensively examine the relationship between product price and presence of nutrition-related marketing using the University of Toronto’s Food Information Labelling Program (2013, n=15,342) database of prepackaged foods from the top 4 Canadian retailers by market-share. Methods: The presence of nutrition-related marketing, including any regulated claim (i.e. nutrient content, disease risk reduction) or any unregulated front-of-package (FOP) claim (e.g. nutrient-specific symbols, summary indicator systems), was identified. Analysis of variance was used to compare the price of products (per 100g/mL) with and without nutrition-related marketing. Food category, package size, store and brand (i.e. national or private label) were included in the analyses as covariates to account for their potential confounding effect on price. Effect modification of food category on the relationship between price and display of nutrition-related marketing was also explored and deemed significant (P=0.0001). Analyses were stratified by food category, considering only those where at least 10% of foods displayed nutrition-related marketing. Results: In 14 of the 20 food categories examined, products with nutrition-related marketing were significantly more expensive than those without. This relationship persisted when only regulated claims were considered. In the 18 categories for which unregulated FOP claims were considered, the price of products with such marketing...
was significantly higher than that of products without FOP claims in 11. Conclusion: The work charted here has revealed a positive association between product price and display of nutrition-related marketing in most food categories, irrespective of the type of claim considered. Insofar as these claims can convey important nutrition information, our findings suggest price-conscious consumers may not be exposed to, and therefore potentially not benefit from, such labelling practices.

Darker-coloured beans induce postprandial vasorelaxation: potential implications for improving vascular function
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Endothelial responsiveness to blood flow, an important factor in maintaining healthy blood vessels, is altered by dietary components. Immediately after consuming a high-fat meal, vessels constrict leading to endothelial damage, and repetition of such poor postprandial vascular responses can contribute to cardiovascular disease (CVD). Foods that elicit a positive postprandial response benefit vascular health and may blunt the negative vascular effects of certain foods. Pulses (dried beans, dried peas, chickpeas, lentils) improve vascular function when consumed over many weeks, but whether they can positively modulate vascular responses postprandially is unknown. In a cross-over study, we compared different bean varieties (black (BB), navy (NB), pinto (PB), red kidney (RKB)) and white rice for their acute postprandial effects on vascular and metabolic responses in healthy individuals. Vascular measurements were obtained in 8 adults before and at 2 and 6 hours after eating ¾ cup of beans or rice. Blood glucose and lipids were measured before and at 1, 2 and 6 hours post-consumption. Serum glucose levels were lower 1 hour after consumption of RKB compared to rice, while serum triglyceride levels were lower 6 hours after consumption of BB compared to PB. Systolic blood pressure was reduced at 2 hours following consumption of RKB compared to rice. Regarding arterial stiffness parameters, BB reduced augmentation pressure after 6 hours compared to rice, while BB, RKB, and PB lowered pulse wave velocity compared to NB after 2 hours. Interestingly, BB lowered pulse wave velocity compared to PB after 6 hours. Greater vasorelaxation was shown by a lower pulse wave reflection magnitude 6 hours following consumption of RKB and BB compared to NB and PB. Overall, darker-coloured beans elicited positive effects on the tensile properties of blood vessels postprandially, suggesting their potential to mitigate the negative postprandial vascular responses of certain foods. Future research is needed to ascertain how darker-coloured beans modify vascular function and whether repeated positive postprandial vascular responses by consuming darker-coloured beans presents a potential therapy for maintaining healthy vascular function and preventing CVD. (Manitoba Pulse & Soybean Growers and the Canadian Institutes of Health Research provided grant and scholarship funding, respectively.)

Green lentils increase satiety but do not affect food intake when substituted for white rice in a chili matrix in healthy adults
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Increasing overweight and obesity rates demand new prevention and management strategies, one of which may be satiety due to its potential to decrease appetite and food intake. Lentils, a type of pulse, have potential to increase satiety due to their unique nutritional profile, and may therefore be a dietary strategy for body weight management. While lentils have been previously investigated for their effects on satiety with mixed results, the effects of replacing more commonly consumed carbohydrates with lentils within food matrices on satiety remain largely unknown. The objective of this study was to determine the effects of replacing white rice with two varieties of lentils within a chili matrix on satiety and food intake. Healthy adults (n=24, age of 25.7 ± 1.0 years, BMI of 23.2 ± 0.5 kg/m2) completed a randomized crossover study in which they consumed chillies made with white rice or in which the white rice was substituted with green or red lentils, separated by washout periods of at least 7 days. Subjective appetite sensations were measured using visual analog scales (VAS) from 0 to 100 minutes, food intake was measured at ad libitum test meal at 180 minutes, and 24-hour energy intake was measured using weighed food records. Results showed that substituting white rice with green lentils within the chili increased fullness area under the curve (AUC) (p=0.02) and decreased desire to eat AUC (p=0.02) and prospective food consumption AUC (p=0.04), with no significant effects on food intake or 24-hour energy intake. None of the study measures were significantly different between the red lentil and white rice chilies, or between the green and red lentil chilies. These data show that substituting white rice with green, but not red, lentils within a food matrix such as chili may help to increase satiety, but may not translate to a decrease in subsequent food intake. (Supported by Agriculture and Agri-Food Canada-Pulse Canada’s Growing Forward 2 Program and the Pulse Science Cluster.)

Differences in diet quality and body composition in participants with inflammatory bowel disease
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The aim of the current study was to characterize the relationship between diet quality and body composition in participants with inflammatory bowel disease (IBD) in Atlantic Canada. Participants from the Atlantic Partnership for Tomorrow’s Health (PATH) study are residents of one of the four Atlantic Canada provinces, a region with the highest incidence IBD worldwide. Participants which completed both the dietary questionnaire and had body composition measured at baseline were included in the study (n=12,433 without IBD and n=280 with IBD). Participants with and without IBD had similar levels of education, income, smoking status, physical activity level, and alcohol consumption, however, a greater number of participants with IBD reported having 2 or more chronic conditions compared to without IBD. Similarly, those with IBD had statistically higher body weight, waist circumference, BMI, total fat mass, trunk fat mass, arm and leg fat mass compared to those without IBD. Significant associations were observed between adiposity and servings of refined grains, meat/poultry, eggs, vegetables, fruit, whole grains, and tofu. Participants with IBD consumed fewer servings of fruit, tofu, beans/legumes, nuts/seed and more servings of eggs and total grains. In multifactorial analysis, adjusting for BMI, grip strength, smoking and physical activity, only the protective effect of servings of beans/legumes and nuts/seeds against IBD, remained. In conclusion, distinct differences in adiposity and diet quality were observed in individuals with IBD compared to those without IBD living in the Atlantic Canadian region. (Supported by the Canadian Partnership Against Cancer.)

Motivators, barriers and other factors related to bean consumption in older adults
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Beans have an excellent nutrient profile and have been extensively studied for their ability to reduce chronic disease risk. These benefits...
are particularly relevant for older adults since age is a risk factor for chronic disease and the proportion of older adults in Canada is rapidly increasing. Despite this, bean consumption is low in Canada and if dietary strategies that promote bean consumption are to be effective, they must be evidence-based. Therefore, the purpose of this study was to explore motivators, barriers and other factors related to bean consumption in community dwelling older adults (65+ years). Participants (n=250; 76% female) completed a researcher-administered validated questionnaire to explore bean consumption and factors related to bean consumption. The prevalence of bean consumption among older adults was 51.2% with chili, soup and baked beans indicated as the most common favourite bean recipes. Motivators to bean consumption were significantly more likely among bean consumers than non-consumers, with the most frequent motivators including “nutritional value” (93.8%), “taste and/or texture” (92.2%) and “versatility” (91.4%). Barriers to bean consumption were significantly more likely among bean non-consumers than consumers, with the most frequent barriers including “do not think to include beans in meals / not part of traditional diet” (57.4%), “flatulence or abdominal discomfort” (34.4%) and knowledge of “preparation / cooking beans” (27.9%). Bean consumers were significantly more likely to be aware of several different bean varieties (adzuki, black, cranberry, fava, great northern, white kidney, navy, pinto) compared to non-consumers. Bean consumers were not significantly different from non-consumers in their likelihood to consume canned beans, but were significantly more likely to rinse those canned beans and consume bagged beans. These data will inform the development of dietary strategies to increase awareness and consumption of beans in the Canadian population. (Supported by the OMAFRA-University of Guelph partnership.)

Effects of an evidence-informed healthy eating blog on self-rated food skills of mothers: secondary analysis of a randomized controlled trial
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Observational studies have demonstrated positive associations between food skills and diet quality, notably among women, who are important healthy eating role models in households. Therefore, improving food skills of mothers could support positive changes in eating habits of families. The primary aim of this secondary data analysis was to compare self-reported food skills among mothers exposed to a 6-month intervention consisting of an evidence-informed healthy eating blog (BLOG group) with those of a control group with no exposure to the blog. Eighty-four adult mothers (mean age ± SD = 37.6 ± 6.7 years) of preschool and school-aged children (2–12 years), and primarily responsible for food purchases and preparation in the household participated in this parallel, randomized, controlled trial. The blog was written by a registered dietitian who provided weekly postings discussing various aspects of healthy eating such as knowledge about food and practical tips for meal planning, and included step-by-step recipes with pictures. Self-rated food skills of mothers were measured by a questionnaire adapted from the Canadian Community Health Survey 2013 Rapid Response on Food Skills, which was completed at baseline and 6 months. Differences between groups were assessed with mixed linear models, adjusted for baseline measurement. At 6 months, no differences were found between groups for meal planning confidence (p = 0.240), meal planning enjoyment (p = 0.115), and abilities to cook from basic ingredients (p = 0.335). A trend for a significant difference was observed for the ability to adjust recipes by adding vegetables and fruit (p = 0.085; Cohen’s d = 0.33); the BLOG group reported higher abilities at 6 months compared to baseline (p = 0.027), while they remained stable in the control group (p = 0.911). In conclusion, the blog had neutral effects on the self-reported food skills of mothers after 6 months. Further studies could explore whether being exposed to blogs specifically designed to improve food skills, such as adding vegetables and fruit to recipes, could contribute to improving diet quality. (This study was funded by the Danone Institute of Canada.)

Dietary phenylalanine requirements in human pregnancy
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Background: Pregnancy, a state of rapid tissue accretion, requires adequate consumption of the essential amino acids for proper fetal development. Phenylalanine (PHE) is an essential amino acid and, via tyrosine (Tyr), is the precursor for the neurotransmitters dopamine, norepinephrine, and epinephrine. Currently, the dietary requirements for PHE during pregnancy are unknown. Objectives: Our objective was to determine PHE requirements (in the presence of T Y R) during early (13–19 weeks) and late (33–39 weeks) gestation using two stable isotope based methods: Indicator Amino Acid Oxidation (IAAO, using L-[1-13C]Leucine) and Direct Amino Acid Oxidation (DAAO, using L-[1-13C]Phenylalanine). Methods: Thirty three healthy pregnant women (age 33±8 years) were studied at a range of PHE intakes (5.5 to 30.5mg/kg/d in early and late pregnancy using DAAO, and 2.5 to 30.5mg/kg/d in late pregnancy using IAAO) for a total of 75 study days. Test intakes were provided on study days as 8 isocaloric and isonitrogenous meals with 1.5g/kg/d of protein and 1.7x the measured resting energy expenditure of calories. Breath samples were collected at baseline and isotopic steady state, and analyzed on an Isotope Ratio Mass Spectrometer for 13C enrichment. PHE requirement was determined using a two-phase linear regression crossover model to identify a breakpoint in 13CO2 production (which represents the mean PHE requirement) in response to changes in PHE intake. RESULTS: PHE requirement during early pregnancy was determined to be 15.81mg/kg/d. PHE requirement during late pregnancy was determined to be 21.36 mg/kg/d (IAAO method) and 21.65 mg/kg/d (DAAO method). Conclusions: Our results suggest an increased requirement (37%) for dietary PHE during late stages of pregnancy when compared to early pregnancy. Both stable isotope based methods provided similar breakpoints in late pregnancy showing that the DAAO method was appropriate even though very low intakes of PHE could not be tested. The results allow for pregnancy specific dietary recommendations, and have implications for maternal phenylketonuria (mPKU). It has been reported that despite deficient phenylalanine hydroxylase activity, mPKU patients PHE tolerance increases, likely due to increased fetal PHE demands. PHE requirement in the absence of tyrosine remains to be determined. (Support: Canadian Institutes of Health Research.)

Ketogenic diet therapy for epilepsy: low ratio slow initiation in a Canadian outpatient setting – achieving optimal diet prescription for seizure control – 1 year follow up
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Ketogenic Diet (KD) is a rigorous high fat, low carbohydrate diet treatment for medically refractory epilepsy. Minimal evidence describes whether traditional classic ketogenic diet prescriptions of 3:1 or 4:1 ratios achieved with inpatient admissions over matter of days is necessary for optimal and sustainable seizure control. Outpatient initiation of the ketogenic diet (KD) has potential advantages, however there are concerns that potential complications require inpatient monitoring. Non-fasting ‘Low and Slow’ KD outpatient method starts KD at a low ratio and advances the diet every 1-2 weeks by titrating % calories of fat upwards while concurrently titrating down the % calories from carbohydrates over 4-6 weeks, or less if

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Role of faba bean flours in crackers on acute postprandial glycemia and metabolic control in healthy young men

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Snack foods have become an integral component of the Canadian diet. There is a demand by consumers and the food sector to create healthier snack options as many commercial products provide little nutrient value and increase post-prandial glycemia (PPG). Pulses, rich in protein and dietary fibre, have been shown to reduce PPG when consumed alone and in mixed meals. However, the effects of pulses as ingredients in functional foods on PPG and other markers of health have not been defined. The objective of the present study is to test the effect of incorporating faba bean (FB) flour versus FB flour fractions into wheat flour crackers on PPG and metabolic responses in healthy young men. In a repeated-measures, randomized, crossover trial, adult males (n=27) consumed 225 kcal crackers made with: [1] 100% whole wheat flour (control), [2] 23.9g FB flour, [3] 24.1g protein concentrate made from FB flour (FB protein concentrate), [4] 23.7g protein isolate made from FB flour (FB protein isolate), or [5] 24.7g high starch FB flour (FB starch). All FB flours replaced 40% of calories of whole wheat flour in crackers. Beta incremental areas under the curve (IAUC) from 0-120 min (pre-meal), 140-200 min (post-meal) and 0-200 min (total) were calculated using PPG concentrations. At 30, 45 and 60 min, BG was lower after both FB protein crackers compared to wheat flour, FB flour and FB starch crackers (p<0.001), and at 60 min after FB flour crackers compared to wheat flour crackers (p<0.05). Pre-meal BG IAUC (0-120 min) was lower after FB protein crackers than wheat flour and FB starch crackers (p<0.001) and after FB flour crackers than wheat flour crackers (p<0.05). Total BG IAUC (0-200 min) was lower after both FB protein crackers than wheat flour crackers (p<0.001) and after FB protein isolate crackers than FB starch crackers (p<0.05). Changes in insulin, GLP-1, ghrelin, PYY and c-peptide will also be reported. We conclude that addition of FB ingredients, particularly protein, to medium-high glycemic snacks will aid in achieving postprandial glucose control. (Funding:Supported by Saskatchewan Pulse Growers, Canada.)

The nutrition north canada program did not reduce vulnerability to household food insecurity in eligible communities

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Background: Household food insecurity, a measure of food access problems caused by insufficient money, is a widespread public health problem that disproportionately affects households living in Canada’s North, with prevalence estimates in the territories ranging between 17.1% and 45.2%. High food cost is considered an important contributor to food insecurity in northern regions. In April 2011, the federal government replaced the Food Mail program with Nutrition North Canada, a program intended to make nutritious and perishable food more accessible and affordable in isolated northern communities, while at the same time removing subsidies for various non-food items. Nutrition North appears to have reduced food cost in some regions during the initial year of implementation, but its impact on food access remains unknown. Objective: Our study aimed to assess the impact of the Nutrition North Canada program on household food insecurity using a quasi-experimental approach. Methods: Drawing on data from the 2007 to 2014 Canadian Community Health Surveys, an interrupted time series analysis was conducted in eleven eligible communities from Ontario and Nunavut. To ensure sample comparability across survey years, propensity score weighting was used to achieve covariate balance for numerous household characteristics associated with food insecurity. Results: Annual food insecurity rates...
declined in the years before Nutrition North was introduced (1.74%, 95% CI: -3.25, -0.23). There was a substantial increase in food insecurity immediately after Nutrition North was introduced (8.51%, 95% CI: 4.30, 12.72): Food insecurity rates did not change in the years after implementation (1.15%, 95% CI: -0.52, 2.83). Conclusion: We found no indication that Nutrition North mitigated food insecurity risk in the communities included. The rise in food insecurity observed after the introduction of the program may be due to changes in macroeconomic factors not fully accounted for in the analyses (e.g., changes in unemployment rates), but the rise may also be related to the removal of subsidies for essential non-food items, such as hunting equipment, infant care and personal hygiene products. Given the health implications of food insecurity, interventions that reduce the magnitude of this problem in Canada’s North are badly needed (Supported by CIHR (FRN 1152088)).

Docosahexaenoic acid at 0.4% of dietary fat limits visceral fat mass in growing female rats
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Docosahexaenoic acid (DHA) is known for beneficial effects on body composition and adiposity. The objective was to test the dose-response of visceral fat accumulation to dietary DHA. Female Sprague-Dawley rats (7 wk at baseline; n=12/diet) were randomized to receive a control (AIN93-M, 6% fat) or experimental diet for 10 weeks. Experimental diets contained 0.1, 0.4, 0.8, and 1.2% DHA (% total dietary fat, mixed with soybean oil to maintain 6% total fat). Abdominal subcutaneous and visceral fat mass, and total fat mass in the lumbar region (L1-L5) was assessed using micro-computed tomography under anesthesia at baseline, week 5 and week 10. Serum leptin concentrations were measured at each time-point using ELISA. Data were tested using Pearson’s correlations and mixed model ANOVA; data are mean (SEM), p<0.05. There were no differences among diet groups for length and food intake at any time-point. By the end of the study, rats in the 1.2% DHA group had higher (p<0.05) weight compared to the 0.1% and 0.4% DHA groups; and greater subcutaneous fat mass (4.7±0.7 g) compared to rats in the control, 0.1 and 0.4% DHA diet groups (3.4±0.5, 2.8±0.3 g respectively). The lowest (p=0.0016) visceral fat mass was observed in rats in the 0.4% DHA diet group (3.4±0.5, 2.8±0.3 g respectively). The lowest (p=0.0016) visceral fat mass was observed in rats in the 0.4% DHA diet group (3.4±0.5, 2.8±0.3 g respectively). The lowest (p=0.0016) visceral fat mass was observed in rats in the 0.4% DHA diet group (3.4±0.5, 2.8±0.3 g respectively). The lowest (p=0.0016) visceral fat mass was observed in rats in the 0.4% DHA diet group (3.4±0.5, 2.8±0.3 g respectively). The lowest (p=0.0016) visceral fat mass was observed in rats in the 0.4% DHA diet group (3.4±0.5, 2.8±0.3 g respectively).

Cardiovascular disease risk factors in a purple wheat functional food study cohort – a clinical trial baseline analysis
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Cardiovascular disease (CVD) contributes to approximately 30% of Canadian deaths annually and many more adults live with comorbid conditions, including obesity and diabetes. Diet-based preventative strategies that target at risk individuals are required. In this work, we evaluate participant CVD risk factors within a human clinical trial investigating the daily consumption of a purple wheat enriched whole grain product (clinicaltrials.gov registry NCT02840357) against the cut-off recommendations from the American Heart Association (AHA), Canadian Cardiovascular Society (CCV) and Health Canada. The study employed a longitudinal, parallel-arm, pragmatic design and included individuals on the basis of overweight or obesity and elevated serum high-sensitivity C-reactive protein (hs-CRP, ≥ 2 mg/L). In total, 202 individuals completed a phone screening, 72 individuals completed an in-person screening and 33 (8 male/25 female) participants were enrolled in the study. Baseline means (±SD) were: age (47.2±14.2 years), body mass index (BMI, 33.5±6.7 kg/m2), waist circumference (105.3±15.4 cm) and hs-CRP (4.0±2.7 mg/L). Mean non-HDL cholesterol (3.95±0.79 mmol/L) and triglycerides (1.39±0.65 mmol/L) were both above the AHA and CCV recommended healthy ranges. Conversely, mean blood pressure (121.2±11.8/74.5±8.9 mmHg), total, LDL and HDL cholesterol (5.01±0.77, 2.96±0.65 and 1.42±0.36 mmol/L, respectively) and total:HDL cholesterol ratio (3.74±1.22) fell within the AHA and CCV recommendations. Other lifestyle parameters, including dietary intake, activity level, medication use, perceived health and typical sleep duration were characterized. Comparing the participants against the AHA’s major CVD major risk factors (i.e., obesity, smoking, advancing age, elevated total cholesterol, LDL cholesterol, and blood pressure, low HDL cholesterol and diabetes mellitus), 27.3% had ≥4 risk factors, 24.2% had 3 risk factors and 48.5% had ≤2 risk factors. Similar to Health Canada’s report that 9 in 10 Canadian adults have at least 1 risk factor for CVD and 4 in 10 have 3 or more, in this study, 51.5% had
≥3 risk factors and 36.4% had 1 or 2. Therefore the study participants are representative of the Canadian population and the results should provide insight into the effectiveness of the dietary strategy in the intended population. (Supported by Canadian Food Innovation Cluster, Agriculture and Agri-Food Canada and Infra-Ready Products Ltd., Saskatoon, SK.)

Can fetal liver regulate oxidative stress after prenatal DHA supplementation and ethanol exposure?
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Prenatal ethanol exposure has adverse effects on fetal and offspring development. Docosahexaenoic acid (DHA; C22:6n-3) has been shown to alleviate these effects by upregulating antioxidant mechanisms. The liver is the first organ to receive enriched blood after placental transport; therefore, it could be negatively affected by ethanol. No studies to date have assessed whether a maternal diet supplemented with DHA during prenatal ethanol exposure alters membrane fatty acid composition thereby affecting the oxidative stress in the fetal liver. We assessed the effects of maternal DHA on fatty acid metabolism and the key enzymes of the glutathione antioxidant system in the fetal liver after prenatal ethanol exposure. Twenty pregnant 10 week-old Sprague-Dawley dams (n=4 dams/group (n=2 per dam/group)) were orally gavaged with ethanol throughout pregnancy (3g/kg, twice a day) vs. dextrose (isocaloric to ethanol), while being fed a control diet or DHA-supplemented diet (1.4%, w/w fatty acids). Fetal livers were collected at gestational day 20 (n=8 fetus/group (n=2 per dam/group)) and the phospholipid fatty acid composition, as well as the glutathione reductase (GR) and glutathione peroxidase-1 (Gpx1) gene expressions were assessed. Prenatal ethanol exposure alone increased fetal liver weight (P<0.05); however, supplementation of DHA in maternal diet during prenatal ethanol exposure decreased the fetal liver weight (P<0.05). Fatty acid composition in the fetal liver was not affected by prenatal ethanol exposure. Compared to all other treatment groups, maternal DHA increased C18:3n-3 and DHA (P<0.05), while decreasing C22:4n-6 (P<0.05) and C22:5n-6 (P<0.0001). GR and Gpx1 mRNA expressions were significantly increased and decreased, respectively, in ethanol only exposed group compared to all other groups (P<0.05). Provision of DHA in the diet normalized both GR and Gpx1 mRNA expression back to control levels. This study is the first to show the effects of maternal DHA supplementation on fetal liver oxidative stress after prenatal ethanol exposure. This may be associated with altered membrane function due to the changes in phospholipid fatty acid composition of the fetal liver. Future studies will assess intracellular signalling cascades associated with ethanol-induced oxidative stress in fetal liver. (Research Manitoba; Canadian Israel International Fetal Alcohol Consortium.)

Environmental, biochemical and genetic factors of the vitamin D pathway are associated with disease activity in Canadian children with juvenile idiopathic arthritis
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Background: Juvenile Idiopathic Arthritis (JIA) is one of the most common chronic diseases in children. Both genetic and environmental factors influence JIA development. Vitamin D may suppress inflammation and immune responses in JIA. Methods: We analysed data from the Biologically-Based Outcome Predictors (BBOP) study, a prospective multi-center study of newly diagnosed Canadian children with JIA (n=186). Blood samples were obtained at baseline and 6 months to measure 25(OH)D, CRP, ESR, and the following cytokines: Interleukin (IL)-2, IL-17, IL-4, IL-1ra, IFNγ, IL-10, IL-6, IL-8, and TNFα. Saliva was collected for genomic analysis. Vitamin D related factors (milk intake, season of measurement, supplementation and steroid use) and clinical data to define remission were recorded every 6 months for 2 years. Longitudinal analysis explored whether 25(OH)D and related factors could predict disease activity in BBOP children. Genome-Wide Association Studies (GWAS) techniques were applied to identify frequent gene polymorphisms of potential relevance to the vitamin D pathway in JIA. Significant variables from linear regressions, genes identified through GWAS, vitamin D pathway genes and gene-gene interactions were selected for further analysis. Results: CRP and ESR concentrations decreased significantly over the 2 years (p<0.05). Mean 25(OH)D concentrations (84.48 ± 37.54 nmol/L) and cytokine concentrations did not change from baseline to 6 months except for a reduction in IL-1α. Increased 25(OH)D or its associated factors predicted lower ESR, CRP and cytokine levels except TNFα. Overall, 36% of children achieved remission on continuing medications; 25% had sustained remission after discontinuing medication. Higher 25(OH)D concentration predicted a reduction in IL-2 in the presence of the following identified genetic components, NOTCH4, HGVY, HLA-DQA1, LEP, IGFBP4, and GS1. Interactions between frequent gene polymorphisms and those in the vitamin D pathway (VDR, GC, CYP24A1, and CYP1R1) significantly predicted disease activity related outcomes. Conclusion: This is the first time gene and environment influences in relation to vitamin D were analyzed together in association with JIA disease activity. Environmental, biochemical, and genetic factors including interactions of genetic polymorphism of the vitamin D pathway predict disease activity in children with JIA. (Supported by Jim Pattison Children’s Hospital Foundation, Arthritis Society, Canadian Arthritis Network, CIHR.)

Impact of a nutritional intervention in adults with type 1 diabetes and metabolic syndrome – a randomized controlled pilot study
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The metabolic syndrome (MS) has been identified in 35 to 44% of patients with type 1 diabetes (T1D), increasing these patient’s risk for cardiovascular complications. Whether nutritional interventions are beneficial for this high risk group remains unknown. Objective: We aimed to compare two dietary interventions, a Mediterranean (MED) diet or a low-fat diet (control group) based intervention, on waist circumference in T1D patients with MS. Methods: Participants were randomized into 2 groups: 1) MED diet or 2) low-fat diet intervention. The 6-month study included 9 teaching visits by a certified nutritionist. Dietary counselling for each teaching visit was pre-defined and was targeted towards dietary quality and not aiming for caloric restriction. Anthropometric (waist circumference, body weight, % body fat measured with DEXA-scan), metabolic (lipid and inflammatory profile, HbA1c, estimated insulin resistance) and nutritional (web food frequency questionnaire) measurements were performed at inclusion, 3 months and 6 months. Results: This preliminary analysis includes 29 participants (50.6 ± 10.3 years old) with baseline body mass index (BMI) 30.8 ± 3.3 kg/m2 and waist circumference 105.4 ± 8.8 cm. No difference was observed for waist circumference reduction between both dietary interventions at 6 months (-3.53cm low-fat diet vs. -1.65cm MED diet; p=0.17). However, a significantly higher weight reduction at 3 months was observed for the low-fat compared to the MED diet group (-1.59kg vs. -0.52kg; p=0.045). The difference was no longer significant at 6 months (-2.22kg vs. -1.47kg; p=0.50). As expected
Food is medicine: a qualitative analysis of patient barriers to food intake in an enhanced recovery after surgery (ERAS) setting

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The Enhanced Recovery After Surgery (ERAS) program for colorectal surgery involves the implementation of 22 perioperative elements that attenuate the surgical stress response and promote early recovery. ERAS hospitals consistently report improvements in morbidity and mortality. These positive outcomes are attributed to a synergistic effect based on full execution and adherence of all elements; still, the element of early oral feeding has been credited as an independent determinant of recovery. Given the importance of early oral intake, we undertook a qualitative investigation to understand the patient barriers to food intake in an ERAS setting for the purpose of integrating patient perspectives into our model of care. Enrolled colorectal patients (n=27, aged 29-89 years) were asked to tell the story of their surgical experience. Narrative interviews (n=20) and focus groups (n=7) were transcribed verbatim and organized into a food and nutrition framework. Three themes were identified through inductive thematic analysis of patient stories: 1) Mistaken nutrition facts & beliefs; 2) White bread for the soul? and 3) Food is medicine. First, information is a key barrier to successful adoption of nutrition ERAS practices. Patients had strong beliefs regarding nutrition, and, unfortunately, many beliefs were misconceptions that impeded adequate food intake. As an example, without understanding the medical rationale for early food intake, most patients did not trust the effectiveness or safety of this ERAS element – “Are you nuts? I didn’t touch [the food] because I felt let’s not overtax the bowel”. Second, the food service system is based on a traditional model of care that treats the disease and not the patient. Many patients, therefore, did not eat adequately because the low fiber diet did not meet their personal food needs for comfort, pleasure, identity (e.g., ‘healthy eater’). Patients enjoyed the food that family brought from home. Third, patients tended to believe that food is healing and a perceived lack of dietary support produced dissatisfaction. Applying a patient-centered model of care that focuses on personalizing food and the ERAS elements might be a useful strat-
egy to improve patient satisfaction, encourage food intake, correct previously held beliefs, and promote care adherence.

**Longitudinal associations of dietary behaviors in childhood with adiposity in adolescence**

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Despite the growing prevalence of overweight and obesity in children, the contributing role of dietary behaviors throughout childhood remains poorly understood. We examined longitudinal associations of dietary behaviors throughout childhood with body mass index z-scores (BMI-z), waist circumference (WC) and whole-body fat percentage (WBPF) in adolescence. Among 1027 children from Project Viva, a pre-birth cohort from eastern Massachusetts, we examined associations of maternal- or child-reported dietary behaviors (breakfast and fast-food intake, family dinner, and watching television during meals) annually from ages 4 to 12 years (median 8 observations/child) with BMI-z, WC, and WBPF (estimated by DXA; n=735) in adolescence (median 12.9 years). We used mixed effects models adjusted for maternal education, pre-pregnancy BMI, marital status and parity, and child’s ages at exposure and outcome, sex, and race/ethnicity. The frequency of healthful dietary behaviors decreased with advancing child age; from age 4 to 12, eating breakfast daily from 86 to 64%, eating dinner together with family daily from 57 to 34%, eating fast food meals <1x/week from 77 to 61%, and watching television during meals <1x/week from 63 to 53%. BMI-z (mean 0.37 units, SD 1.06) in adolescence was lower in children who reported daily breakfast eating (β-0.14; 95% CI -0.20, -0.07), daily family dinner (β-0.09; -0.13, -0.04), fast food <1x/week (β-0.08; -0.13, -0.03) and television during meals <1x/week (β-0.09; -0.13, -0.04) throughout childhood. WC (mean 73.1 cm, SD 11.8) and WBPF (mean 28.5%, SD 7.5%) in adolescence were also lower with daily breakfast (β-1.35; 95% CI -2.06, -0.64 and β-1.35; -1.88, -0.82) and television during meals <1x/week (β-1.18; -1.69, -0.66 and β-0.64; -1.03, -0.25) throughout childhood. Family dinner was not associated with WC or WBPF and eating fast food <1x/week throughout childhood was associated with a lower WC (β-0.74; -1.27, -0.21), but not with WBPF in adolescence. Healthful dietary behaviors throughout childhood are associated with lower BMI-z and adiposity measures. Healthier dietary behaviors, which are possibly associated with a healthier overall diet quality, could be translated into simple and applicable dietary advice for families and communities. (Funding: National Institutes of Health – NICHD.)

**Applying compound specific isotope analysis to determine the dietary origin of brain DHA**

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The lack of cost-efficient methods available to trace fatty acids in vivo is a key factor that limits the study of the dietary origin and metabolism of brain fatty acids. Here, we apply compound-specific isotope analysis as a cost-efficient means to differentiate between biosynthesized brain DHA and DHA obtained directly from the diet to determine the origin of brain DHA in fat-1 mice. Fat-1 and wild-type mice were either weaned onto an omega (n)-3 polyunsaturated fatty acid (PUFA) deficient 10% safflower oil (SO) diet or an 8% SO, 2% fish oil (FO) diet until sacrifice at 12 weeks of age. To validate our findings, a separate subset of animals were placed onto an isotopically unique 10% corn oil (CO) diet or an 8% CO, 2% FO diet. Fatty acid methyl esters were isotopically analyzed via gas chromatography-isotope ratio mass spectrometry. In the SO and SOFO diets, δ13C values of LA were -31.86 ± 0.12 mUr and -30.67 ± 0.27 mUr, respectively. In the FO diet, the δ13C value of DHA was -21.99 ± 0.44 mUr. Brain DHA δ13C values clustered towards that of its dietary origin. Brain DHA δ13C values of SO fed-fat-1 mice differed significantly from SO fed wild-type mice and FO fed-fat-1 mice (−27.82 ± 0.40 mUr, −28.81 ± 0.35 mUr and −24.12 ± 0.38 mUr, respectively) while δ13C values of brain DHA of FO fed-fat-land wild-type animals did not differ (−23.85 ± 0.19 mUr and −24.12 ± 0.38 mUr, respectively). This trend was replicated in CO and COFO fed mice. These results demonstrate that fat-1 mice fed a diet containing FO obtain their brain DHA solely from dietary n-3 PUFA. In addition to determining the source of brain DHA in fat-1 mice, this study has validated a novel method to study the origin of tissue fatty acids in a complex multivariate model.

**Developing a nutrition-specific set of tools to assess the quality of nutrition studies**

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Background: To ensure the scientific rigour of nutrient reference values, clinical practice recommendations, health policies and guidelines, the primary studies on which they are based need to be evaluated. Published nutrition studies are abundant, and while general evaluation tools exist, there are currently no research design-specific tools specializing in evaluating the quality of nutrition studies. Method: We developed a set of nutrition-specific quality appraisal instruments (QAIs) for the major nutrition research designs following these steps. 1) Existing general QAIs were identified and evaluated with input from experts; the SIGN 50 methodology was recommended and used as a foundation. It addresses study quality from design to interpretation and versions are available for controlled trials, cohort and case-control study designs. 2) A literature review identified QAIs previously used to evaluate nutrition studies, focusing on modifications used to address nutrition-specific quality appraisal items. 3) We added key literature-scoped nutrition-specific items, with corresponding guidance for tool use, to the SIGN 50 QAIs for controlled trials, cohort, and case-control designs; a cross-sectional tool was developed de novo. All QAIs address assessment of intake or nutritional status based on diet, supplements, dietary patterns, or biomarkers. Some nutrition items and guidance were similar across study designs. Depending on study design, other relevant items were added to account for baseline intake or status; background intake over the study period; quantity and form of the intervention or exposure; adherence to the intervention or exposure; and study duration. 4) Pilot nutrition-specific QAIs underwent external review and were modified based on feedback. 5) The Nutrition QAI tool for each study design is currently undergoing a final round of internal reliability and validity testing. For each round, two reviewers (nutritionists, biologists and/or epidemiologists) reviewed 10 nutrition studies for each QAI type. The QAI tools will be refined according to feedback on clarity, feasibility, and ease of use; final versions will be described. Conclusion: We have developed a set of nutrition-specific QAIs to assess the quality and robustness of nutrition studies. These QAIs are intended to be used in the evaluation of individual studies or applied in nutrition-related systematic reviews.

**Association between adiposity and dietary quality varies by cancer status**

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Background: Cancer survivorship guidelines recommend eating a healthy diet and maintaining a healthy body weight. However, litera-
tured in inconsistent regarding diet quality post cancer diagnosis. Our objective was to explore the relationship between diet and adiposity in cancer-free individuals and cancer survivors. Methods: This cross-sectional study involved 20,857 participants aged 35-69 years, including 1,974 cancer survivors, from the Atlantic PATH study. Participants completed questionnaires about sociodemographic information, lifestyle behaviours and cancer diagnosis. A food frequency questionnaire assessed typical daily intake of fruit and vegetables, grains, dairy products, meat and alternatives, snacks, desserts, beverages, fats, sauces and salts in the prior 12 months. A healthy eating index (HEI), from 0 (worst) to 60 (best), was calculated to reflect diet quality. Height and waist circumference (WC) were measured, and bioelectrical impedance was used to measure weight and body fat (BF). Multivariable logistic regression was used to examine the association between each adiposity measure and HEI. To explore whether this association differed by cancer status, the interaction between adiposity measures and cancer status was assessed. Results: Mean HEI was 38.8 and did not differ between cancer survivors and cancer-free individuals. A total of 69% participants were overweight or obese based on body mass index (BMI). There was a significant interaction between BMI and cancer status. Among cancer-free individuals, overweight and obesity were associated with 10% (95% CI: 0.82, 0.98) and 13% (95% CI: 0.79, 0.96) lower odds of high diet quality, compared with healthy weight, whereas among cancer survivors, overweight and obese individuals had 28% (95% CI: 0.97, 1.70) and 25% (95% CI: 0.94, 1.67) higher odds of high diet quality. Similar results were observed for high WC (≥102 cm in males and ≥88 cm in females) and BF (≥25% in males and ≥35% in females). Conclusions: The relationship between adiposity and HEI varies by cancer status whereby adiposity is negatively associated with high diet quality in cancer-free individuals, but positively associated with high diet quality in cancer survivors. This may suggest that overweight and obese individuals are more receptive to diet changes after a cancer diagnosis. (Supported by a Canadian Cancer Society Grant.)

Does Canadians' diet quality align with Health Canada's Surveillance Tool Tier System?: Evidence from Canadian Community Health Survey-Nutrition 2015

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Identifying healthy foods low in sodium, added sugars, and saturated fats are difficult for Canadian consumers. Health Canada, as part of Canada’s Healthy Eating Strategy has recognized action is needed to “make the healthy choice, the easiest choice”. Using the most recent, nationally representative Canadian Community Health Survey Nutrition 2015, this study aimed to examine the overall diet quality of Canadian adults using Health Canada’s Surveillance Tool Tier System 2014. Foods categorized as Tier 1 and 2, represent those that are in line with Eating Well with Canada’s Food Guide (EWCFG) 2007, Tier 3 foods are “foods to limit”, and Tier 4 represents foods that are “not recommended” by EWCFG. Valid 24-hour dietary recalls of n=13,605 adults aged >19 years were categorized into the four Tiers. In general, Tier 4 and “other” foods/beverages not recommended in EWCFG comprised 28% (among >70 yr) to 30% (among 19-30 yr) of total calorie intakes among males; and 24% to 25% among females. Among all Tier 4 foods and across the DRI age and sex groups, potatoes emerged as the most popular Vegetable option (68-96% of all Tier 4 vegetable), and enriched grains as the most popular within Grain Products (72-85% of all Tier 4 grains). Across the food subgroups in adults, there was a significant trend towards consumption of healthier food options (higher amounts and proportions of Tier 1-3 foods) in older adults, compared to the younger age group, and in females compared to males (p<0.0001). Through highlighting the intake trends of food items with different nutrient profiles in Canada, findings of this study help inform educational campaigns and interventions to reduce the intake of frequently consumed Tier 4 foods and beverages. These results can help identify targets of food reformulation to ensure a supportive food environment for healthy eating (Tier 1 and 2). (Funding: Mitacs accelerate (SH); CCNHI (SH); Earle W. McHenry Research Chair Research Grant (MRJ).)

Assessment of socio-demographic correlates of the American Heart Association’s “Life’s Simple 7” metrics in a French-Canadian population - the PREDISE study

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Objectives: As part of its 2020 Impact Goals, the American Heart Association (AHA) developed “Life’s Simple 7” (LS7) metrics to assess and promote cardiovascular (CV) health in the American population. The LS7 metrics include seven subscales referred to as either core health behaviours or health factors. Multiple studies have shown that the LS7 score is inversely associated with the risk of stroke, CV disease and mortality, and all-cause mortality. To our knowledge, this score has never been evaluated in Canada. Therefore, the purpose of this study was to assess associations between socio-demographic characteristics and the LS7 score within a French-Canadian population from 5 administrative regions of the province of Quebec. Methods: A total of 771 participants (366 men and 405 women, mean age (SD) 42.5±13.2 y) from the PREDISE study met inclusion criteria and were included in the analyses. Dietary intake was assessed using a validated web-based 24-hour recall completed on three different occasions over a 21-day period. Physical activity (PA) was assessed using the International Physical Activity Questionnaire. Each metric of the LS7 score (health behaviours: 1-smoking, 2-PA, 3-diet, 4-body mass index; health factors: 1-blood pressure, 2-fasting cholesterol and 3-fasting glucose) was categorized according to AHA’s criteria, resulting in a final LS7 score ranging from 0 to 7. Results: LS7 score for women=3.9±1.4 vs. men=3.4±1.5, p<0.001), age (19-34y=4.3±1.3, 35-50y=3.7±1.4 and >50y=3.0±1.4, p<0.001), administrative region of residence (p=0.009) and education level (≥university=4.0±1.4 vs. pre-university college=3.5±1.4 vs. <high school=3.4±1.5, p<0.001) were all significantly associated with the LS7 score. In a multivariate model, age (β=1.28 [95%-CI: 0.34y vs. >50y], p<0.001), sex (β=-0.51 [men vs. women], p<0.001) and education level (β=-0.67 [<high school vs. ≥university], p<0.001) remained significant correlates of the LS7 score while administrative region of residence did not (p=0.077). Conclusions: These data indicate that health determinants, such as socio-demographic characteristics, should not be overlooked when developing CV health promotion interventions. More specifically, men, older adults and individuals with a lower education level should be primary targets for the promotion of optimal CV health in the province of Quebec. (Canadian Institutes of Health Research (CIHR).)

Based on current evidence-based practice, can dietitians recommend soy beverages as an acceptable alternative to cow’s milk for healthy term infants at weaning? – a review of the literature

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Background: Practice-based Evidence in Nutrition (PEN) is a knowledge translation subscription service developed by Dietitians of Can-

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ada. Knowledge pathways synthesize current evidence and evaluate the level of evidence. Current pathways suggest that fortified soy beverages (FSB) be introduced in weaning, under limited circumstances. Growing interest in plant-based diets requires a review of the material to determine whether there is sufficient evidence to support Dietitians in recommending the use of FSB in complementary feeding. A literature review was conducted to provide Dietitians with adequate knowledge to develop nutrition clinical care guidelines regarding the use of FSB in healthy term infants. Methods: Infant Nutrition PEN Pathways Infant Formula and Complementary Feeding [2013-2016] were reviewed. SUMMON searches took place in February/March 2017 using key words: Complementary feeding, Cow milk protein allergy, Galactosemia, Genistein, Infant feeding, Isolavones, Manganese, Nutrition, Phytoestrogens, Plant-based milk alternatives, Protein, Soy beverages, and Vegetarian. Original research and review articles from peer-reviewed journals published in English between 2000-2017 were included. Fifty-four human and animal full-text articles were obtained and PEN-graded. Results: Eighteen original research studies show limited adverse effects of hormonal shifts from consumption of soy; thirteen show inconsistent results; and two show adverse effects. FSBs are comparable in nutritional adequacy to cow’s milk, and do not appear to have a negative effect on growth and development, or endocrine functions. Other plant-based beverages including oat and rice milk should not be used in complementary feeding due to low protein concentration, and risk of mineral toxicity. Conclusion: There remains a scarcity of human data available that examines long-term effects of genistein, the primary phytoestrogen in FSBs. Evidence is insufficient to conclusively support the use of FSBs as an acceptable alternative to cow’s milk for healthy term infants at weaning. The results reinforce the need to conduct clinical research that examines the long-term effects of using FSBs in complementary feeding practices of healthy term infants to enhance dietetic evidence-based practice.

Omega-3 alpha-linolenic and omega-6 linoleic fatty acid ethanalamides suppress short-term food intake in rats

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Fatty acids serve a critical structural and functional role in the periphery and brain. Of recent interest is the role of fatty acids as regulators of food intake. Because dietary fats, when ingested, directly affect levels of fatty acids and fatty acid ethanalamides (FAEs) in the small intestine and brain, it can be hypothesized that fatty acids regulate food intake through the gut-brain axis. Among non-essential fatty acids, palmitic acid, oleic acid, and their FAEs have been shown to acutely reduce food intake. However, the short-term effects of essential omega-3 alpha-linolenic acid (ALA, 18:3n-3), omega-6 linoleic acid (LA, 18:2n-6), and their FAEs on food intake regulation have not been defined. The objective of this study was to determine the effects of ALA, LA, and their FAEs (alpha-linolenoylethanolamide and linoleoylthanolamide, respectively) on short-term food intake. In a randomized crossover design, 15 male Wistar rats were assigned to receive one of five treatments via intraperitoneal injections: control (vehicle, 9% BSA/sterile saline solution), ALA, LA, alpha-linolenoylethanolamide, and linoleoylthanolamide. Prior to injections, rats were fasted overnight and food intake was measured at 1, 2, 4, and 12 h post-injection. Both alpha-linolenoylethanolamide and linoleoylthanolamide significantly reduced food intake compared to control at 1h (-30.4% and -29.5%, respectively; p<0.05) and 2h (-24.1% and -23.5%, respectively; p<0.05). However, these effects were not observed with ALA and LA (p>0.05). No significant differences in food intake were observed among all treatments at 4h and 12h post-injection. These results suggest that FAEs of essential omega-3 alpha-linolenic and omega-6 linoleic fatty acids suppress short-term food intake in rats. We are currently examining the mechanisms by which essential fatty acids and their corresponding FAEs regulate satiety via the gut-brain axis. (Supported by Natural Sciences and Engineering Research Council of Canada.)

Multiple micronutrient supplementation with iron and zinc leads to lower serum zinc concentrations than multiple micronutrients without iron in non-pregnant Cambodian women

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Background: Zinc deficiency is common in countries where diets are low in zinc and inflammation is prevalent. Our aim was to examine the effect of micronutrient supplementation over 12-wk on serum zinc concentrations and zinc deficiency prevalence (<70 μg/dL) in non-pregnant Cambodian women (18-45 y). Methods: In a 2x2 factorial double-blind randomized trial conducted in 2015, women received 60 mg of iron (Fe; n=201), 14 other micronutrients including 15 mg zinc but no iron (MMN; n=202), iron plus MMN (Fe+MMN; n=206), or a placebo (n=200) for 12-wk. Fasting morning blood was collected in a trace element-free tube at baseline and 12-wk from women in 26 villages in Kampong Chhnang province. Serum zinc concentration was measured using flame atomic absorption spectrophotometry. C-reactive protein (CRP) and alpha-1 glycophotein (AGP) concentrations (inflammation biomarkers) were measured using a sandwich-ELISA. A 2x2 factorial intention-to-treat analysis using a generalized linear mixed-effects model was used to assess the effects of Fe and MMN, and the potential interaction, on zinc status. Marginal mean serum zinc concentrations and predicted proportions of deficiency were estimated at 12-wk, adjusting for baseline zinc, endline CRP and AGP, and village clusters. Results: Of 809 women recruited, 760 (94%) completed the trial. Baseline prevalence of acute (CRP >5 g/L) and chronic (AGP >1 g/L) inflammation was 4% and 8%, respectively. Baseline mean ± SD inflammation-adjusted serum zinc was 72 ± 11 μg/dL; deficiency prevalence was 44%. At 12-wk, marginal mean (95% CI) serum zinc concentrations in the Fe, MMN, Fe+MMN, and placebo groups were 72 (71, 73), 81 (80, 83), 76 (75, 77), and 74 (73, 74) μg/dL, with a significant Fe x MMN interaction (P=0.02). The predicted proportions (95% CI) of inflammation-adjusted zinc deficiency were 45% (44, 46%), 19% (18, 19%), 31% (30, 32%), and 36% (35, 37%), respectively. Conclusions: Daily zinc-containing micronutrient supplements over 12-wk was associated with a decrease in zinc deficiency. However, the Fe+MMN group showed less benefit than the MMN group at 12-wk (~31% vs. 19% zinc deficiency, respectively). The inclusion of 60 mg iron in micronutrient supplements is potentially interfering with the absorption or metabolism of zinc.

Is the Western dietary pattern of Canadian adults tied to the risk of cardiovascular diseases?

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3Cardiovascular diseases (CVD), being one of the leading causes of hospitalization in Canada, places a heavy burden on the health care system. Metabolic Syndrome (MetS) doubles the risk of developing CVD, indicating a high relative risk for CVD. However, due to the fatal consequences and high global prevalence of CVD, it is important to also measure the absolute risk itself. Absolute CVD risk is the probability of a person developing CVD over a certain period of time. Diet is an important factor in modifying the status of MetS and CVD risk. Our
aim was to determine the association between Western dietary pattern with MetS, CVD risk and CVD age gap among Canadians adults (20-79y). We used data from the Canadian Health Measures Survey (2012-2014) to determine the usual dietary intake. Principal component analysis method was used to obtain the dietary patterns of Canadian adults. MetS was determined using the harmonized MetS statement for adults and adolescents. The 2013 risk assessment approach by the American College of Cardiology/American Heart Association was used to assess the 10-year risk of CVD. After obtaining the vascular age, the “CVD age gap” was obtained by subtracting the actual age from the vascular age. Controlling for potential covariates including age, sex, income, education, physical activity, alcohol intake, and other dietary patterns logistic regression was used to determine the association between MetS, CVD risk, CVD age gap and dietary patterns. To obtain nationally representative results, weighting and bootstrapping were applied. Four different prevalent dietary patterns were emerged, named: “Healthy-like”, “Added fats/sugar”, “Dairy/cereal”, and “Western” dietary patterns for Canadians 20-79y. The Western-like dietary pattern with positive loadings of hotdogs, pasta, French fries, fat potato chips, ice-cream/frozen yogurt, diet drinks had a direct association with MetS (OR: 1.25 (95% CI: 1.05-1.48), p-value=0.01). Our findings for MetS suggest that the Western dietary pattern prevalent among Canadians adults is associated with MetS and thus increased the risk CVD among Canadians adults. (Supported by a contribution from the Dairy Research Cluster Initiative and the University of Saskatchewan.)

### Does enteral arginine enhance intestinal blood flow in the neonatal intestine that is compromised by parenteral nutrition?

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Arginine is a nutritionally and metabolically important amino acid for the neonate that is synthesized in the small intestine (SI) in early life. Deficiency in preterm infants has been associated with severe complications such as necrotizing enterocolitis. Arginine is involved in the synthesis of proteins, creatine, urea and polyamines and is the substrate for nitric oxide synthase to produce nitric oxide (NO); NO inhibits vascular smooth muscle contraction to enhance blood flow. A high-risk time for feeding preterm neonates occurs during the transition from intravenous (parenteral) nutritional support (PN) to oral (enteral) feeding. We speculated that greater dietary arginine will lead to better gut morphology during this transition phase. In piglets with SI atrophy induced by PN-feeding, we hypothesized that supplemental dietary arginine would lead to greater NO production, higher blood flow to the intestine and structural and functional improvements in the intestinal mucosa. Piglets (7-10 d old, n = 12) were implanted with jugular and femoral vein and gastric catheters. An ultrasonic flow probe was secured around the superior mesenteric artery (SMA). Piglets were supplied by the supplier. SMA blood flow was measured for 10 hours on day 4 starting with the initiation of enteral feeding. On day 5, piglets underwent a 6-hour isotope tracer experiment to measure whole body protein and NO synthesis. Blood flow increased significantly with enteral feeding, with no difference detected between treatments. Whole body protein synthesis tended to be higher in the high arginine group (20.9 ± 1.3 versus 25.5 ± 2.1 g protein/kg/d; P = 0.08). Analysis of NO synthesis is ongoing, but will provide a sensitive indicator of the adequacy of arginine to maintain intestinal blood flow. Dietary arginine at the concentration in milk may not meet the whole body needs of the neonate with compromised SI function. (Supported by CIHR, RDC-NI, Aldrich-Memorial)

### n-3 and n-6 polyunsaturated fatty acids attenuate macrophage-myocte inflammatory crosstalk in a co-culture model of obese skeletal muscle

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Skeletal muscle is the primary site for insulin-stimulated glucose disposal and utilization in obesity, increased circulating saturated fatty acids (SFA) and inflammatory cytokines interfere with skeletal muscle insulin signaling, leading to whole body insulin resistance (IR). Obese skeletal muscle is characterized by macrophage infiltration and polarization to the M1 inflammatory phenotype, which is central to the development of local inflammation and IR. While skeletal muscle infiltrated macrophage-macrophage crosstalk is exacerbated by SFA, the effects of other fatty acids, such as n-3 and n-6 polyunsaturated fatty acids (PUFA), are unknown. Using an in vitro model of obese skeletal muscle, differentiated L6 myocytes were cultured for 24h with RAW 264.7 macrophage-conditioned media (MCM), followed by insulin stimulation (100nM, 20min). MCM was generated by pre-treating macrophages for 24h with or without (control, CON) 100μM palmitic acid (16:0, PA), arachidonic acid (20:4n-6, AA) or docosahexaenoic acid (22:6n-3, DHA) and a subset of these were treated with 100μM bisphenol A (BADGE), a PPAR-γ antagonist. Next, all macrophage cultures were stimulated with a physiological dose (10ng/ml) of lipo-poly saccharide for an additional 12h to mimic the in vivo obese skeletal muscle inflammatory microenvironment. Our previous work in this model showed that AA and DHA promoted the polarization of anti-inflammatory M2 macrophages and in turn, AA- and DHA-derived MCM improved markers of insulin-stimulated myocyte function, as demonstrated by increased phosphorylation of insulin signaling proteins and glucose uptake. In our current work, the presence of BADGE blunted the M2 macrophage polarization effects of AA and DHA, as demonstrated by reduced gene expression of M2 polarization markers (IL-10, Tgf-β, Cd206; P≤0.05). In myocytes, and compared to CON- and PA-derived MCM, AA- and DHA-derived MCM had no effect on anti-inflammatory cytokines (IL-6, Tnf-α, Il-10, Tgf-β, Cd206; P≤0.05). Together, these data suggest that myocyte-macrophage crosstalk is a potential target for dietary intervention with n-3 and n-6 PUFA to attenuate skeletal muscle macrophage infiltration and subsequent inflammation and IR in obesity, in part through a PPAR-γ dependent mechanism. (NSERC.)

### Can satiety responsiveness identify individuals at risk for overeating in a natural setting?

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Experimental settings have demonstrated that some individuals have a weak satiety responsiveness, i.e. low satiety quotient (SQ), that puts them at risk of overeating. Although this marker has been validated in laboratory settings, its validity in a natural setting remains unknown. The aims of this study were 1) to assess the reliability of the SQ in a natural setting and 2) to assess its association with measured total energy intake (TEI) and eating behaviour traits among women. Data from normal-weight and obese women (n=141; age=45.9±13.1 years; BMI=28.1±6.5 kg/m2) who participated in an experimental study during which they consumed three ad libitum at-home meals per day during a 10-day period were analyzed. Participants recorded hunger and fullness sensations on visual analogue scales immediately before and after each meal. The SQ was calculated for breakfasts of days 2 to 10. Women who...
Dietary protein intake among active, older adults and the relationship to sarcopenia: pilot application of the prot-age study group recommendations for dietary protein intakes

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The PROT-AGE Study Group recommends that individuals ≥65 years of age consume 1.0-1.2 g protein/kg/day and 25-30 g protein per meal to maintain skeletal muscle. According to the Foundation for the National Institutes of Health (FNIH) Sarcopenia Project, low skeletal muscle mass and strength are predictors of mobility impairment. The purpose of this study was to determine: 1) the proportion of active, older adults meeting the per day and per meal PROT-AGE recommendations; 2) the relationship between total and per meal protein intake, grip strength and appendicular lean mass (ALM/body mass index (BMI)) with dual energy x-ray absorptiometry (DXA). Student’s t-test and Pearson correlation coefficients were used. P < 0.05 was significant. Here we include pilot data from 13/40 participants, of whom 8 were male. Group mean ± SD age was 76.2 ± 5 years and BMI was 27.2 ± 2 kg/m². Mean protein intake was 1.12 ± 0.2 g/kg/day, and 8/13 (61%) participants met the daily protein recommendations. 1/13 (8%) of participants met the per meal protein recommendations for all meals. Participants consumed the most protein at dinner (36/14 g) and more participants met the per meal recommendations at dinner (11/13 [85%]) compared to breakfast (1/13 [8%]) and lunch (6/13 [46%]). There was a positive correlation between protein consumed at lunch and grip strength (r = 0.59, p < 0.05) and ALM (r = 0.55, p < 0.05). There were no significant relationships between protein intake and ALM or grip strength. Our preliminary analysis suggests that even in an active, older adult cohort, only 61% were meeting PROT-AGE recommendations. While most participants met per meal protein recommendations at dinner, the majority of participants did not consume enough protein at breakfast or lunch, which may increase the risk of sarcopenia. (The Lloyd Carr Harris Foundation.)

Quality of gluten-free diets using the NOVA food processing system: piloting the GF study in Nova Scotia

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A gluten-free diet (GFD) is the only available treatment for celiac disease and wheat-related digestive disorders. The nutritional adequacy of the GFD is questioned, given reduction of wheat and lack of mandatory fortification regulations for wheat alternatives. Previous published data from our team have shown labeled GF foods sold across Nova Scotia (NS) in 2014-2015 to be 168% more expensive, more energy-dense and less nutrient-dense than their gluten-containing counterparts. Following a GFD using more whole foods and nutrient-rich flours, and less processed foods, may improve nutrient adequacy on GFD. A pilot, online survey was conducted in 2017 across NS, with a convenience sample of 68 adults, self-identified as following a GFD, to assess diet quality and qualitatively explore the role of food literacy in dietary adherence. Of 68 participants, 30 (90% female) completed 89 non-consecutive, automated 24-hour food recalls (ASA24-Canada-2016). Respondents (N = 30) reported following a GFD because of celiac disease (53%) or other medical reasons including wheat sensitivities and self-reported intolerances or symptoms (47%). Average energy intakes from carbohydrate, protein, and fat were 50.4%, 15.5% and 34.9%, respectively. Mean intakes of fibre were 20.8 ± 7.9 g (AI = 25g) for women, and mean iron intake was 11.0 ± 3.7 g for premenopausal women (RDA = 18 mg). Each food item reported in the recalls was categorized according to the NOVA system of food classification. Ultra-processed foods (UPF) represented 39.3 ± 15.7% of total energy intake on average. Higher UPF intakes were noted among those reporting annual net household income ≥ CDN$100K (47.4 ± 16.6% energy) versus < CDN$100K (33.2 ± 12.1%; χ² = 4.29; P = 0.04). The dietary proportion of nutrients derived from non-UPF had 188% more protein, 137% more fibre, 417% more vitamin C, 288% more vitamin A, 317% more cholesterol, and 346% less energy density than nutrients derived from UPF. It is hypothesized that replacing gluten-free UPF with less processed foods may improve nutrient adequacy of the GFD. The next phase of this pilot project will use semi-structured interviews to explore aspects related to food literacy as barriers and facilitators in GFD adherence and diet quality. (Supported by Nova Scotia Health Research Foundation: DI-2016-812.)
and provincial legislation (ban on partially hydrogenated oils and menu labelling of calories in Ontario, taxes on unhealthy food). Municipalities shared implementation with the Ontario provincial government in 2 domains: retail (zoning laws) and governance (access and transparency to government data and policy agendas). Policies, such as easier access to farmer’s markets and increased density of mobile healthy food vendors were common among the three municipalities and fully under local control. Conclusion: Local food environment policies have significant potential to influence the food environment policy landscape in Canada, sharing responsibility with federal and provincial policy agendas; while the municipalities examined have implemented some policies, there are a variety of opportunities to develop new local policies to improve food environments in these cities. (Funded by the Canadian Institutes of Health Research.)

Parenteral betaine as a strategy to prevent fatty liver and improve docosahexaenoic acid (DHA) distribution in parenterally fed neonatal piglets
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Parenterally fed infants carry the risk of developing liver disease. Hepatic dysfunction caused by TPN is often characterized by hepatic fat accumulation due to impaired very low density lipoprotein (VLDL) secretion. Moreover, VLDL secretion requires sufficient phosphatidylcholine (PC) synthesis via either the CDP-choline pathway (using choline) or the phosphatidylethanolamine methyltransferase (PEMT) pathway (using methionine). The export of hepatic fat via VLDL secretion into the circulation is a key mechanism to alleviate fatty liver. Methionine supplementation may enhance PC synthesis, but can cause hyperhomocysteinemia. Thus, alternative strategies to enhance PC synthesis are required. Betaine may contribute to PC synthesis by sparing choline (its precursor) as well as by remethylating homocysteine to methionine for PC synthesis. Also, PEMT derived PC is rich in DHA and DHA distribution to target tissues depends on PC release via VLDL. Thus, the objective of our study is to assess the effects of parenteral betaine, methionine and its combination on fatty liver and DHA content in the brain. Yucatán miniature piglets (8-12 days old, N=32) were parenterally fed for 8 days one of the four diets: control, betaine, excess methionine or betaine+excess methionine. DHA-enriched SMOFlipid was used as the lipid emulsion. At necropsy, tissues were analyzed for total lipids, phospholipids, total cholesterol (TC), triacylglycerol (TAG) and fatty acids. There were no significant differences among groups for total hepatic fat, plasma and hepatic TC or TAG. suggesting none of the pigs developed fatty liver in the one week on parenteral nutrition. Fatty acid composition from total hepatic fat was not different among groups, which was expected since all pigs were fed the identical lipid source. The phospholipid-associated fatty acid composition of the brain and liver will elucidate whether DHA distribution was improved by betaine. Betaine is a novel parenteral ingredient and has the potential to prevent fatty liver, alleviate hyperhomocysteinemia, improve DHA distribution and spare the methionine and choline requirements during parenteral feeding in neonates. (Funded by CIHR.)

Improving the standard of care and reducing mealtime barriers to food intake in the More-2-Eat study
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Poor food intake is common in hospital patients and can extend the hospital stay. Barriers to food intake, such as inability to open packages, or mealtime interruptions, are prevalent and lead to inadequate food intake, estimated at approximately one-third of patients. More-2-Eat is an implementation study focused on improving nutrition care by applying the Integrated Nutrition Pathway for Acute Care (INPAC). Along with facilitating appropriate identification of malnourished patients on admission, INPAC aims to prevent in-hospital malnutrition by promoting a standard of care that ensures adequate food intake for all patients by reducing organizational and physical barriers to food consumption, among other practice changes. The purpose of this analysis was to demonstrate how mealtime barriers were reduced during the More-2-Eat study with the implementation of new standard of care procedures. In 2015-16, 1250 medical patients were recruited over the course of the study in five diverse hospital units from four provinces. Mealtime barriers were tallied with the Mealtime Audit Tool after a meal. Three periods of implementation (pre-, early, and late) were compared to demonstrate change over time and with implementation of new standard care activities (e.g. volunteers supporting food intake). Regression analyses determined the effect of time.
while adjusting for key covariates (e.g. site, handgrip strength, diagnosis, nutritional status, age, gender) that could also influence the outcome of mealtime barriers reported by patients. A variety of strategies were used to promote food intake (e.g. volunteer assistants, monitoring of food intake, providing ward stock of nutrient dense food staples etc.). The number of mealtime barriers was reduced over the implementation periods (Period 1=2.5+/−2.1; Period 3=1.8+/−1.7), with site differences noted. This decrease over implementation periods was statistically significant in regression analyses (β=0.28 95% CI -0.44, -0.11), even after adjusting for important covariates. Mealtime barriers can be reduced and sustained by implementing a variety of standard care procedures such as volunteer assistance and food intake monitoring. The More-2-Eat study provides an example of how to implement changes in practice to support the detection, prevention, and treatment of malnutrition. (Funding: Canadian Frailty Network.)

Perceptions on use of the subjective global assessment before and after it became part of regular practice: results from the More-2-Eat study

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Subjective global assessment (SGA) is considered a standardized diagnostic tool to determine nutritional status that helps to identify those who would benefit from nutrition care. SGA has been validated in a variety of patient populations, however there is still some resistance to its use. The aim of this analysis was to compare perceptions on use of SGA before and after it became part of regular practice with hospital dietitians. The More-2-Eat implementation study aimed to improve nutrition care in 5 hospital medical units across Canada, which included adoption of SGA. Focus groups (FG) and key informant interviews (KI) were conducted with a variety of hospital staff at three time points between 2015-2018. Interviews were transcribed verbatim and line-by-line coding with thematic analysis was completed. A subset analysis was conducted on perceptions of the use of SGA. Participants included dietitians, physicians, nurses, and hospital management, among others, although not all individuals who were interviewed commented on use of SGA. At baseline there were 11 FG (n=93 participants) and 40 KI; after a year of implementation, 9 FG, 4 small group discussions (n=78 participants), 45 KI; and a year post implementation, 11 KI. Results indicated that before SGA was adopted, clinicians thought that: there was a lack of standardized process for diagnosing malnutrition; they wanted to be able to provide a consistent malnutrition diagnosis; there was discomfort in use of SGA; and there was recognition that attending training was not necessarily enough to become comfortable using SGA. A year after SGA was adopted, clinicians thought: SGA contributed to becoming a better clinician and care provider; malnourished patients were seen sooner; and SGA improved overall efficiency in delivery of care. There was still some uncertainty about the treatment path for SGA B (mild/moderately malnourished) patients. Initially there was skepticism regarding use of SGA. Adoption through a focused implementation study and experience with implementation, changed these perceptions. Supportive processes for adoption, such as using a “buddy system” or slowly integrating SGA into the routine, are advocated for spreading this relevant nutrition care practice. (Funding: Canadian Frailty Network.)

The dipeptide l-lysyl-lysine enhances arginine uptake via trans-stimulation in the neonatal small intestine

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Dietary peptide transport by PepT1 appears to enhance free amino acid absorption via trans-stimulation of the Na+ independent amino acid transporter b0,+ which exchanges intracellular cationic amino acids for extracellular amino acids. Previously, we demonstrated enhanced arginine uptake from in situ isolated small intestinal segments co-perfused with l-lysyl-lysine (lys-lys). We speculated that enhanced arginine uptake was facilitated by PepT1 mediated transport of lys-lys, which, when hydrolyzed, increased intracellular lysine concentration. Higher intracellular lysine enhanced arginine uptake through the trans-stimulation of the b0,+ transporter. In this study, we hypothesized that the lys-lys-enhanced uptake of arginine into enterocytes could be diminished by the addition of glycyrrhizin (gly-sar), a hydrolysis-resistant dipeptide that will compete with lys-lys for transport via PepT1. In piglets, (16-17 d, N=6) the small intestine was exposed by laparotomy, and six 10-cm segments of proximal small intestine were isolated with 50 cm separating each segment. Inlet and outlet cannulas were inserted in segments to facilitate the continuous perfusion of treatment buffers. All treatment buffers contained L-arginine (10 mM) and 3H-arginine, either 1) alone (control), or with 2) lys-lys (20 mM), 3) gly-sar (20 mM), 4) lys-lys (20 mM) + gly-sar (5 mM) or 5) lys-lys (20 mM) + gly-sar (10 mM) or 6) lys-lys (20 mM) + gly-sar (20 mM). After 2 h of perfusion, arginine uptake was determined by the disappearance of 3H-arginine from the perfusate. As hypothesized, arginine uptake was greater (p<0.05) with lys-lys compared to control or gly-sar. Furthermore, a significant reduction (p<0.05) in arginine uptake was observed when gly-sar (20 mM) was co-perfused with lys-lys. Thus, we propose that 20 mM gly-sar competitively inhibited the lys-lys uptake, which reduced intracellular lysine availability. No differences in mucosal free arginine were detected; this may be due to the subsequent transport of arginine to the portal blood. These findings confirm an interaction between amino acid and dietary peptide absorption and may contribute to nutrition strategies that enhance the uptake of nutritionally important arginine, particularly during intestinal stress or injury in neonates. (Funded by NSERC.)

Chlorogenic acid (CGA) isomers ameliorates oxidative stress in inflamed caco-2 cells by activating the nuclear factor-erythroid-derived 2-like 2 (NRF2) pathway

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The single-layered gut epithelium is the primary line of defense against luminal stressors. The epithelium in inflamed intestinal segments of patients with inflammatory bowel disease is characterized by an imbalanced redox status, excessive secretion of pro-inflammatory cytokines and decreased integrity. Understanding the potential effect of CGA isomers on intestinal epithelium is of importance because the intestine of coffee drinkers is exposed to dietary CGA isomers. For example, 3-cafeoylquinic acid (3-CQA), 4-cafeoylquinic acid (4-CQA), 5-cafeoylquinic acid (5-CQA), 3,4-dicaffeoylquinic acid (3,4-dCQA), 3,5-dicaffeoylquinic acid (3,5-diCQA), and 4,5-dicaffeoylquinic acid (4,5-diCQA) are the major CGA isomers present in coffee. The objective of this work was to study the potential of these six CGA isomers to modulate redox biology using the Caco-2 cell line. Specific questions that were derived consisted of determining: whether or not oxidative stress was accompanied with the initiation of inflamed intestinal cells; and what was the relative effectiveness of these six CGA isomers to alleviate oxidative stress in inflamed intestinal cells. The underlying mechanisms for CGA isomers to modulate the oxidative stress-responsive pathway, Nrf2 signaling, was studied. Differentiated Caco-2 cells challenged with the mixture of inflammatory mediators (human interferon γ and phorbol 12-myristate 13-acetate (IFNγ+PMA)) was used as an in vitro model of intestinal inflammation. Redox responses to the mixture of inflammatory mediators were assessed by measuring the generation of reactive oxygen species (ROS), expression of reduced glutathione (GSH) and oxidized glutathione (GSSG). In addition, the level of Nrf2 activation was examined. Results: An increase in ROS level was observed in cells exposed to IFNγ+PMA compared to control, indicating that inflammation status was accompanied with an increased ROS generation. CGA isomers ameliorated inflammation.
Chlorogenic acid (CGA) isomers attenuate interleukin 8 (IL-8) secretion in CACO-2 cells by decreasing the phosphorylation of mitogen-activated protein kinase (MAPK) cascades and up-regulating nuclear factor-κB (NF-κB) signaling

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Background: 5-caffeoylquinic acid (5-CQA) is the most dominant group of chlorogenic acid (CGA) in coffee beans. Many researchers have studied CGA biological activity; however, individual bioactivities of 3-caffeoylquinic acid (3-CQA), 4-caffeoylquinic acid (4-CQA), 3,4-dicaffeoylquinic acid (3,4-dCQA), 3,5-dicaffeoylquinic acid (3,5-dCQA), and 4,5-dicaffeoylquinic acid (4,5-dCQA) are not well established. This information has importance since these particular CGA isomers exist in plant foods, for example, coffee beans. Objectives: The objective of this study was to determine the effect of these six CGA isomers on modulating the inflammatory response in Caco-2 human intestinal epithelial cell line. Methods: Differentiated Caco-2 cells challenged with the mixture of inflammatory mediators (human interferon gamma and phorbol 12-myristate 13-acetate (INFγ/PMA)) were used as an in vitro model for intestinal inflammation. The efficacy of CGA isomers to modulate inflammation marker IL-8 were determined using this inflamed Caco-2 cell model. The effect of CGA isomers on the phosphorylation of three MAPK cascades (ERK1/2, JNK, and p38) and the nuclear translocation of NF-κB was determined. Results: All six CGA isomers significantly (p<0.05) reduced the secretion of IL-8 level in INFγ/PMA challenged Caco-2 cells. Dicaffeoylquinic acids had a significantly stronger capacity compared to caffeoylquinic acids. Increasing the concentration of 3-CQA from 0.2 mM to 2 mM, resulted in a IL-8 secretion that was 82% and 50% of INFγ/PMA challenge obtained in control cells, respectively. Repeating the experiments with 3,5-dCQA, 3,4-dCQA, and 4,5-dCQA at 2 mM showed that more than 90% of the IL-8 secretion was inhibited, compared to controls. There were no significant differences from controls, observed for ERK phosphorylation and JNK phosphorylation, when CGA isomers were administrated to Caco-2 cells. However, CGA isomer treatment produced a significant (p<0.05) increase in p38 phosphorylation compared with the control. Furthermore, CGA isomers (at concentrations of 1 mM and 2 mM) were effective to significantly (p<0.05) up-regulate NF-κB subunit p65 nuclear translocation, by more than 1.5 times compared to the control. Conclusions: We concluded that CGA isomers exert anti-inflammatory activity in INFγ/PMA challenged Caco-2 cells by decreasing the phosphorylation of p38 MAPK cascade and up-regulating NF-κB signaling. (Work is supported by NSERC-Discovery grant.)

Natural abundance carbon isotopic analysis indicates equal contribution of local synthesis from dietary sugars and plasma uptake to palmitate levels in the mouse brain

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Although saturated fatty acids are ubiquitous within the diet and are the most abundant fatty acid species in the brain, there is some controversy regarding the ability of dietary saturated fatty acids to incor-
Objective: To explore the associations between vegetable and fruit intake assessed using a new web-based self-administered 24-hour dietary recall (R24W) and plasma carotenoids levels. Methods: Seventy-five women and 73 men (mean age 47.4 ±13.3 years, BMI 25.5 ± 4.4 kg/m²) completed the R24W on four non-consecutive occasions over 20 days in order to assess portions of vegetables and fruits. The following plasma carotenoids were obtained from 12-hour fasted blood samples and measured by high performance liquid chromatography: α- and β-carotene (both found mostly in orange and dark green vegetables); lutein, zeaxanthin and β-cryptoxanthin (mostly found in fruit and non-orange vegetables); and lycopene (primarily found in tomatoes). Pearson correlations were performed to determine how vegetable and/or fruit intake were associated with plasma carotenoids. Results: Total vegetable and fruit intake was positively associated with all plasma carotenoids (r=0.32, p<0.01 for all) except lycopene (r=0.01, p=0.93). Plasma α- and β-carotene concentrations were associated with orange vegetable intake (r=0.26 and r=0.28, respectively, both P<0.01) and dark green vegetable intake (r=0.20, P=0.01 and r=0.30, P<0.01, respectively) but not with fruit intake (r=0.14, P=0.10 and r=0.16, P=0.05, respectively). Lutein (r=0.25), zeaxanthin (r=0.21) and β-cryptoxanthin (r=0.23, all P<0.01) levels were positively associated with fruit intake but not with orange vegetable intake (r=0.03, P=0.15, r=0.08, P=0.31 and r=0.04, P=0.60, respectively). Lutein (r=0.26 P<0.01) and zeaxanthin (r=0.19, P=0.02) were both associated with dark green vegetable intake. Conclusion: These analyses suggest that concentrations of α-carotene, β-carotene, lutein, zeaxanthin, and β-cryptoxanthin are all weakly but significantly associated with a mixed vegetable and fruit intake assessed by a new web-based self-administered 24-hour dietary recall. Specific associations between vegetables or fruit and plasma carotenoids are representative of food sources and bioavailability of the different carotenoids. Overall, these observations support the appropriateness of the R24W to assess dietary intake of vegetables and fruits. (Funded by the Canadian Institutes of Health Research [grant no. FHG 129921].)

Contribution of “other foods” to the diet of adults from Quebec and their associations with cardiometabolic risk factors – the PREDISE study

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Background: We have recently developed and validated a web-based self-administered 24-hour recall (R24W) to assess adherence of a French-Canadian population to Canadian dietary guidelines. The R24W automatically generates the Canadian Healthy Eating Index (C-HEI-2007) according to which foods and beverages that are not part of Canada’s Food Guide are categorized as “Other foods”. Objective: The aim of the present study was to assess the overall contribution of “other foods” to total energy intake of French-speaking adults from Quebec and to determine whether calories from “other food” are associated with cardiometabolic risk factors. Methods: As part of the cross-sectional PREDISE Study and the McGill Diabetes Prevention Trial, a sample of healthy eating, a sample of adults from 5 administrative regions of the Province of Quebec (531 men and 548 women; mean (SD) age 43±14 years) completed a R24W on three occasions over a 21-day period. Blood pressure, lipid profile, fasting insulin, fasting glucose, weight and height were also measured. Results: French-speaking adults from Quebec consume on average 28.8±13.1% of their calories as “other foods”, including pastries (5.4±6.5%), alcohol (4.8±7.1%), sweets (3.5±4.1%), sugar sweetened beverages (2.0±4.0%), chips and pop-corn (2.0±4.3%), processed meat (1.6±3.0%), fries (1.3±2.6%) and ice cream and frozen desserts (1.0±2.7%). “Other foods” account for less total daily energy intake in women compared to men (27.3±12.3% vs. 30.4±13.5% respectively, p<0.0001) as well as in participants with a university degree compared with those with a college or a high school diploma (27.7±13.0% vs. 29.6±13.0% or 29.9±13.0% respectively, p<0.05 vs. university). After adjustment for BMI, daily percent energy intake from “other foods” was associated with plasma triglycerides (r=0.10, p<0.05) and diastolic blood pressure (r=0.07, p<0.05). Conclusion: Almost 30% of daily energy intake of French speaking adults from the Province of Quebec comes from foods that are not recommended in Canada’s Food Guide. Consumption of “other foods” was found to be significantly associated with cardiometabolic risk profile features. (Supported by Canadian Institutes of Health Research.)

Effects of lentil supplementation on defined human gut microbial communities in a combined in vitro model of digestion and fermentation

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In the current study, a combined in vitro model of upper gut digestion and lower gut fermentation (RoboGut system) was used to assess the effects of lentils on the composition and activity of defined microbial communities derived from individual human donors. Microbial communities were developed from two healthy donors (HD5 and HD6) by exhaustive culturing of donor stool on different media, resulting in 63 and 58 isolates, respectively. Fermentation vessels were seeded in duplicate with each community and cultured for one week each in basal media, followed by lentil-supplemented media, and finally basal media again. The microbial community structure was examined at regular intervals by 16S rRNA gene sequencing and QIME analysis. Principal coordinate analysis (PCoA) of weighted UniFrac distances revealed the community compositions of both HD5 and HD6 shifted within 2 days of lentil supplementation, but quickly reverted back to their original states after removal of lentil. Specifically, the abundance of 27 and 20 community members from HD5 and HD6, respectively, were significantly altered by lentil supplementation, as determined by LEfSe analysis, whereas no significant differences in taxa abundances were observed in control vessels without lentil supplementation. Eighteen and 15 respective species within HD5 and HD6 increased in abundance in response to lentil supplementation, six of which were common to both communities: Blautia producta, Collinsella aerofaciens, Bacteroides vulgatus, Eubacterium limosum, Escherichia coli and Eubacterium eligens. A significant increase in...
production of the short-chain fatty acid (SCFA) acetate was also observed during lentil-supplementation, compared to pre-lentil. This work establishes a novel standardized in vitro model for studying the effects of whole foods on the human gut microbiota. The results indicate that lentil diets can cause a non-permanent shift in key constituents of the human gut microbiota, thereby altering production of SCFAs.

**Beneficial effects of fruit and vegetable supplementation on serum sphingolipid concentrations in high fat diet-induced obese mice**

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Evidence suggests that sphingolipids, including ceramides, sphingosine and sphingosine-1-phosphate may play a role in the development of obesity-associated metabolic dysfunctions. High fat diet (HFD) enhances ceramide levels, more specifically long chain ceramide species. Epidemiological evidence suggests fruits and vegetables (F&V) may be associated with reduced incidence of obesity, with F&V components potentially modulating serum ceramides and metabolites. The objective of this study was to determine the impact of supplementing a unique mixture of 24 F&V on serum sphingolipid concentrations in the context of a low fat diet, or a high fat diet. Mice were randomized to 1 of 4 diets (n=12/group): low fat diet (LFD) with 15% (w/w) F&V or without F&V and HFD with 15% F&V or without F&V. The mice remained on the diets for 20 weeks. The 15% (w/w) F&V corresponded to current recommendations for daily F&V consumption for humans. Serum lipidomic profile was analyzed using LC-MS/MS techniques. There was no difference in weight gain or fat accretion between mice fed the LFD diets. Mice fed the HFD with 15% F&V had significantly lower weight gain and fat mass compared to mice fed the HFD alone. Total ceramide, total monohexoseceramide and specific ceramide species (C16:0, C20:0, C22:0, C24:0) were significantly lower in serum of mice fed the LFD supplemented with F&V than in mice fed the LFD alone. Compared to mice fed the LFD alone, mice fed the LFD supplemented with F&V had significantly lower levels of sphingosine-1-phosphate and dihydro sphingosine-1-phosphate, by 14% and 19%, respectively. Mice fed the HFD supplemented with F&V had significantly lower levels of total ceramide and specific ceramide species (C16:0, C24:1 and C26:1) than mice fed the HFD alone. Serum concentrations of eicosphosphoglycerol were 39% lower in mice fed the HFD supplemented with F&V than mice fed the HFD alone. Our results suggest the beneficial metabolic effects of F&V may be partially mediated by suppressing circulating sphingolipids, both in lean animals and in the context of high fat diet-induced obesity. (Supported by U.S. Department of Agriculture – Agricultural Research Service (ARS), under Agreement No. 58-1950-4-003 and Canadian Institutes of Health Research Postdoctoral Fellowship.)

**The immunomodulatory effects of apple polyphenols and plant- and fish oil-derived n-3 polyunsaturated fatty acids are enhanced in combination in an in vitro model of obese adipose tissue**

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Obese adipose tissue (AT)-derived inflammatory mediators represent a pivotal target for dietary intervention to mitigate the development of chronic metabolic diseases. Apple polyphenols (AP) such as phloretin (PT) and chlorogenic acid (CQA), and n-3 polyunsaturated fatty acids (n-3 PUFA)such as plant-derived α-linolenic acid (18:3n-3), ALA and fish oil-derived eicosapentaenoic acid (20:5n-3, EPA) and docosahexaenoic acid (22:6n-3, DHA), are established anti-inflammatory dietary bioactives suggested to act, in part, via PPARγ, but their effectiveness in combination is less understood. Considering the complexity of diet and its influence on chronic metabolic disease development, investigation into the potential interactions between such anti-inflammatory bioactives is warranted. Using an in vitro model designed to recapitulate the obese AT inflammatory microenvironment, 3T3-L1 adipocytes were cultured for 24h with a physiological dose (10ng/mL) of lipopolysaccharide (LPS) concomitantly with 100μM of each AP (PT, CQA) or n-3 PUFA (ALA, EPA, DHA) alone, or with 100μM of each AP and n-3 PUFA combined. LPS-cultured adipocytes served as the control and 100μM of bisphenol A diglycidyl ether, a PPARγ antagonist, was added to a subset of all cultures. Compared to control, PT, EPA and DHA alone increased (P<0.05) the mRNA and secreted protein levels of the anti-inflammatory adipokine, adiponectin, and decreased that of the inflammatory adipokines, leptin, IL-1β and IL-6, as well as the macrophage chemokines, MCP-1, MCP-3 and MIP-1α; whereas PT and CQA were relatively inert. Interestingly, PT + ALA, PT + EPA and PT + DHA, as well as PT + DHA synergistically increased the mRNA and secreted protein levels of adiponectin, and additively or synergistically decreased that of the inflammatory adipokines and macrophage chemokines (P<0.05). Likewise, these AP + n-3 PUFA combinations additively or synergistically decreased NF-κB activation, reactive oxygen species generation, and NLRP3 inflammasome (caspase-1) activity (P<0.05). Finally, these immunomodulatory effects were partially dependent on PPARγ activity in all cultures, especially adipocytes cultured with PT and/or DHA (P<0.05). Overall, these data confirm the anti-inflammatory effects of AP and n-3 PUFA and suggest that their potential to mitigate development of obesity-associated chronic metabolic diseases is enhanced when provided in combination. (NSERC.)

**Dietary fatty acids augment tissue levels of fatty acid ethanolamides in n-acylphosphatidylethanolamine phospholipase D (NAPE-PLD) knockout mice**

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Dietary fatty acids are precursors to lipid signaling mediators, called fatty acid ethanolamides (FAEs). The well-studied FAEs are arachidonoyl ethanolamide (AEA), oleoyl ethanolamide (OEA) and docosahexaenoyl ethanolamide (DHEA). The enzymatic synthesis of FAEs requires n-acylphosphatidylethanolamine-phospholipase D (NAPE-PLD). Previous work indicates that modulating dietary fatty acid composition can affect blood and tissue FAE levels, which in turn impact physiological outcomes. However, the role of NAPE-PLD in this metabolic process has not been elucidated. The objective of this project was to assess the role of NAPE-PLD during the synthesis of FAEs upon chronic feeding of AIN-93G-based diets containing different fatty acid sources. Male wild-type (C57Bl/6) mice, heterozygous (NAPE-PLD +/−) and homozygous (NAPE-PLD −/−) mice received either beef tallow, corn oil, canola oil or fish oil (10% w/w from fat) post-weaning for 9 weeks. Results showed that brain docosahexaenoic acid levels were higher (p < 0.01) in NAPE-PLD −/− mice compared to all other diets. Liver and jejunum AEA, 1,2-arachidonoyl glycerol levels were highest (p < 0.05) in the corn oil diet. A significant effect of genotype showed that NAPE-PLD −/− mice had lower OEA levels in the plasma and jejunum, lower (p < 0.0001) food intake, body weight, and fat composition than the wild-type mice. These results demonstrate that NAPE-PLD is not necessary for FAE synthesis from dietary fatty acids, but does result in a leaner phenotype independent of dietary fatty acid composition. This research expanded our knowl-
edge on lipid metabolism and novel signaling molecules targeting on weight management and body composition. (Supported by Natural Sciences and Engineering Research Council of Canada.)

Do foods and beverages advertised in Canadian grocery flyers adhere to Canada’s Food Guide?
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Background: Food marketing can have influence on consumers’ food choices, but in Canada there is very limited research on whether foods advertised in grocery flyers adhere to recommendations in Canada’s Food Guide (CFG). Objective: This study aimed to assess the healthiness of foods and beverages advertised in Canadian grocery flyers and their adherence to CFG. Methods: Online weekly flyers from four Canadian grocery stores (two primary banners and two discount banners) were collected from official websites, during five consecutive weeks in Spring and Fall 2017 respectively, for a total of ten weeks. Foods and beverages were extracted from flyers. Natural health products, supplements, and baby food products were excluded. Products (n=8,237) were classified into 22 food categories, defined by Health Canada’s Table of Reference Amounts for Food, and classified into corresponding Tiers defined by CFG based on fat, sugars and sodium content. Adherence to CFG was assessed by the proportion of foods in each Tier advertised in flyers. Tiers 1 and 2 were the healthiest and considered in line with CFG, whereas Tiers 3 and 4 were less healthy and not fully in line. Analyses were performed using R Studio. Results: Overall, four stores, only 46.6% (n=3,838) of foods in flyers were in Tiers 1 and 2, 48.5% (n=3,995) were in Tiers 3 and 4, and 4.9% (n=404) had no Tier classification. Significant difference in the proportion of each Tier was observed among four stores (p<0.001), between primary banners (p<0.001) and between Spring and Fall (p=0.04). Proportion of each Tier had no significant difference between primary and discount banners (p=0.75), nor between the two discount banners (p=0.39).

Conclusion: Half of the foods in flyers not adhering to CFG illustrates that Canadian grocery stores advertise a significant proportion of unhealthy foods and potentially encourage unhealthy food choices in food marketing. In order to encourage consumers to have healthier daily food choices, the study suggests the need for food policies of monitoring and restricting unhealthy food marketing in grocery flyers. (Undergraduate Research Opportunity Program Scholarship [KL], E.W. McHenry Research Chair Operating Grant [MRL].)

Acute Food Intake Effect of Hemp (A FINHE) protein trial
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Objective: The examine the effects of hemp protein consumption on food intake at an ad libitum meal, as well as appetite and blood glucose responses before and after the meal compared to soybean protein and a carbohydrate control. Methods: In a repeated-measures crossover trial, adults (n = 27) randomly consumed (1) 40g of hemp protein (hemp40), (2) 20g of hemp protein (hemp20), (3) 40 g of soybean protein (soy40), (4) 20g of soybean protein (soy20), and (5) non-protein carbohydrate control. Treatments were given as isocaloric fruit shakes. Food intake was measured at a pizza meal (60 min). Appetite and blood glucose were measured at 0-60 min and 80-200 min (post-pizza). Results: Blood glucose was affected by treatment (p<0.0001), time (p<0.0001) and time-by-treatment (p<0.0001) at 0-200 min. In a dose dependent manner, protein treatments led to lower 0-60 min blood glucose overall mean, and area under the curve (AUC) compared to carbohydrate control (p<0.05). In contrast, although hemp40 and soy40 led to a lower overall mean blood glucose compared to control from 80-200 min, all protein treatments led to higher 80-200 min blood glucose AUC compared to control in a dose dependent manner (p<0.05). There was a treatment (p<0.05), time (p<0.0001), but no time-by-treatment effect on 0-60 and 80-200 min appetite. From 0-60 min, hemp40 consumption led to higher overall mean appetite ratings compared to soy20 and control, whereas 80-200 min soy40 led to higher mean ratings compared to control. No differences between treatments in appetite AUC, food intake or blood pressure were seen.

Implications and Conclusions: These data suggest that hemp protein, similar to soybean protein, dose dependently leads to lower post-prandial blood glucose compared to a carbohydrate control. This trial supports the use of hemp protein, as an alternative to soy protein, when replacing carbohydrates in beverages to improve glycemic control. (This project was funded by the Canada and Manitoba governments through Growing Forward 2, a federal-provincial-territorial initiative. Matching funds were provided by Manitoba Harvest, Hempro Int. GmbH & Co. KG, and Hemp Oil Canada.)

The effect of green and red lentils in half and quarter cup serving sizes on acute postprandial glucose response compared to multiple starchy controls
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Lentils, a type of pulse, can contribute to diabetes prevention and management, since it lowers postprandial blood glucose response (PBGR). However, consumption of lentils is low and the majority of studies on the PBGR-lowering effect of lentils have examined ½ to 1 cup serving sizes. The objective of this study was to examine the effects of lower serving sizes (½ and ¼ cup) of two lentil varieties on PBGR, compared to matched serving sizes of four commonly consumed starchy foods (corn, macaroni, white potato, white rice). The two serving sizes of lentils were examined in separate randomized, crossover studies in which 24 healthy adults (24.5 ± 2.8 and 23.8 ± 2.1 years old; BMI 23.3 ± 1.56 and 23.3 ± 1.69 kg/m2 for the ½ cup and ¼ cup studies, respectively) completed six study visits separated by wash-out periods of 3-7 days. Blood glucose response, as summarized by incremental area under the curve (IAUC), was significantly lower following consumption of the ½ cup serving of red and green lentils compared to macaroni (p<0.005), white potato (p<0.0001) and white rice (p<0.0001) but not corn; and following consumption of the ¼ cup serving of green lentils compared to red lentils (p<0.05), white potato (p<0.0001) and white rice (p<0.004), but not corn or macaroni. Blood glucose maximum concentration (Cmax) was significantly lower following consumption of the ½ cup serving of green and red lentils compared to corn (p<0.05), white potato (p<0.0001) and white rice (p<0.0003); and to macaroni for green (p<0.0002) but not red lentils. These results show that green and red lentils can effectively reduce postprandial blood glucose in a ¼ cup serving size compared to commonly consumed starch meals, and green lentils can do so in a smaller ¼ cup serving size. (Funded by Saskatchewan Pulse Growers and Agriculture and Agri-Food Canada.)

An examination of price in rural consumer food environment exposures in Newfoundland and Labrador
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Introduction: Rural residents face disparities in economic and geographic access to retail sources for healthy and affordable food, yet there is a paucity of rural food environment research. Of specific
concern are disparities in rural consumer prices, reflecting conditions of ‘market failure’. Existing consumer price studies examining urban/ rural disparities have used market basket-type measures. The objective of this study was to test a new method for assessing the price component of consumer food environment exposures. Methods: We conducted a 2015 cross-sectional census of the rural consumer food environment in Eastern Newfoundland and Labrador (NL) (n=78 stores), using an adapted Nutrition Environment Measures Survey-Stores for NL (NEMS-S-NL) comprised of 14 product category measures, encompassing 98 food and beverage items. NEMS is a widely used checklist observational measure that emphasizes relative availability of healthier alternatives alongside commonly consumed ‘regular’ (less healthy) items. Descriptive statistics were used to summarize store characteristics, item availability, and item prices. We derived a healthy food price index (HFPI) for each store, calculated as a ratio of unit prices for healthier compared to less healthy alternatives, based on standardized unit prices by weight within measures, adjusted for availability. Associations between store remoteness (NL government Accessibility-Remoteness Index, a continuous variable based on community location) and HFPI were then investigated using a series of bivariate and multivariate linear regression models, with store characteristics as covariates. Results: Of n=78 rural stores, 23% were supermarkets, 56% were convenience stores, and 21% were gas stations with convenience. 56% were in accessible communities; the remainder were in highly accessible (10%), somewhat accessible (22%), and moderately remote (12%) communities. Within measures, prices varied considerably. For example, mean unit price for skim milk was $2.37/kg but ranged from $1.83/kg to $3.50/kg. No correlation was observed between store remoteness and HFPI. Conclusions: This study proposes a healthy food price index for estimating HFPI and HFPI effects on food environments based on NEMS data. In rural NL, store remoteness did not predict the ratio of healthier to less healthy food prices. Further research is needed on store/system drivers of food price disparities in rural areas beyond geographic remoteness. (Funding: CIHR and Health Canada.)

The effect of a pre-meal serving of dairy products on satiety, food intake, and post-meal glycaemia in normal weight and overweight older adults

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Dairy products contribute to satiety, glycaemic control and food intake (FI) reduction. We previously reported the effects of dairy form on these factors in older adults consuming two dairy product servings. The effects of a single serving of dairy products on these responses have not been reported, a prerequisite for Health Canada’s comparative health claims. We report the results of two pilot experiments evaluating the effects of form of dairy on subjective appetite (SA), FI, and glycaemic control in older adults. Both experiments followed a randomized crossover design. In Experiment 1 (Exp.1), 16 healthy/overweight older adults (65.6±0.7 y old; BMI 25.1±0.6 kg/m2) were given a single serving of skim milk (0.1%M.F.), whole milk (3.25%M.F.), Greek yogurt (2%M.F.), cheddar cheese (31%M.F.), or water (control) following a 12 h fast. SA and blood glucose (BG) were measured at baseline and every 15-30 min over 125 min (Exp.1) and every 15-20 min over 50 min (Exp.2). To assess FI, an ad libitum pizza meal was provided at 30 min (Exp.1) and 15 min (Exp.2). This approach allowed us to evaluate whether FI varies by treatment and by meal intake time post-treatment. In Exp.1, post-treatment (0-30 min) BG was lower following cheese, yogurt and water than both milks (P<0.0001). In Exp.2, post-treatment (0-15 min) BG was lower after cheese compared to both milks (P=0.005), but no effect of yogurt was observed. Post-meal BG (50-125 min) was significantly lower after all dairy than water (P=0.0001). In Exp.2, yogurt and cheese exhibited lower post-meal BG (35-50 min) than water (P=0.0005). In Exp.1 only, all dairy reduced SA compared to water, but yogurt and cheese further lowered SA than skim milk (P<0.0001). In both experiments, there were no differences among treatments in FI or post-meal SA. We conclude that pre-meal ingestion and form of dairy merits consideration in managing satiety and glycaemia, with yogurt and cheese eliciting the greatest effects. Funding: Supported by a contribution from the Dairy Research Cluster Initiative. (Dairy Farmers of Canada, Agriculture and Agri-Food Canada, and the Canadian Dairy Commission.)

Postprandial effects of a high potassium meal in patients with hypertension

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Background: There is compelling evidence of an inverse association between potassium intake and blood pressure (BP). A potential mechanism for this effect may be dietary potassium mediated augmentation of endothelial dependent relaxation. To date, studies have investigated potassium intake supplementation over several weeks in healthy volunteers with variable results on vascular function. There is no assessment of the acute vascular effects of potassium supplementation achieved by ingestion of potassium rich food in a hypertensive population. Objective: The purpose of this study was to investigate the effect of a high potassium meal on postprandial endothelial function as measured by flow mediated dilatation (FMD). Design: We performed an investigator blinded randomized crossover trial in 33 hypertensive individuals. Participants consumed both a high (~ 2400 mg) and low (~ 543 mg) K+ meal, separated by a one week washout period. The primary endpoint was endothelial function as assessed by FMD. Results: In the fasting state (Baseline), and at 60 minute postprandial, radial artery FMD was not significantly different between high and low K+ meals (baseline: high K+ 4.2 ± 2% versus Low K+ 2.6 ± 3%, P=0.93; 60 min: high K+ 3.8 ± 4% versus Low K+ 4.1 ± 3%, P=0.69). There was however a non-significant trend at the 120 time-point (120 min: high K+ 5.2 ± 4% ± versus Low K+ 3.9 ± 4%, P=0.07). There were no differences between meals in radial artery diameter and blood flow. Conclusions: This study does not support the hypothesis that a single high potassium meal improves vascular function in individuals with treated hypertension. This does not negate the clinical evidence relating K+ intake to lowering BP, but suggests that the mechanisms of beneficial effects are complex and not simply due to single nutrient mediated improvement in vascular function.

What are Canadians eating in 2015?

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The 2015 Canadian Community Health Survey – Nutrition (2015 CCHS-Nutrition) is the latest nationally-representative survey that collected information, from Canadians ages 1 and older in the 10 provinces, about their eating habits and use of nutritional supplements, as well as other health factors (e.g. height and weight, physical activity and chronic conditions). The nutrient database used for this survey was based on the 2015 Canadian Nutrient File (CNF), a compilation of Canadian food composition data. In total, 20,487 individuals took part in the survey, with a response rate of 61.6%. The data collected in the 2015 CCHS-Nutrition was released in June 2017. Selected tables were also produced at the time of the data release: BMI of adults and children, physical activity and screen time for those aged 6 to 17 years, past-month vitamin and mineral supplement consumption, and percentage of total energy intake from carbohydrate, protein and fat. Results: Canadians reported consuming more of their calories from...
protein and fat and fewer from carbohydrates than they did a decade ago. Among children and teenagers, the percentage of daily energy intake from carbohydrates edged down from 54.6% in 2004 to 53.4% in 2015, while among adults, it decreased from 49.1% to 47.7%. Almost half of Canadians (45.6%) aged 1 year and older reported taking a nutritional supplement in 2015. Multivitamins were the most common nutritional supplement products consumed by Canadians. The percentage of overweight and obese Canadians aged 18 or older has increased from 2004, 59.2% to 61.3%, while in children and teenagers, a decrease from 34.3% to 30.9% was observed. Conclusion: The 2015 CCHS-Nutrition provides an opportunity to examine the food and nutrient intakes of Canadians, the extent to which intakes have changed since the 2004 CCHS-Nutrition, and the relationship between diet and a wide range of health and socio-demographic characteristics.

When the healthy choice is impossible: sodium levels of prepared foods in a university dining hall
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The average daily sodium intake of Canadians (3400 mg) is well above the tolerable upper intake (2300 mg) and more than double the recommended level (1500 mg). Most sodium consumed by Canadians comes from processed food (77%) and levels in many food categories exceed voluntary targets set by Health Canada. This research asked: based on the types of foods available at a university dining hall, how feasible is it for students to choose a diet that meets sodium recommendations (1500 mg)? The first step was to record sodium levels for all foods listed on the foodservice company’s website served during a 35 day dining cycle, approximately 40 food items per day. To assist with the research, the company provided us with students’ consumption patterns for the time period, which averaged 3 entrees at breakfast; 3-4 entrees, 1 side, and 1 dessert at lunch and supper; and 3-4 entrees and 2 sides at Saturday and Sunday brunch. To analyze the data, we wrote a “Nutrition Simulation” software program that accounted for the students’ consumption patterns. Using the R programming language, we randomly analyzed 2500 meal combinations per day, a total of 87,500 combinations. The results were that sodium availability ranged from 2070 mg – 20,010 mg per day, with an average availability of 6490 mg. Because the meal items did not include beverages or single items such as bread, breakfast cereals, salad bar items, spreads, or foods or beverages consumed outside the dining hall, we estimated the analyzed foods comprised 64% of the student’s total daily intake, equating to a recommended level of 960 mg of sodium. The results were the sodium levels were almost 7 times recommended (6490/960 mg); and consuming the recommended intake was impossible based on student consumption patterns. Students spend 8 months per year eating this food, unwittingly becoming accustomed to high sodium intakes that may be difficult to decrease once they leave. Foodservice companies can use numerous strategies to decrease sodium availability, including: sourcing lower sodium ingredients, flavouring food with non-sodium herbs and spices, and eliminating high sodium culprits (some individual items contained over 2000 mg).

Acute dietary DHA intake increases omega-3 polyunsaturated fatty acid synthesis-secretion kinetics from alpha-linolenic acid
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Docosahexaenoic acid (DHA, 22:6n-3) in mammals must be consumed in the diet or synthesized from polyunsaturated fatty acid (PUFA) precursors, including α-linolenic acid (ALA, 18:3n-3) and eicosapentaenoic acid (EPA, 20:5n-3). It is believed that dietary DHA supplementation/intake decreases the ability to make DHA from metabolic precursors such as ALA and EPA. However, the effect of dietary DHA on the PUFA metabolic pathway has not yet been fully elucidated. Presently, 21-day old Long Evans rats were weaned onto one of 4 dietary protocols: 1) 8 weeks of 2% ALA in total fat (ALA), 2) 6 weeks ALA followed by 2 weeks of 2% ALA + 2% DHA (DHA), 3) 4 weeks ALA followed by 4 weeks DHA and 4) 8 weeks of DHA. After 8 weeks of feeding, 2H5-ALA and 13C20-EPA were co-infused over three hours with blood collected at 30 minute intervals for the assessment of whole-body synthesis-secretion kinetics, and livers for gene expression and enzyme activities. The synthesis-secretion coefficient (representing synthesis capacity, ml/min, mean ± SEM) for the synthesis of EPA (0.238 ± 0.104 vs. 0.021 ± 0.001) and DPAn-3 (0.194 ± 0.060 vs. 0.020 ± 0.008) from plasma unesterified ALA, and DPAn-3 from plasma unesterified EPA (2.04 ± 0.89 vs. 0.163 ± 0.025) are higher (p < 0.05) after 2 weeks vs. 8 weeks of DHA, respectively. Subsequently, DHA synthesis-secretion rates from plasma unesterified EPA (nmol/d, mean ± SEM) were determined to be 70 ± 22, 341 ± 199, 843 ± 409 and 270 ± 76 for the ALA, 2ALA, 4ALA and DHA diets, respectively. Gene expression of ELOVL2 and FADS2 were lower (p < 0.05) after 4 weeks DHA and neared significance after 2 weeks of DHA compared to 8 weeks DHA. In conclusion, higher synthesis-secretion kinetics after 2 weeks of dietary DHA compared to 8 weeks suggests an increased throughput of the PUFA metabolic pathway as a potential means for reaching steady-state DHA levels more rapidly. Furthermore, these findings may lead to the implementation of new dietary strategies to maximize DHA levels while minimizing dietary requirements.

An investigation of cardiovascular benefits of okra in LDL-receptor-knockout mice
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In this study the cardiovascular benefits of okra powder (OP) have been tested in low density lipoprotein receptor knockout (LDL-r-KO) mice. OP was prepared at the Ibadan University, Nigeria. Male 4-week-old LDL-r-KO mice were purchased from the Jackson Laboratories, USA. The mice were divided into two groups of control and treated animals. The control group (n=10) was fed with a mouse chow supplemented with 0.06% (w/w) cholesterol; the treated group (n=9) received the same control diet supplemented with 10% (w/w) OP. The study lasted 24 weeks. Body weight, food intake, and plasma lipid levels were measured frequently over the study course. At sacrifice, final blood samples and the hearts were collected and used for final biochemical analyses and histological examinations of atherosclerotic lesions in the aortic roots. By week 20 of the experiments, the treated mice had 33%, 40% and 11% reductions in plasma total cholesterol, plasma triglycerides and body weight, respectively, as compared to those in the control group. Morphological examinations of the aortic roots will determine whether such beneficial effects in plasma lipid levels are associated with reductions in atherosclerotic lesion size. Thus, additional data are being collected to make the final conclusion of potential lipid-lowering and anti-atherogenic properties of OP in this animal model. Should OP show effectiveness in prevention of atherogenesis in this animal model, further studies in other animal models warrant an investigation of potential mechanisms of action for such beneficial effects of OP. (This study was approved by the Animal Care Committee at the University of Manitoba. Financial support from the University of Manitoba through University Research Grant Program.
In this study the metabolic effects of dietary Saskatoon berry powder (SBP) have been tested in a diabetic mouse model, namely db/db mice as well as their wild-type counterparts, C57BL/6J mice. Saskatoon berries were purchased locally and SBP was prepared using standard freeze-dry methods. Both animal models were purchased from the Jackson Laboratories, USA. SBP was added to the mouse chow at 5% (w/w). The animals were fed with the experimental diets for 4 weeks. Body weight, food intake, plasma lipid levels as well as blood glucose levels were measured. At sacrifice, final blood samples and urine were taken and used for final biochemical analyses. The hearts, livers and pancreas were collected and processed for histological and immunohistological examinations. The db/db mice had larger body weight and food consumption throughout the study as compared to those in the wild-type mice. Furthermore, the db/db mice developed a state of hypercholesterolemia and hyperglycemia by the end of the study as compared to the wild-type mice. Regular consumption of SBP was associated with an approximate 30% reduction in blood and urine glucose levels in db/db mice only. Reductions in blood glucose and urine levels were associated with apparent increases in beta-cell population in the islands of Langerhans as observed by immunohistological examinations. Morphological examinations of the liver and kidney tissues revealed fewer tissue destructions in the SBP-treated db/db mice as compared to those in the non-treated control db/db animals. This short-term study suggests beneficial metabolic effects for SBP in these animal models. Future studies warrant long-term safety and efficacy of SBP in other animal models of type-2 diabetes and patients with mild to moderate hyperglycemia. (This study was approved by the Animal Care Committee at the University of Manitoba. Financial support from Agricultural and Food Development Initiative-Growing Forward 2, Diabetes Canada and Natural Sciences, and Engineering Research Council of Canada (NSERC) is appreciated. The authors would like to thank the St. Boniface Hospital Research Foundation for providing the infrastructure that enabled this study.)

Acute effects of pulse ingredients incorporated into bagels on post-prandial glycemia in adults

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Currently there is industry interest in developing food products using pulses as ingredients that can be marketed to have post-prandial glycemic and metabolic benefits. The objective of this study was to test the effects of adding faba bean (FB) flours and fractions from flours to smoothies on the post-prandial blood glucose, insulin and gut hormone response before and after a fixed meal served at 120 min. In a repeated-measures crossover trial, adult males (n=28) randomly consumed a 300 kcal smoothie containing: (1) 32 g corn maltodextrin (control), (2) 32 g FB flour (FB flour), (3) 33 g high starch FB flour (FB starch), (4) 32 g protein concentrate made from FB flour (FB protein concentrate), and (5) 32 g protein isolate made from FB flour (FB protein isolate). FB ingredients and maltodextrin contributed 40% of calories in smoothies. Area under the curve (AUC) from 0-200 min (cumulative), 0-120 min (pre-meal) and 120-200 min (post-meal) was calculated for blood glucose. Over the session (0-200 min), there was an effect of time (p<0.0001), treatment (p<0.0001) and time-by-treatment interaction (p<0.0001) on the blood glucose response. An effect of treatment on cumulative, post-meal and post-meal blood glucose AUC was also observed (p<0.05). All FB smoothies led to a lower (p<0.05) cumulative blood glucose AUC compared with control. Also, FB protein isolate led to lower (p<0.05) cumulative blood glucose AUC compared to FB starch. During the pre-meal period, blood glucose AUC was lower (p<0.05) after all FB smoothies compared with control and after FB protein isolate (p<0.05) compared with FB flour and FB starch. In the post-meal period, FB protein isolate led to lower (p<0.05) blood glucose AUC compared to FB starch and control. Insulin, GLP-1, ghrelin, PYY and c-peptide responses will also be reported. These findings suggest that FB flours, particularly protein, can be used in smoothies designed for improved post-prandial glycemic control. (Funding: Supported by Saskatchewan Pulse Growers, Alberta Pulse Growers.)

The effects of consuming smoothies containing faba bean ingredients on post-prandial glycemia, insulin and hormone responses in young men

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Studies indicate that the consumption of whole pulses improve the post-prandial glycemic control compared to non-pulse controls. However, whether pulse ingredients retain the glycemic benefits of whole pulses when consumed in bakery products and whether pea ingredients are more effective when consumed in combination is unclear. In this trial, the acute effects of pulse ingredients consumed within a bagel on post-prandial glycemic responses before (0-120min) and after (120-200min) a meal were assessed. Following a repeated-measures crossover design, healthy adults randomly consumed bagels made with 100% wheat flour (control) and wheat flour with 1) pea flour, 2) pea fibre, 3) pea protein, 4) pea flour + pea protein, and 5) pea fibre + pea protein. Blood glucose (BG) was measured in all participants (n=25) and insulin was measured in a subgroup (n=15). Area under the curve (AUC) 0-120min (pre-meal) and 120-200min (post-meal) were calculated. Over the session (0-200min), there was an effect of time (p<0.0001), treatment (p<0.0001) and time-by-treatment interaction (p<0.0001) on BG. The effect of treatment on BG was observed at multiple pre-meal time points. At 45, 60 and 90min, bagels made with pea fibre + pea protein and pea protein had lower BG (p<0.05) compared to pea flour, pea fibre and control. Also at 60 and 90min, pea flour + pea protein had lower (p<0.05) BG compared to pea flour and pea fibre. At 120min, pea protein had lower (p=0.05, p<0.05, respectively) BG compared to pea fibre and control. There was also an effect of treatment on pre-meal BG AUC (p<0.0001). Pea fibre + protein and pea protein had lower (p<0.05) pre-meal BG AUC compared to pea flour and pea fibre. Pea protein was also lower (p<0.05) compared to control. Bagels made with pea flour + pea protein also had lower pre-meal BG AUC compared to pea fibre (p<0.05). There were no differences in post-meal BG, pre-meal insulin or post-meal insulin. Results indicate that effects on post-prandial glycemic responses to pulse ingredients are dependent upon type and support the use of pea protein in bakery products designed to improve post-prandial glycemic control. (Funding: Supported by Saskatchewan Pulse Growers, Alberta Pulse Growers.)
Navy bean supplementation in established obesity attenuates impairments in the colon epithelial barrier and visceral adipose tissue inflammation

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Obesity is a gut-associated pathology characterized by intestinal mucosal epithelial barrier impairments (i.e., leaky gut) and visceral adipose tissue (AT) inflammation. Therefore, bean supplementation in established obesity can improve mucosal epithelial barrier impairments due to the production of short chain fatty acids (SCFA), wherein both colonic and fecal SCFA concentrations were increased by YP (total SCFA, aceticoic, propionic and butyric acids) along with colonic epithelial cell expression of the SCFA receptors (GPR41, GPR43) compared to BD (P<0.05). Mechanistically, these protective colonic epithelial and mucus barrier effects could be attributable to the production of short chain fatty acids (SCFA), wherein both colonic and fecal SCFA concentrations were increased by YP (total SCFA, aceticoic, propionic and butyric acids) along with colonic epithelial cell expression of the SCFA receptors (GPR41, GPR43) compared to BD (P<0.05). Collectively, these data demonstrate the ability of YP supplementation to modify the colonic epithelial and mucosal barrier structure in the healthy unchallenged state.

Substituting rice with lentils in a chili reduces postprandial blood glucose in healthy adults

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Carbohydrate replacement of a portion of common starchy foods, such as white rice or white potato, with lentils markedly reduces postprandial blood glucose response (PBGR) and could lead to significant health benefits if consumed regularly. However, it is not known whether this attenuation effect is maintained when lentils are incorporated into a commonly consumed Canadian food, such as chili. This randomized crossover clinical trial assessed the extent to which PBGR is lowered when 25 g of available carbohydrate from lentils (small green and split red) replaces rice in chili made from rice only (control). Twenty-four healthy adults (26.6 ± 1 years old, BMI of 24.2 ± 0.4 kg/m2) completed three 3-hour study visits separated by washout periods of 3-7 days. Fasting and postprandial (15, 30, 45, 60, 90, 120 min) blood samples were collected by finger prick for analysis of blood glucose. Incremental area under the glucose curve (IAUC) and maximum blood glucose were assessed for treatment effects. Mean (±SEM) IAUC of the chilies were significantly (p<0.0001) different: rice: 107.0 ± 10.9; green lentil: 59.9 ± 7.4; red lentil: 50.3 ± 9.9 mmol/L x 120min. As such, the relative glycemnic response of green and red lentil chilies was 57.7 ± 7.4 and 48.9 ± 6.1, respectively, which is equivalent to a 42.3% and 51.1% reduction in IAUC, respectively, compared to rice chili (p<0.0001). Maximum blood glucose values were also lower (green lentil 6.0 ± 0.1 mmol/L; red lentil 5.7 ± 0.1 mmol/L) relative to rice chili (7.7 ± 0.2 mmol/L; p<0.0001). These results demonstrate beneficial effects on PBGR from substituting lentils for rice in a chili matrix and support simple dietary strategies that can have significant impacts on health. (Funded by AAFC Growing Forward 2 and Pulse Science Cluster; trial registered at ClinicalTrials.gov (NCT02426606).)

Examining the relationship between on-package children’s marketing and the frequency of consumption in different food categories

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Backgroung: Food and beverage marketing to children has been shown to influence children’s taste preferences, purchasing behaviours and consumption patterns. Previous work has revealed that approximately 5% of the packaged food supply is marketed to children using child-directed product packaging. However, it is unknown whether food categories with more child-directed marketing are being consumed more frequently by Canadian children. Objective: To determine whether the foods most frequently consumed by Canadian children are also those most heavily marketed to children on package. Methods: The University of Toronto Food Label Information Program (FLIP) 2013 database was analysed to determine which products were localizing anti-microbials (Reg3γ, IgA) were all up-regulated by YP compared to BD (P<0.05). Mechanistically, these protective colonic epithelial and mucus barrier promoting effects could be attributable to the production of short chain fatty acids (SCFA), wherein both colonic and fecal SCFA concentrations were increased by YP (total SCFA, aceticoic, propionic and butyric acids) along with colonic epithelial cell expression of the SCFA receptors (GPR41, GPR43) compared to BD (P<0.05). Collectively, these data demonstrate the ability of YP supplementation to modify the colonic epithelial and mucosal barrier structure in the healthy unchallenged state.

Substituting rice with lentils in a chili reduces postprandial blood glucose in healthy adults

Dita Moravek,1 Alison Duncan,2 Michael Loreto,1 Frances Pais-Horne,3 Patricia Lukus,1 Aileen Hawke,4 Michel Aliani,3 and Dan Ramdath2

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Carbohydrate replacement of a portion of common starchy foods, such as white rice or white potato, with lentils markedly reduces postprandial blood glucose response (PBGR) and could lead to significant health benefits if consumed regularly. However, it is not known whether this attenuation effect is maintained when lentils are incorporated into a commonly consumed Canadian food, such as chili. This randomized crossover clinical trial assessed the extent to which PBGR is lowered when 25 g of available carbohydrate from lentils (small green and split red) replaces rice in chili made from rice only (control). Twenty-four healthy adults (26.6 ± 1 years old, BMI of 24.2 ± 0.4 kg/m2) completed three 3-hour study visits separated by washout periods of 3-7 days. Fasting and postprandial (15, 30, 45, 60, 90, 120 min) blood samples were collected by finger prick for analysis of blood glucose. Incremental area under the glucose curve (IAUC) and maximum blood glucose were assessed for treatment effects. Mean (±SEM) IAUC of the chilies were significantly (p<0.0001) different: rice: 107.0 ± 10.9; green lentil: 59.9 ± 7.4; red lentil: 50.3 ± 9.9 mmol/L x 120min. As such, the relative glycemnic response of green and red lentil chilies was 57.7 ± 7.4 and 48.9 ± 6.1, respectively, which is equivalent to a 42.3% and 51.1% reduction in IAUC, respectively, compared to rice chili (p<0.0001). Maximum blood glucose values were also lower (green lentil 6.0 ± 0.1 mmol/L; red lentil 5.7 ± 0.1 mmol/L) relative to rice chili (7.7 ± 0.2 mmol/L; p<0.0001). These results demonstrate beneficial effects on PBGR from substituting lentils for rice in a chili matrix and support simple dietary strategies that can have significant impacts on health. (Funded by AAFC Growing Forward 2 and Pulse Science Cluster; trial registered at ClinicalTrials.gov (NCT02426606).)

Examining the relationship between on-package children’s marketing and the frequency of consumption in different food categories

Christine Mulligan, Alena Praneet Ng, Anthea Christosforou, and Mary L’Abbé

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Backgroung: Food and beverage marketing to children has been shown to influence children’s taste preferences, purchasing behaviours and consumption patterns. Previous work has revealed that approximately 5% of the packaged food supply is marketed to children using child-directed product packaging. However, it is unknown whether food categories with more child-directed marketing are being consumed more frequently by Canadian children. Objective: To determine whether the foods most frequently consumed by Canadian children are also those most heavily marketed to children on package. Methods: The University of Toronto Food Label Information Program (FLIP) 2013 database was analysed to determine which products were...
marketed to children on-package using criteria adapted from Colby et al and Elliott. The weighted frequency for which children reported consuming foods from product categories determined to have on-package child-directed marketing was determined using 2015 Canadian Community Health Survey-Nutrition data. Product categories were then ranked in descending order of frequency of consumption. A Cochrane-Armitage test was used to assess the association between the degree of consumption (ordinal explanatory variable) and the proportion of child-directed products in a food category (binary dependent variable). Results: In total, 726 child-directed products were identified in FLIP 2013, across 14 food categories. The proportion of children’s products in a category ranged from 17.4% (Desserts) to 0.2% (Salads). The most frequently consumed food category was Fruit and Fruit Juices (reported to be consumed > 9.6 million times), and the least frequently consumed was Marine and Fresh Water Animals (>100,000 times). As a product category was more frequently consumed by children, it had a higher proportion of products with child-directed packaging (p for trend=0.0004). Significance: Since the types of products that are frequently consumed by children are also those that are most marketed to children, these results support the assertion that child-directed marketing could influence children’s eating behaviours. Regulations limiting their marketing could reduce their consumption and encourage manufacturers to reformulate products, thereby impacting the diet quality of Canadian children. (Ontario Graduate Scholarship (CM); CIHR Strategic Operating Grant (201103SOK-118150); Earle W. McHenry Endowed Chair & Burroughs Wellcome Fund-Innovation in Regulatory Science (MRI)).

Proportion of restaurant foods eligible for marketing to children under the CAI uniform nutrition criteria

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Background: The Canadian Children’s Food and Beverage Advertising Initiative (CAI) is a voluntary, industry-based framework designed to improve the overall health of children, and includes criteria to evaluate whether a food should be marketed to children. Although CAI criteria is primarily designed for packaged foods, many restaurants also market their foods to children, and only one currently participates in the program (McDonalds). To date, there has been no evaluation of restaurants foods with respect to the CAI’s criteria for the marketing of children. Objective: To determine the proportion of restaurant foods eligible for marketing to children based on the CAI Uniform Nutrition Criteria. Methods: Data was collected from publicly available nutritional information on Canadian restaurants’ websites. Only chains with ≥20 Canadian outlets were included. In total, 10,806 food items from 97 chains (2016) were included. Items were categorized according to the CAI framework, and corresponding thresholds for saturated and trans fats, sugars, and sodium (classified as Components Required to Limit) were applied. As ingredients lists were not available for all foods, only the Components Required to Limit portion of the model could be used to determine eligibility. Both nutrient values and CAI categorizations were checked by other reviewers (XL and MW). Results: Of 10,806 foods, 14.4% (n=1558) either provided insufficient data (n=160) or did not fit any CAI category (n=1393) and could not be analyzed. Of 9253 items, 8.4% (n=780) items were eligible for marketing to children according to the CAI criteria, and 8274 (91.6%) were ineligible due to exceeding nutrient thresholds. Sides and Starters had the greatest proportion of eligible items, at 24.8% (n=430) and 12.2% (n=55) respectively, while Desserts (4.1%, n=49) and Entrées (3.4%, n=169) had the lowest. Conclusion: Over 90% of restaurant foods are ineligible for marketing to children under the voluntary CAI standards for nutrients to limit. This suggests a need for reformulation to improve the healthfulness of menu items, as well as a need to restrict marketing restaurant items to children, as voluntary programs have been shown to be ineffective in this sector. (Funding: Canadian Institutes of Health Research (CIHR) Impact Grant, Health Canada.)

Assessing willingness to try novel and familiar foods among British Columbia children: impact of food explorers, a school-based nutrition education program

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Introduction: Dietary habits are established early in life. Unwillingness to try new foods (neophobia) or familiar foods (pickiness) may lead to unhealthy dietary habits and in turn negatively impact health. The Food Explorers (FE) program, developed by the BC Dairy Association, is a school-based program aimed to address food pickiness through classroom-based activities. This study examined the impact of FE on neophobia and pickiness among children (5-6y) and the strengths, weaknesses of the program from the parents and teachers’ perspective. Methods: Students were recruited to an intervention group (n=114) and a comparison group (n=105) from 2 school districts. Children’s food knowledge and preferences were assessed at baseline through in-class interviews. Parent’s perception of child neophobia were assessed through questionnaires. Assessments were repeated at ~5 months. Qualitative questionnaires were used to assess parents and teachers’ perspectives at the end of the program. Mean(SD) differences in child-driven food preference scores (range 20-60; higher scores indicate less pickiness) and parent-perceived neophobia scores (range 9-45; lower scores indicate less neophobia) at pre and post intervention were compared with paired-t tests and Wilcoxon signed-rank test, respectively. Results: Preliminary results from the intervention group show no change in the absolute food preference scores [43.1(7.3) vs 44.4(6.7), p=0.06; n=85] or preference for novel foods [19.05(4.0) vs 19.8(4.1), p=0.09]. However, a significant reduction in pickiness was observed [23.7(3.6) vs 24.3(3.4), p=0.02]. In addition, Parent- perceived food neophobia scores significantly decreased [26.9(7.9) vs 24.6(7.3), p=0.005; n=37]. Qualitative questionnaires from 7 teachers indicated positive self-experience: ‘enthusiasm among children for participating in cooking activities’, and perceived positive experiences of children: ‘open to trying new foods’ and ‘learning new food-based vocabulary’. The majority of parents also indicated positive experiences including a decrease in food neophobia after the FE program. Conclusions: Preliminary results suggest reduced pickiness in children and reduced parent- perceived food neophobia post intervention. This suggests that an educational program may have a positive effect on food neophobia in children. Our continued study of the program and the comparison group will shed more light on the impact of the FE program. (Study supported by: BC Dairy Association and MITACS.)

Assessing the impact of a combined horticulture and peer-led nutrition education intervention on diet diversity, nutrition knowledge and practices and household food security of women farmers in Kenya

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Research in developing countries suggests that horticulture interventions (including home gardens and drip irrigation), are an effective means of enhancing the diversity of diets and food security. Interven-
tions are most effective when they are combined with nutrition education and when women are the focus. However, there is little evidence of the effectiveness of such interventions in developing countries such as Kenya, where micronutrient deficiencies and food insecurity remain a significant problem, particularly among the rural poor. The purpose of this study was to compare diet diversity (DD), nutrition knowledge and practices (NKP) and household food security (HFS) between a group of Kenyan women farmers receiving a combined horticulture and peer-led nutrition education intervention and a comparison group not receiving the intervention. A quasi-experimental design was used. The intervention included a peer-led food based workshop featuring staple foods enhanced with nutritious crops such as sweet potatoes. In home interviews were used to assess HFS, DD and NKP prior to and five weeks after the intervention. HFS and NKP were assessed via questionnaire; DD was assessed using 24 hour recalls. The intervention group included 30 members of a women’s group in Naari, Kenya. The comparison group consisted of 20 women farmers. The intervention group had higher overall DD scores than the comparison group (p≤0.02), with more women consuming yellow and green vegetables and dried beans and peas (p≤0.05). Knowledge scores related to iron and vitamin-A messages were higher in the intervention than in the comparison group (p=0.01, p=0.04, respectively). There were no differences in the number of women reporting implementing recommended food practices between the groups. Households in the intervention group were more food insecure than the comparison group (p≤0.01). In conclusion, results suggest that the intervention was associated with higher levels of knowledge and diet diversity, particularly with regards to consumption of vitamin A containing vegetables. Higher food insecurity levels in the intervention group may reflect their lower involvement in dairying relative to the comparison group. Findings will be used to inform the design and evaluation of future interventions. (Funding: Queen Elizabeth II Diamond Jubilee Scholarship Program.)

Pre-exercise dietary choices in endurance runners
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4Introduction: Endurance runners often experience gastrointestinal symptoms during training or racing, which can cause discomfort and hinder performance. Unfortunately, although there are recommendations regarding nutrient intakes, little guidance is provided on how to translate these recommendations to whole foods. Consequently, it may be difficult for this population to make dietary selections that maximize performance whilst minimizing discomfort. Objectives: 1) Gain insight into the types of foods that endurance runners consume pre-training and pre-racing to limit gastrointestinal discomfort and optimize performance. 2) Develop nutritional recommendations on ideal food types that should be consumed to support running performance. Methodology: The Dietary Restrictions in Runners Questionnaire was administered to 525 athletes at various running events. Two open-ended questions collected data on foods consumed by endurance runners prior to training and racing. Registered Dietitians, with a specialization in sport nutrition, developed food classifications using the What We Eat in America food categories, Fermentable Oligo-, Di-, Mono-saccharides And Polyols (FODMAP) food lists, and sport nutrition recommendations. Food choices were categorized and frequencies determined for each category. Results: Commonly chosen foods pre-exercise included grains, hot cereals, low-FODMAP fruits, nuts, and eggs. Popular pre-exercise drinks included water and coffee/tea. Food choices were consistent between pre-training and pre-competition. Conclusion: The results from this study bridge the gap between individual nutrient recommendations and dietary selection for endurance runners. Future research should aim to test the identified food patterns to work towards evidence informed recommendations. Given that running is a very accessible form of exercise, the information provided by this research will be far reaching and useful for runners at all levels. (Funded by a Mount Royal University Innovation Grant.)

Pediatric malnutrition screening
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Background: Malnutrition, when present in hospitalized children, can result in prolonged hospital stay and increased morbidity and mortality. Screening for malnutrition is a critical first step in the nutrition care process. Multiple screening tools have been proposed for pediatric use, but none are validated in a Canadian population. This study aimed to compare two pediatric screening tools to the Subjective Global Assessment (SGA). Methods: The Screening Tool for Risk of Impaired Nutritional Status and Growth (STRONGkids) and the Pediatric Nutrition Screening Tool (PNST) were evaluated to deter-
mine which was best able to identify malnutrition risk on admission with acceptable sensitivity and specificity. Patients admitted to one surgery and two medicine units at a tertiary Alberta pediatric hospital were approached to participate. Both screening tools were completed for each patient by a registered nurse. The SGNA was then administered by a trained dietitian to identify presence of malnutrition. Sensitivity and specificity were calculated to validate each tool against the SGNA. Results: A total of 165 patients 1 month to 16.9 years of age were included. Based on the SGNA, 29% of patients were malnourished on admission. Those who were malnourished stayed in hospital on average 6.9 days, compared to 4 days for those well-nourished (p < 0.05). STRONGkids identified 56% and 16% of patients as at moderate and severe nutrition risk respectively with a sensitivity of 89% and specificity of 35%. PNST identified 26% of patients as at nutrition risk with a sensitivity of 58% and specificity of 88%. Both STRONGkids and PNST were predictive of increased length of stay (p < 0.05). Conclusion: This study showed that both tools have strengths and limitations. STRONGkids had poor specificity which could hinder clinical use, despite strong sensitivity. The PNST had lower sensitivity, therefore other indicators of nutrition status may have to be utilized in conjunction with the tool if used clinically. Further analysis of both tools, including potential reclassification of scores, may improve their ability to identify children who are malnourished without excessive false positives. (Funded through the Maternal Newborn Child & Youth SCN HOI fund.)

The effect of high dairy product intake on bodyweight, body composition and blood pressure in overweight and obese subjects: preliminary results

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Context: High dairy product intake showed an inverse association with body mass index (BMI), waist circumference (WC), systolic and diastolic blood pressure (SBP and DBP) in observational studies. A meta-analysis of clinical trials observed an additive effect of high dairy intake on weight loss when combined with energy restriction in adults, however no effect was reported with dairy intake alone. Furthermore, dairy product intake showed no effect on SBP and DBP in clinical trials. The discrepancies surrounding the role of dairy intake on cardiometabolic parameters need to be clarified. Objective: The objective of this randomized parallel study is to investigate, during a 6-week period, the effects of high dairy product intake (HD) (4-5 servings/day) on body weight, BMI, WC, body composition, SBP and DBP in healthy overweight and obese subjects. Methods: Body weight, BMI, WC, SBP and DBP were collected prior to and following the interventions. Body composition was analysed using a bio-impedance scale. Results: Twenty-three subjects completed the study, 21 males and 2 females, aged 51.8 (15.6) years (mean (SD)) and with a BMI of 31.3 (3.1) kg/m2. Twelve subjects were allocated to LD and eleven to HD. No difference was observed between groups at baseline. After the 6-week intervention, a reduction of lean mass (p=0.04) was observed in the LD group compared with baseline while in the HD group, reduced DBP was observed (p=0.04). Adjusting for sex, age, BMI and baseline characteristics, no difference was observed between groups after 6 weeks for body weight, BMI, WC, SBP, DBP or body composition. However, the results showed high inter-variability between subjects. Conclusion: These preliminary results suggest that high dairy product intake does not affect body weight, BMI, WC, SBP and body composition in overweight and obese subjects. DBP was reduced in the LD group after the 6-week intervention, yet no difference was observed between groups after the intervention. Additional subjects are required to better understand the role of dairy products on cardiometabolic parameters. (Grant acknowledgement: Diabète Québec and Canadian Institutes of Health Research (CIHR).)

Self-reported food label use by Canadian consumers

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Introduction: Unhealthy diet is a modifiable risk factor for non-communicable diseases amongst Canadians. Nutritional labelling on packaged foods is one strategy to promote healthy food selection. Currently, the Nutrition Facts table (NFI), ingredient list and discretionary nutritional claims convey nutrition information to consumers at the point-of-purchase. While there has been some research examining the extent to which consumers engage with such labelling, shifting consumer attitudes around evolving public health and nutrition concerns, warrants a contemporary investigation. Therefore, the current study aims to investigate Canadian consumers’ self-reported use of food labels. Methods: As part of a larger survey examining consumer perceptions of interpretative nutrition rating systems on food products, an online questionnaire investigated consumers’ self-reported frequency of label use (NFI, ingredient, and use of nutrient information contained on the label (energy, macro- and micro-nutrients, allergens, health/nutrient claim). Data were collected from a geographically representative commercial sample of Canadians (n=1997) by participant characteristics September to October 2017 and analyzed using descriptive statistics and Kruskal-Wallis tests. Results: Approximately 67% of Canadians perceived their overall knowledge of nutrition to be good or very good while 10% perceived it as poor. Although 86% found the NFI helpful in choosing healthier foods, 63% of Canadians sometimes or usually used the NFI. Similarly, 68% of Canadians used nutrition symbols sometimes or usually. On a 7-point Likert scale, participants rated sugar and trans-fat, as strongly influencing their food choice whereas energy and additional nutrients (e.g. saturated fat, sodium, protein) had a moderately strong influence. Participants indicated using the labels sometimes to compare calories between foods, but rarely for managing a health condition or following a specified diet. Conclusion: This study indicates that Canadians utilize nutrition labels quite often and their usage also impacts their food choice. Having a comprehensive understanding of label use by consumers can aid in the development of future guidelines for the Canadian Food Guide and help improve educational campaigns/initiatives to increase comprehension of nutrition labels to support healthy eating. (Financial support: Heart and Stroke Foundation of Canada, Mitacs Elevate PostDoctoral Fellowship (MA), CIHR-D (BFA) Earle W. McHenry Endowed Chair (MRL).)

Acute effects of pulse flours in extruded snack products on post-prandial glycemic and satiety responses before and after an endurance exercise session in adults

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Objective of this study was to examine the effects of extruded pulse snacks on blood glucose (BG), insulin and appetite responses before and after endurance exercise compared to a non-pulse snack. Food intake was measured 2 hours following exercise. Following a repeated-measures crossover trial, adults (n=25) randomly consumed extruded snacks made with: 1) whole grain yellow pea flour, 2) split yellow pea flour, 3) green lentil flour, 4) chickpea flour, 5) pinto bean flour, and 6) corn flour (control). Pulse extruded snacks contained 40% pulse flour and 60% corn flour, whereas the control was 100% corn flour. BG and appetite were measured pre-exercise (0-60 min) and post-exercise (120-
Acute effects of pulse fractions in extruded cereal products on post-prandial glycemic and satiety responses before and after an endurance exercise session in adults

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Studies indicate that whole pulse consumption is beneficial for post-prandial glycemic and satiety control and may impact the glycemic response following exercise. However, whether pulse fractions retain the health benefits of whole pulses when consumed in commercially available food products and if they provide any benefits following exercise is unclear. The objectives of this study were to examine the effects of extruded pulse cereals on blood glucose, insulin and appetite responses before and after endurance exercise compared to a non-pulse cereal. Food intake was measured 2 hours following exercise. In a repeated-measures crossover trial, adults (n=27) randomly consumed extruded cereals (35g) made with: 1) 80% oat flour (control), 2) 39% oat flour and 50% pea starch (starch), 3) 47% oat flour and 40% pea protein (protein), 4) 32% oat flour, 18% pea starch and 40% pea protein (starch + protein), 5) 32% oat flour, 18% pea fibre and 40% pea protein (fibre + protein), and 6) 16% pea fibre, 45% pea starch and 36% pea protein (fibre + starch + protein). Area under the curve (AUC) was calculated for blood glucose (BG), insulin and appetite from 0-60 min (pre-exercise) and 120-240 min (post-exercise), and food intake was measured at 240 min in all participants. Insulin was measured in a subset (n=15). Pre-exercise BG netAUC was lower following the starch + fibre + protein and fibre compared to control (p<0.05). However, post-exercise BG netAUC showed no differences among treatments (p=0.33). No differences were identified for insulin pre-exercise or post-exercise netAUC. Appetite pre-exercise netAUC showed differences in treatments (p=0.03). Protein + starch and protein showed lower appetite compared to control. There were no differences between treatments in appetite post-exercise netAUC (p=0.21). There were no differences in food intake. This research supports the use of pea fractions to improve glycemic response and appetite before exercise. However, no benefit after aerobic exercise was observed. Incorporating pulse fractions into commonly consumed and readily available products such as cereal would make it easier for consumers to consume pulses and also increase the nutritional value of these products by increasing the amount of protein and fibre. (Funding: Supported by Saskatchewan Pulse Growers, Alberta Pulse Growers.)

Dietary restrictions to mitigate gastrointestinal discomfort in runners

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Endurance runners often report gastrointestinal (GI) symptoms, which negatively affect their performance. Reasons for GI discomfort during exercise remain incompletely understood; however, nutrition is a key factor. Currently, there is a lack of information concerning foods to consume or avoid before running. The objective of this study was to use a valid and reliable questionnaire to identify self-reported pre-training/pre-race food avoidances and GI symptoms in endurance runners. The questionnaire was administered to 440 runners, with no reported food allergies, at races and events in Alberta. Participants (60% female) were endurance runners who primarily classified themselves as recreational athletes performing in the top half of their category. The most commonly avoided foods while training were meat, milk, and fish by 34%, 24%, and 18% of participants respectively. Similarly, while racing 36% of participants avoided milk, 31% avoided meat, and 26% avoided fish. The top three reasons for avoiding foods while training were experience 39%, personal preference 33%, and routine 17% of participants. When racing, experience, personal preference, and routine were also the top three reasons for food avoidance in 39%, 38%, and 21% of participants respectively. The top five symptoms experienced while training were stomach pain/cramps 41%, intestinal issues 24%, bloating 22%, diarrhea 22%, and gas 21%. Similar results were reported while racing with slight increases in the prevalence. Of the top ten most popular foods avoided while training and racing, more than half fell into either milk and alternatives or meat and alternatives. While racing, 9% of participants avoided sports drinks, gels, and bars; foods specifically formulated and marketed for this purpose. Current recommendations stop short of providing information on specific foods to consume or avoid while running. The present study uses data collected from experienced runners to identify food choices that will minimize gastrointestinal discomfort while running. Future research should assess the most common food avoidances, using clinical trials, to confirm they are detrimental to performance and in which populations. (Funded by Mount Royal University Innovation Grant.)

The use of whole body calirometry to compare measured versus predicted energy expenditure in postpartum women

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Background: Accurate assessment of energy needs in postpartum (PP) women may support the development of appropriate weight management recommendations. Since measuring energy expenditure in every woman is unfeasible, it is important to identify accurate predictive equations. Objective: To compare the accuracy of measured versus predicted resting energy expenditure (REE) and total energy expenditure (TEE) in PP women. Methods: REE was measured at three months (3M) (n=52) and nine months (9M) (n=49) PP while TEE was measured only at 9M PP (n=43) using whole body calorimetry. Measured REE was compared to 16 predictive equations; measured TEE was compared to: 1) Dietary Reference Intakes (DRI) energy recommendations and 2) factorial approaches (predicted REE*1.3 activity factor + 400kcal if breastfeeding). Fat mass and fat-free mass, as required for three equations, were measured by dual-energy X-ray absorptiometry. Paired t-test and Bland-Altman analyses were used to compare measured and predicted REE and TEE. Bias (average difference), and limits of agreement (LOA) were used for accuracy on a group and individual level.
Eating behaviors of women with and without prior gestational diabetes mellitus

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Background: Women with gestational diabetes mellitus (GDM) receive nutrition counselling during pregnancy in order to achieve adequate gestational weight gain and glyceemic control. After delivery, women with a history of GDM are at higher risk of abnormal glycaemia which can modulate appetite and eating behaviors. However, data on eating behaviors in women with a history of GDM is limited. The aim of this study was to compare, after pregnancy, eating behaviors between women with (GDM+) and without (GDM-) a history of GDM. Methods: A total of 214 GDM+ women and 150 GDM- women were recruited 3 to 12 years after pregnancy. All GDM+ women received nutrition counselling during pregnancy. Women completed the validated Three Factor Eating Questionnaire (TFEQ) to assess their eating behaviors, including scores for dietary restraint (flexible and rigid), hunger (internal and external) and disinhibition (emotional, situational and situational susceptibility). Eating behaviors were compared between GDM+ and GDM- women using ANOVAs. Results were adjusted for age and body mass index (BMI). Results: Mean age was 36.4±5.1 years, time since pregnancy was 6.5±3.4 years and mean BMI was 26.1±5.7 kg/m². GDM+ and GDM- women had similar mean dietary restraint score (7.8±4.2 and 7.1±4.3 respectively; p=0.87) and disinhibition score (6.0±3.0 and 5.5±3.1; p=0.17). Susceptibility to hunger score was higher in GDM+ women compared to GDM- women (4.5±3.1 and 4.2±3.0 respectively; p=0.01). Conclusions: Preliminary data suggest that women with prior GDM had similar dietary restraint and disinhibition scores compared to women without prior GDM. However, women with a history GDM have higher susceptibility to hunger which could be related to their diabetic monitoring during pregnancy and/or actual glycaemia variations. This result remains to be investigated.

Food beyond borders: experience of international students at the University of Manitoba

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Post-secondary students who move to a new country experience a drastic shift in food landscape, often resulting in unhealthy dietary adaptations. The objective of this study was to compare, after pregnancy, eating behaviors between women with a history of GDM are at higher risk of abnormal glycaemia which can modulate appetite and eating behaviors. However, data on eating behaviors in women with a history of GDM is limited. The aim of this study was to compare, after pregnancy, eating behaviors between women with (GDM+) and without (GDM-) a history of GDM. Methods: A total of 214 GDM+ women and 150 GDM- women were recruited 3 to 12 years after pregnancy. All GDM+ women received nutrition counselling during pregnancy. Women completed the validated Three Factor Eating Questionnaire (TFEQ) to assess their eating behaviors, including scores for dietary restraint (flexible and rigid), hunger (internal and external) and disinhibition (emotional, situational and situational susceptibility). Eating behaviors were compared between GDM+ and GDM- women using ANOVAs. Results were adjusted for age and body mass index (BMI). Results: Mean age was 36.4±5.1 years, time since pregnancy was 6.5±3.4 years and mean BMI was 26.1±5.7 kg/m². GDM+ and GDM- women had similar mean dietary restraint score (7.8±4.2 and 7.1±4.3 respectively; p=0.87) and disinhibition score (6.0±3.0 and 5.5±3.1; p=0.17). Susceptibility to hunger score was higher in GDM+ women compared to GDM- women (4.5±3.1 and 4.2±3.0 respectively; p=0.01). Conclusions: Preliminary data suggest that women with prior GDM had similar dietary restraint and disinhibition scores compared to women without prior GDM. However, women with a history GDM have higher susceptibility to hunger which could be related to their diabetic monitoring during pregnancy and/or actual glycaemia variations. This result remains to be investigated.
implication on eating habits and food acquisition. Results from this study demonstrate the need for incorporating resources and programs in universities to help increase food awareness, food skills and healthy eating. Strategies include providing nutrition and food skills education, time management workshops, and increased exposure to unfamiliar healthy foods, all of which could be incorporated into orientation sessions or special courses targeted to newcomer students.

Overview of the nutritional value of ready-to-eat breakfast cereals available in grocery stores in the province of Quebec – results from the food quality observatory

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Ready-to-eat breakfast cereals are highly consumed and known to have an impact on both nutrient intakes and health. Moreover, information available on the front of the package can influence consumers’ purchase decisions. In this study, the Food Quality Observatory aimed to characterize the nutritional value of cereals offered in the province of Québec. Using UPC codes, a database documenting the nutrient values (55g serving size) of 331 cereals available in Québec was merged with a sales database of more than 700 products sold between 05/2016 and 05/2017. A total of 306 products were successfully cross-referenced representing 90% of cereal sales in the province. Cereals were then classified regarding their transformation type and targeted consumers. Contribution of each cereal type to the whole category was measured based on their nutritional value, total sales and number of products. The granola cereals made up 37% of the products in the database and most of products targeted the general population (78%). Granola’s mean nutritional value differed from other cereals, with a higher content in energy (234±24 vs. 209±17kcal), total fat (6.8±3.7 vs. 2.3±2.1g) and protein (6.2± vs. 5±2g), and a lower content in sodium (90±72 vs. 182±124mg) (all ps<0.001). Sugary cereals were also different from other cereals, with larger amounts of sugar (1626± 105±5g) and sodium (201±1222 vs. 135±112mg), and smaller amounts of protein (4±1 vs. 6±2g), total fat (1.9±1.6 vs. 4.4±3.7g) and fibre (3.1±1.8 vs. 5±3.3g) (all ps<0.001). Multivariate analyses showed that cereals targeting children were higher in sugar than cereals targeting the general population (1626± vs. 1105±5g; p<0.006). Despite a small variety of products (16±3% of the total market), cereals targeting children represented a large proportion of total cereal sales (39.8%) and contributed to an even larger proportion of total sugar from cereals (50.9%). These findings showed a wide variability of the nutritional value among the different cereal types and targeted consumers. These results may help public health stakeholders and food industry to better define where improvements should be undertaken to offer more nutritious ready-to-eat breakfast cereals to consumers (Supported by Gouvernement du Québec en forme and INAF).

Vitamin B12 deficiency in new users of proton pump inhibitors: a population-based study in older adults using 20 years of administrative health data

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Objectives: Proton pump inhibitors (PPI) are gastric acid suppressors known to decrease vitamin B12 absorption. However, data remain conflicting at identifying long-term PPI usage as a risk factor for vitamin B12 deficiency, notably in older adults. Our study examined whether the risk of vitamin B12 deficiency in older adults is associated with the degree and duration of PPI usage. Methods: A nested case-control study was conducted using a random sample of 531,299 adults aged ≥66 years in 1995-2015, drawn from Quebec administrative health databases, which include >90% of the older population. Incident PPI users were identified using claims to the public drug insurance, the first claim being the cohort entry date. They had not used PPI for >1 year prior to this date. Exclusion criteria were stomach/intestine surgery, use of other vitamin B12 status-altering drugs, and prevalent cases of vitamin B12 deficiency. New cases of vitamin B12 deficiency were identified during follow-up based on either claims for prescribed vitamin B12 supplements or diagnosis of vitamin B12 deficiency recorded by outpatient clinics, emergency departments or hospitals. Control-to-case ratio was 10:1, matched for sex, age and calendar year. Degree of PPI exposure was assessed by the Medication Possession Ratio (MPR), which is the % of days of medication supply divided by the duration of follow-up. Rate Ratios (RRs) were computed according to MPR levels and duration of PPI usage, using conditional logistic regressions. Results: The cohort includes 231,231 incident PPI users and 16,085 cases of vitamin B12 deficiency were identified throughout follow-up (median=4.3 years; IQR [1,7-7.8]). Quasi-daily PPI use (MPR>80%) was associated with an increased risk for vitamin B12 deficiency after <1 year of PPI usage (RR=1.30 [95%CI: 1.20-1.41]), compared with low-level usage (MPR<40%). Surprisingly, RRs at MPR>80% remained stable up to ≥5 years of PPI usage, varying from 1.33 [1.18-1.49] to 1.38 [1.24-1.53] over time. Moderate exposure (MPR:40-80%) showed intermediate RRs varying from non-significant (1.09 [0.93-1.29]) to 1.27 [1.15-1.39]. Conclusions: In this large cohort of older adults who were new PPI users, the risk of vitamin B12 deficiency appears associated only with the degree but not duration of PPI usage.

Can undergraduate students help change older adults’ self-efficacy for making nutrition-related decisions in a 45-minute nutrition workshop?

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Background: The Social Cognitive Theory (SCT) suggests that health behaviours can be modified by improving self-efficacy (belief in ability to succeed at a task), enhancing knowledge of health benefits and outcome expectations and developing goals based on facilitators and barriers. These constructs explain 35-59% of the variance in dietary choices. The purpose of this study was to determine the impact of student-led nutrition workshops on participants’ self-efficacy, knowledge, outcome expectations, goal setting ability, and barriers related to implementing evidence-based nutrition guidance for disease prevention and management. Methods: Life Science students in a Level-4 Advanced Nutrition course at McMaster University (Hamilton, ON) developed workshops on nutrition recommendations for the prevention and management of age-related diseases (sarcopenia, osteoporosis, osteoarthritis, Alzheimer’s Disease, hypertension). The students were instructed to design 45-minute interactive workshops based on Dietitians of Canada guidance and other peer-reviewed evidence to improve self-efficacy related to nutrition. Workshops were delivered at various sites in Hamilton (subsidized living facilities, seniors centers, older adult fitness centers). Community members who attended the workshops completed pre- and post-surveys to assess SCT constructs. For each SCT construct, participants rated their level of confidence on a 10-point Likert scale. Analysis was performed with SPSS, and pre-and post-survey means were compared using an independent Student’s t-test. P<0.05 was significant. Results: A total of 70 community members (40/70 females [57%], mean (SD) age 71 (8) years) attended 9 workshops. There was an improvement in self-efficacy for decision making around selecting foods that are beneficial for managing their disease [pre-survey 6.4±2.9 versus post-survey 8.2±2.0, p<0.05]. Knowledge of the nutrition-related health benefits [6.2±3.0 versus 8.1±1.9, p<0.05] and dietary recommendations [6.1±2.9 versus 8.1±2.4, p<0.05] for disease management also improved. After completing the workshops, participants were more confident in goal-setting abilities and
overcoming barriers to healthy eating. Conclusion: This study suggests that undergraduate students can positively influence community members’ self-efficacy for making nutrition-related decisions for disease prevention and management. Involving students in interventions where SCT-structured, interactive nutrition workshops are used may help conserve healthcare resources and reach older adults living in various community settings, including subsidized living facilities. (Funding: MacPherson Institute, McMaster University.)

Effects of high-intensity interval exercise and chocolate milk on glycemic control, appetite, and cognitive performance in 9-13 year-old children

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Few Canadian children are meeting milk and alternatives or physical activity (PA) guidelines. Chocolate milk has a similar total sugars content to other sugars-sweetened beverages, but has been shown to suppress appetite, attenuate glycemic response, and may favourably affect cognitive performance via its carbohydrate and protein content. High intensity interval exercise (HIIE), a time-efficient PA option, may positively affect glycemic control and appetite and may improve cognitive performance via HIIE-induced cortisol release. The objective of the present study was to determine the separate and combined effects of chocolate milk and HIIE on appetite, glycemic control, and cognitive performance in children. Using a 2x2 within-subject repeated measures design, 20 children (age=11.4±0.34 y) performed HIIE on a cycle ergometer (7 x 60 s sprints, interspersed by 60 s active recovery) or sitting, followed by consumption of 163 kcal chocolate milk or water. Blood glucose via finger prick, subjective average appetite via visual analogue scales and cognitive performance were assessed at baseline, 10, 30, 60 and 90 min post-treatment. Salivary cortisol was assessed at baseline, 10 and 30 min. Cognitive tests evaluated executive functioning, working memory, selective attention, verbal learning and delayed declarative memory. Chocolate milk decreased subjective average appetite compared to HIIE (Δ -21.6±4.5 mm, p<0.001) and sitting (Δ -13.6±4.6 mm, p=0.016). Blood glucose increased by 0.37±0.06 mmol/L following chocolate milk consumption compared to water (p<0.001), but was not affected by HIIE (p=0.12). Children recalled more words (Δ 1.12±0.5 words, p=0.02), had faster reaction time during the n-back task (Δ -95.6±29.3 ms, p<0.01) and slower reaction time to incongruent stimuli during the Stroop test (Δ 66.0±24.0 ms, p<0.05) following HIIE compared to sitting. Cortisol was not affected by chocolate milk (p=0.092) or HIIE (p=0.921). While HIIE was insufficient to improve glycemic response or subjective average appetite, it may improve performance in several cognitive domains. HIIE should be promoted as a means to improve cognitive performance in children; future work should investigate potential mechanisms responsible for improved cognitive performance after HIIE. (Supported by: Ryerson University Faculty of Community Services Seed Grant, and the Nutrition and Exercise Testing (NExT) Laboratory.)

Plasma 25-hydroxy vitamin D level is not associated with cognitive function in adolescent school children

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Compelling evidence from basic science research support the hypothesis that vitamin D (VD) is involved in brain development and function. However, epidemiological studies on the association between VD and cognitive function, particularly in children are inconclusive. The very high prevalence of VD deficiency (VDD) globally together with importance of VD for brain development and function warrants that the association between VDD and cognitive function in children be investigated. We hypothesized that VDD in adolescents is associated with poor cognitive function. This hypothesis was tested in a cross-sectional study conducted on a nationally representative sample of adolescent boys and girls from public middle schools in Kuwait. Cognitive function was tested using the Raven’s Standard Progressive test (SPM). Plasma 25-hydroxy VD (25-OH-D) was measured by liquid chromatography-tandem mass spectrometry. Spearman correlation coefficient and scatter plot were used to assess the crude correlation between the SPM standard score and VD. Linear regression, quantile regression and ordered logistic regression were used to assess the association between VD and SPM standard score. Data were analyzed on 1370 adolescents (49.2% boys). The median (inter-quartile range) of 25-OH-D level was 29.7 (19.2-44.1) nmol/L, which was significantly different between females and males (p<0.001). The mean (SD) of standard scores was 101.30 (23.43) which was not significantly different by gender (p=0.12). Very weak positive correlation was found between 25-OH-D level and standard score (Spearman correlation coefficient=0.06; p=0.038) which became evident among males after stratification by gender (Spearman correlation coefficient=0.14; p<0.001 and Spearman correlation coefficient=0.03; p=0.42 for males and females respectively). Univariate linear regression analysis also showed association between standard score and 25-OH-D categories after stratification by gender, but adjusting for parental education was sufficient to explain this association. There was no significant association between 25-OH-D level and standard scores before and after adjusting for confounders, as assessed by multiple linear regression, bootstrap methods and quantile regression. In conclusion, our data do not provide a convincing evidence of an association between plasma 25-OH-D and cognitive function. (Supported by Kuwait University Grant # WPO13/13.)

Effect of low-fat and high-fat dairy consumption on blood pressure and other cardiometabolic risk factors

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Data from epidemiological studies suggest that intake of total and low-fat dairy intakes are associated with reduced risks of hypertension, while data from randomized controlled trials suggest that dairy consumption has no effect on blood pressure (BP). The objective was to assess how consumption of low-fat MILK and regular-fat CHEESE enriched in gamma-aminobutyric acid (GABA) influences daytime ambulatory BP and other cardiometabolic risk factors. Present in some cheeses, GABA has been shown to have potential antihypertensive properties. In a randomized crossover controlled feeding study, 55 healthy men and women with daytime systolic blood pressure (SBP) ≥125 mmHg were randomly assigned to sequences of 3 isocaloric diets comprising (per 2500 kcal): 1) 3 servings of 250 mL of 1%-fat MILK; 2) 50 g of 31%-fat cheddar CHEESE (GABA 10 mg); 3) no dairy (CTRL diet). Each experimental diet had a 6-week duration and was separated by a 4 to 12-week washout period. Milk and cheese were replaced by a mix of equivalent nutrients from different foods in the control diet. The experimental diets were otherwise developed using similar recipes provided in different amounts to match for total fat, protein and carbohydrate content. Cardiometabolic outcomes were measured before and after each treatment. SBP and diastolic BP (DBP), both ambulatory and resting, were similar among the 3 diets (P>0.05). However, baseline ambulatory DBP significantly modified the daytime response to diets (P=interaction=0.04). In subjects with ambulatory DBP below the median of the group (81 mmHg), MILK decreased ambulatory DBP by 2 mmHg compared to CTRL (P=0.02). This difference was not ob-
Low newborn vitamin D status is associated with lower lean mass at 6 mo of age despite infant vitamin D supplementation

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Vitamin D status is positively associated with lean mass in healthy infants born with sufficient vitamin D stores. The objective of this study is to test whether rapid correction of low vitamin D status early in life improves lean mass. Therefore, an open-label randomized, parallel group controlled trial (NCT02563015) was conducted. Healthy term born infants of appropriate weight for gestational age (37-42 weeks post menstrual age) who were recruited from Montreal. Capillary blood samples were collected between 24-36 h for serum 25-hydroxyvitamin D [25(OH)D] measurement (Liaison, Diasorin Inc.). Infants with serum 25(OH)D < 50 nmol/L (n=72) were randomized to receive 400 or 1000 IU/d until 12 mo of age. Those with 25(OH)D ≥ 50 nmol/L (n=21) were recruited to the reference group, receiving 400 IU/d. Data available for analysis is up to 6 mo and remains blinded. Anthropometry and lean mass (dual-energy x-ray absorptiometry) were measured at 1, 3, and 6 mo. Skin color was measured using a spectrophotometer. Differences between treatment and reference groups were tested using mixed model and repeated measures ANOVA accounting for the effects of sex, season of birth, skin color and gestational age (GA). Healthy breastfed newborns (51 males, 42 females) were 39.0±1.1 wk GA and 3392±392 g at birth. Infants in the treatment group had lower serum 25(OH)D concentrations at birth compared to the reference group (39.4±19.0 vs. 67.2±12.7 nmol/L, P=0.001). At 6 mo of age, serum 25(OH)D concentration was considerably higher in treatment group (n=47) compared to the reference group (n=15) (105.0±29.4 vs. 72.3±31.3 nmol/L, P<0.001). Whole body lean mass at 6 mo (5034.56±2072.1 vs. 5419.33±2567.7 g, P=0.03) and its accretion rate (316.9±106.2 vs. 377.2±80.8 g/mo, P=0.02) were significantly lower for the combined blinded treatment group compared to the reference group respectively. There were no differences between groups in lean mass at baseline and in weight or length at any timepoint. Lean mass and its accretion rate in infants born with low vitamin D stores were lower at 6 mo compared to those with sufficient stores. Further investigation is required to determine if rapid correction of 25(OH)D levels can reverse this observation. (Funded by Canadian Institutes of Health Research.)

Implications for adherence to healthy eating guidelines for early years centres on PEI

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Early Years Centres (EYCs) across Prince Edward Island (PEI) were created to offer an accessible and sustainable system that provides high quality early learning opportunities for young children. As part of this initiative, the Healthy Eating Guidelines for EYCs on PEI were collaboratively developed with the goal of creating the healthiest environments possible for young children. Very little data exists in a setting that has a strong potential to positively influence early childhood development and behaviours. EYCs provide a unique research opportunity to examine the impact of the support structure offered to centres. The purpose of this research was to assess the level of implementation and determine the impact of the support structure for the Healthy Eating Guidelines for EYCs on PEI. A mixture of one-on-one interviews and focus groups were conducted with 27 participants exploring the barriers and supports for the Healthy Eating Guidelines in EYCs on PEI. Participants included a total of 13 EYC directors, 4 early childhood educators, 3 cooks, and 7 parents. Inductive thematic analysis of transcripts and field notes revealed barriers affecting adherence to the Healthy Eating Guidelines including: the high cost of healthy food options, food preferences, lack of support, lack of communication, attitudes and beliefs, and lack of skills. The supports identified for the Healthy Eating Guidelines were government assistance, centre buy-in, parental and community support, training, the guidelines themselves, and food education tools. Knowledge gained from this inquiry will be used to inform and enhance the comprehensive approach to support healthy eating among young children on PEI. (This research is funded through the Canadian Foundation for Dietetic Research.)

High doses of medium chain fatty acids do not induce lipotoxicity nor insulin resistance in HEPG2 hepatocytes

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Context: Long chain fatty acids (LCFA) such as palmitate (C16) are potent contributors to obesity, fatty liver disease and insulin resistance (IR). Conversely, growing evidence suggests that medium chain fatty acids (MCFAs), namely hexanoate (C6), octanoate (C8) and decanoate (C10), can improve metabolic health. Indeed, we recently reported (APNM, vol 42, 2017) that a high-fat diet loaded with medium chain triglyceride oil (MCT-oil) instead of lard (rich in LCFA) did not induce body weight gain, liver steatosis, glucose intolerance, IR or global adiposity in mice. Objective: To elucidate the mechanisms by which MCFAs avoid hepatic steatosis and IR. Methods: HepG2 cells were exposed 24h to increasing doses of C16, C6, C8 and/or C10 then submitted to an MTT viability test. HepG2 cells exposed 24h to 0.25mM of either C16 or MCFAs were submitted to: a) BODIPY fluorophore staining; b) quantification of key anabolic (e.g. SREBP-1) and catabolic (e.g. CPT-I) gene expression, by Western blot and qRT-PCR; c) 3H-deoxyglucose uptake assay following a 1h exposure to 100mM insulin; d) evaluation of the phosphorylation levels of AKT1, mTOR and p70S6K kinases in response to insulin stimulation (100nM, 10min); e) and fatty acid beta-oxidation assay based on the conversion rate of 14C-oleate into 14CO2.

Results: While C16 significantly decreases HepG2 cell viability in a dose-response fashion, MCFAs do not. At 0.25mM, the threshold of C16 toxicity, MCFAs do not induce a rise in lipid droplet number and size, while C16 does so substantially. In the same time, MCFAs maintain the basal beta-oxidation rate, while C16 inhibits it two-fold. Furthermore, anabolic and catabolic genes are respectively downregulated and up-regulated by MCFAs, at both mRNA and protein levels, and inversely regulated by C16. Finally, whereas C16 inhibits insulin-induced glucose uptake and the underlying phosphorylation of the AKT1-mTOR-p70S6K axis, MCFAs treatment does not alter them. Conclusion: In hepatocytes, MCFAs increase lipid oxidation and impede both lipogenesis and lipid esterification, thus do not cause steatosis or lipotoxicity. Then, insulin signalling pathway remains unaltered, preserving insulin sensitivity. These results demonstrate that MCFAs are promising bioactive lipids in the management of metabolic diseases. (Supported by NSERC and Aligo Innovation.)

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Gut-derived short chain fatty acids alter lipidomic profile and have sex-specific effects to regulate lipid metabolism in Long Evans rats

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Fermentation of fibers by the colonic microbiota generates acetate, propionate and butyrate, the main short-chain fatty acids (SCFAs). After production, SCFAs enter diverse pathways, thereby affecting metabolic regulation. However, the sex-specific effects of SCFAs in metabolic regulation are not known. Furthermore, it is not known whether SCFAs alter the fatty acid composition of specific lipid classes important in metabolic regulation. Male and female Long Evans rats (7-8 weeks old) were divided into control and treatment groups (n=6 per group) and fed normal Chow diet. Treatment groups were given intraperitoneally a mixture of acetate, propionate and butyrate (molar ratio 60:20:20) each day for 7 days. Blood and tissues were collected 20 minutes after the last injection. Plasma and hepatic total cholesterol (TC) and triacylglycerols (TAG) were measured. Hepatic and plasma lipids were extracted and fatty acid composition was measured using LC-MS. The mRNA expression of hepatic genes involved in lipid synthesis and breakdown were measured by real-time PCR. Two-way ANOVA was used to determine the main effects of treatment and sex. SCFAs significantly decreased plasma (p<0.0001) and hepatic (p<0.0005) TC in males, compared to controls; there was no effect in females. SCFAs had no effect on the mRNA expression of HMG-CoA reductase or cholesterol 7α-hydroxylase. SCFAs caused a decrease in arachidonic acid in plasma cholesterol esters (CE) of both males and females, compared to controls. SCFAs also caused a significant decrease in plasma (p<0.05) and hepatic (p<0.03) TAG in males, but not in females. SCFAs caused a decrease in saturated fatty acids (p<0.0001) in plasma TAG of females. Interestingly, both males and females showed a decrease in the mRNA expression of acetyl-CoA carboxylase-1 (p=0.0004). Furthermore, SCFAs caused enrichment of plasma phosphatidylcholine (PC) with omega (n)-3 FAs (p<0.001); however, there was no change in brain PC fatty acids. Our findings demonstrate that SCFAs improve plasma and hepatic lipid profile in a sex-specific manner. Furthermore, SCFAs decreased arachidonic acid incorporation in CE, while increasing n-3 FAs in PC; these alterations may contribute towards beneficial effects of SCFAs. Our findings support that SCFAs may represent a useful therapeutic strategy in health. (Funded by Memorial University.)

Body composition in offspring of obese fathers–mouse model

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Background. It is widely recognized that parental diet can substantially impact offspring metabolic function. Offspring of obese parents have increased risk of obesity. It is now recognized that there is a paternal contribution to this phenomenon. Based on this we did a comparative study of body composition and fat distribution of obese and lean dams and their offspring. Methods: Male C57Bl/6/N mice were placed for 12 weeks on either a high fat diet (HFD, 45% kcal fat) or a low fat diet (LFD, 10% kcal fat) and then mated with females on LFD. After mating, parents were maintained on their preconception diets. All offspring were maintained on regular mouse chow. Body composition was measured by nuclear magnetic resonance (NMR). Fat pads were dissected at the time of euthanasia. Results. Males on HFD at time of mating (15 w) and at 6 month were heavier than their counterparts on LFD. Based on NMR, body weight (BW) was increased due to increases in fat and lean compartments and also fluid. Extra fat was accumulated in white adipose tissue (WAT), subcutaneous (S), retroperitoneal (R) and mesenteric (M) depots, but not in gonadal WAT or interscapular brown adipose tissue. We also examined offspring vs their sires at 6 months. It was no significant changes between offspring and sires on LFD. Male offspring of HFD sires weighed less than their sires on HFD at the same age due to decreases in fat, lean and fluid compartments. There were no differences in total BW of offspring from the two groups. However, there were significant differences in body composition, with HFD male offspring having a higher Sfat and a lower fluid. All WAT depots, M, S, G, and R, were heavier in HFD male offspring. Only the R depot was heavier in female HFD offspring. Conclusion: HFD with 45% of fat for 12 weeks results in obesity and changes in body composition in male mice that affects the offspring in a sex-specific manner, suggesting an epigenetic mechanism.

An investigation of women’s experiences seeking pregnancy-related nutrition information in Ontario, with an emphasis on online resources

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Studies have shown that the diet quality of Canadian pregnant women is poor and prenatal nutrition education in Canada is lacking, causing women to turn to other sources of information. In particular, the internet is a popular source of prenatal nutrition advice. There are no studies to date on the information-seeking behaviours of pregnant women in Canada. This study aimed to 1) determine when and where women in Ontario search for pregnancy-related nutrition information, 2) gain a better understanding of their experiences seeking this information online and 3) determine if online sources are meeting their needs. Online questionnaires were completed by 97 pregnant women in Ontario to determine how they got pregnancy-related nutrition information and when during their pregnancies they sought this information. A set of 10 primiparous women then participated in semi-structured telephone interviews to gain an in-depth understanding of their experiences with seeking prenatal nutrition information online. Descriptive statistics were used to analyze the survey and thematic analysis was used to analyze the interview data. The internet was found to be the most commonly used source for prenatal nutrition information, and information-seeking was most common during the first trimester of pregnancy, although most women continued to look for nutrition information throughout their pregnancies. Convenience was a major reason for seeking information online. The participants made positive changes to their diets after reading nutrition information online, however they expressed a lack of trust in online sources of information. Some negative emotions of confusion, frustration and worry arose when seeking information online. Women found internet sources of information to be important as health care professionals did not always provide women with adequate nutritional support. These results indicate a need for greater availability of credible, personalized nutrition support during pregnancy, whether this be through health professionals or web-based materials. Health professionals should also be encouraged to guide their patients in finding nutrition information online to ensure they are seeking accurate and current advice.

The effect of energy intake misreporting on the associations between dietary patterns derived by K-means clustering and risk of all cancers: findings from Alberta’s Tomorrow Project cohort

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Exploring associations between diet and cancer risk in observational studies may be approached by deriving dietary patterns that provide a more holistic view of diet than simply reporting on intakes of individual nutrients and foods. However, estimates of such associations rely on accurate measures of dietary data. Although food frequency questionnaires (FFQs) have traditionally been used in large cohorts due to their cost-effectiveness and efficiency, they are prone to systematic
biases with respect to energy intake (EI). Using data from Alberta’s Tomorrow Project, we aimed to determine the effect of different ways of handling EI misestimation during pattern analysis on observed associations between dietary patterns and risk of all cancers combined (except non-melanoma skin cancer). Data from participants (n=9,847 men, 16,241 women) who completed the past-year Canadian Diet History Questionnaire I and sociodemographic and lifestyle questionnaires, were linked to the Alberta Cancer Registry (follow-up time (median[IQR]= 12.5(5.3) years). Plausible reporters (n=5,128 men; 8,627 women) and misreporters were identified using the revised-Goldberg method. Using K-means clustering, three dietary patterns were identified: healthy, meats/pizza, and whole-meal breads. EI misreporters were excluded before clustering (ExBefore), after clustering (ExAfter), included during clustering (Inclusion), or reassigned into dietary patterns of ExBefore cluster solutions using the nearest neighbor method (Inclusion NN). The healthy cluster was used as the reference group in Cox proportional hazards ratio (HR) analyses. In men, positive associations were observed for all cancers with the whole-meal breads pattern in all cluster solutions, and with the meats/pizza pattern in the “Inclusion” and “ExAfter” cluster solutions. In women, increased risks were observed for all cancers with the whole-meal breads and meat/pizza patterns in the ExBefore (HR (95% CI): 1.30 (1.05-1.59)) and Inclusion NN (1.15 (1.01-1.31)) solutions, respectively. Our results suggest that how EI misestimation is handled during cluster analyses influences observed associations between dietary patterns and risk of all cancers combined. Identifying optimal approaches for accounting for EI misestimation using biomarker-based studies could improve our understanding of the association between dietary patterns and cancer risk. (Financial support: Alberta Health, Alberta Cancer Prevention Legacy Fund, Alberta Cancer Foundation, The Canadian Partnership Against Cancer, and Alberta Health Services.)

Managing hyperbilirubinemia in an ultrashort bowel syndrome patient with parenteral nutrition containing pure fish oil emulsion and high dose levocarnitine

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Intestinal failure associated liver disease (IFALD) is a known complication in short bowel syndrome patients receiving long-term home parenteral nutrition (HPN) support. Multidisciplinary management is required to address this complication. A 39-year-old male patient developed superior mesenteric artery thrombosis secondary to antiphospholipid antibody syndrome. He underwent massive bowel resection leaving him with a duodenal stump, not in continuity to the remaining colon. HPN therapy became his only source of nutrition while awaiting intestinal transplantation. After a few months of follow-up, laboratory investigations showed progressive elevation of aspartate aminotransferase (AST), alanine transaminase (ALT) and alkaline phosphatase (ALP). Ultrasoundography of abdomen and blood tests for viral hepatitis were all unremarkable. Drug-related causes were also ruled out. This led to the change of his HPN formulation from soybean oil-based (Intralipid 20%) to olive oil-based lipid emulsion (Clinoleic 20%) which stabilized his liver function. A year later, after developing two episodes of catheter-related infections, his liver function tests including bilirubin continued to elevate gradually. His HPN solution was subsequently modified by reducing total calories from dextrose and lipid emulsions, and high dose lipid emulsions, and levocarnitine should be considered in a deteriorating patient with progressive IFALD.

Vitamin D status is positively associated with hepcidin in healthy young children

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Vitamin D deficiency has been associated with greater prevalence of anemia through reduced erythropoiesis. In vitro, both 25-hydroxyvitamin D [25(OH)D] and calcitriol inhibit hepcidin expression, with further implications in iron metabolism. The aim of the study was to examine the associations between vitamin D status and hepcidin in healthy children. Healthy 2-5 year old children (n=420) attending pre-school in Montreal, Quebec, Canada were sampled from randomly selected daycares. Demographic and anthropometric data were assessed. Capillary blood samples were collected to assess plasma 25(OH)D, hepcidin, hemoglobin, ferritin, soluble transferrin receptor (sTfR) and C-reactive protein (CRP; samples with values > 5 mg/L were excluded from analysis). Body mass index z-scores for age (BAZ) was calculated using the World Health Organization (WHO) growth standard. WHO cut-offs were used to define iron deficiency and iron deficiency anemia. Vitamin D status was categorized as 25(OH)D <50.0 nmol/L (insufficient), 50.0-74.9 nmol/L (sufficient-group 1) and ≥75.0 nmol/L (sufficient-group 2). Body iron (mg/kg) was calculated as [−log(sTfR) ferritin ratio]–2.8229/0.1207. Partial correlations and multivariate regression analyses were done with adjustment for age, sex and race. Differences among vitamin D categories were tested using mixed-model ANOVA. Children were 3.81±1.0 y with BAZ of 0.47±0.96 kg/m2, 25(OH)D was 78.9±28.2 nmol/L, body iron was 3.91±2.21 mg/kg, and 51.2% were white. Based on the biomarkers, 10.5% were vitamin D insufficient, 16.9% had iron deficiency and 3.1% had iron deficiency anaemia. Plasma 25(OH)D concentrations correlated positively with hepcidin (r=0.16 p=0.001), sTfR (r=0.10 p=0.035) and negatively with body iron (r=-0.13, p=0.01). Vitamin D insufficient children had lower hepcidin concentrations and lower sTfR compared to children with 25(OH)D ≥ 75 nmol/L (6.91±26.75 vs 16.0±19.3 ng/mL; p=0.004 and 0.03±0.68 vs 4.42±1.03 mg/L; p=0.042, respectively). In the multivariate regression model, 25(OH)D and hepcidin maintained the positive association (β=0.107; p=0.004). Positive associations between hepcidin and 25(OH)D in this healthy study population are consistent with the very low prevalence of iron deficiency anaemia. Further research is needed to clarify if children with insufficient vitamin D status have higher circulating concentrations of calcitriol to explain the lower hepcidin and sTfR.

Consumption of a western diet impacts on joint inflammation in a murine model of rheumatoid arthritis

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Introduction: Mouse models are used to investigate the effectiveness of nutritional or pharmaceutical interventions for the prevention or treatment of human diseases. These models generate important pre-clinical data for screening purposes, however the translation of results to humans is often disappointing. A potential problem is that the composition of standard mouse chows has very little resemblance to human diets. In this study, a commercial chow or a diet based on the typical Western diets were compared in a mouse model of rheumatoid arthritis (RA). Methods: A randomized, blind, controlled experiment investigated the effects of a commercial chow diet (Charles River rodent diet 5075) with diets formulated to mimic the typical “western” diet using the (K/BxN) mouse model of RA. Chow diets from 201 to 90 U/L and bilirubin reduced from 150 to 82 μmol/L. This case report demonstrates nutritional and medical interventions to address IFALD in an ultrashort bowel syndrome adult patient. Modification of HPN solutions by using pure fish oil emulsion, not the mixture of lipid emulsions, and levocarnitine should be considered in a deteriorating patient with progressive IFALD.
Background: Aging is associated with sarcopenia (low muscle mass) and dynapenia (weakness) leading to disabilities and morbidity. No diagnostic criteria are currently derived from Canadian populations.

Objectives: 1) To identify cut-points of low appendicular lean mass (ALM) and low strength as predictors of impaired physical performance in a large Canadian cohort. 2) To determine whether sarcodynapenia, i.e. the combined conditions, is an independent predictor of chronic diseases. Methods: Cross-sectional analyses were conducted on baseline data from 4,725 and 4,363 free-living men and women (65-86 y, 96.8% Caucasian) of the Canadian Longitudinal Study on Aging (CLSA) comprehensive cohort. Physical performance was evaluated from gait speed, timed-up-and-go, chair rise, and balance tests; a score was computed using weighted factor analysis. Strength was measured by handgrip dynamometry; ALM, by dual-energy x-ray absorptiometry and ALM index (ALMI; kg/m2) was calculated. Classification tree analyses determined optimal sex-specific cut-points of low ALM and low strength predicting impaired physical performance (score<1.5 SD below the mean). Associations between sarcodynapenia and diseases were assessed by logistic regressions. Results: Mean (±SD) handgrip strength was 39.8±8.4 and 23.9±5.1 kg in men and women; ALMI was 8.5±1.02 and 6.7±0.98 kg/m2. Correlations between physical performance score, strength, and ALMI were modest (r=0.327, all p<0.01). We identified <33.1 kg and <20.4 kg as cut-points to define dynapenia in men and women, respectively, corresponding to 21.5% and 24.0% prevalence rates. Sarcopenia cut-points were <7.76 kg/m2 in men and <5.72 kg/m2 in women; prevalence rates of 21.7% and 13.7%. Overall, 8.3% of men and 5.5% of women had sarco-dynapenia. Sarco-penic participants were older and had lower fat mass and BMI than non-sarcopenic. In men only, sarco-dynapenia was an independent predictor of diabetes and COPD, but not of peripheral vascular diseases, kidney diseases and heart conditions. Conclusions: The proposed function-derived cut-points established from this large, contemporary Canadian cohort should be used to guide the identification of sarcopenia and dynapenia in older Canadians, and to further investigate the role of nutrition in each. The modest agreement between these conditions denotes potential distinct health implications justifying to study both components separately.

New cut-points for the diagnosis of sarcopenia and dynapenia in Canadian older adults

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Familial resemblances in plasma carotenoid levels

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Carotenoids are a reliable biomarker of fruit and vegetable intakes. Inter-individual variability in blood levels of circulating carotenoids has been observed and may be, at least partly, due to genetic factors. Up to now, the only study that has reported high genetic heritability of α- and β-carotene levels has not considered the shared environmental component. The aim of the present study was to estimate the contribution of both genetic and common environmental effects to the variance of plasma carotenoid levels (α-carotene, β-carotene, β-cryptoxanthin, lutein, lycopene, zeaxanthin, and total carotenoids). A total of 48 healthy subjects from 16 families were recruited. Plasma carotenoid levels were measured using high performance liquid chromatography analysis. Heritability estimates of carotenoid levels were calculated using the variance component method implemented in QTDT. The phenotypic variance (VP) of each carotenoid was partitioned into genetic effect (Va), common environmental effect (VC), and non-shared environmental effect (Ve). Lutein and lycopene showed a significant familial effect (Va and VC > 0; P-values of 6x10⁻5 and 3.3x10⁻3, respectively). Maximal heritability (Va+VC/VP), genetic heritability (Va/VP), and common environmental effect (VC/VP) for lutein were 88.3%, 43.8%, and 44.5%, respectively. For lycopene, corresponding values were 45.2%, 0%, and 45.2%, respectively. In conclusion, familial resemblances in lycopene levels were mainly attributable to common environmental effect, whereas familial resemblances in lute...
tein levels were both attributable to genetic and common environmental effects. To the best of our knowledge, this is the first study to report combination of both genetic and common environmental effects to the variance of predominant plasma carotenoid levels in healthy families. (This work was supported by the Canada Research Chair in Genomics Applied to Nutrition and Metabolic Health.)

Pleasure-oriented messages in the promotion of healthy food choices in adult men and women

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Recent literature suggests that eating pleasure would be an innovative approach to promote healthy dietary habits. This study aimed to compare the effects of pleasure versus health-oriented messages promoting healthy eating on subsequent food choices. One hundred and seventy-three adults (57.2% women, 35.8 ± 13.4y), unaware of the true objective of the study, were randomized in three groups: pleasure (n=58), health (n=58) and control (n=57). All participants completed 24h food recalls to assess their diet quality using the Healthy Eating Index (HEI). Participants in pleasure or health groups first had to read a leaflet presenting pleasure or health messages whereas those in the control group received no leaflet. The content of the leaflets was developed using data from focus groups. Accordingly, the “pleasure” leaflet highlighted four dimensions related to the pleasure of eating healthily: 1) sharing meals, 2) discovery/variety, 3) cooking, and 4) organoleptic aspects of food. The “health” leaflet focused on dimensions associated with the health benefits of eating healthily: 1) general health, 2) weight management, 3) level of energy, and 4) control of hunger and satiety. Participants were thereafter invited to choose four food items, i.e. main course, side dish, beverage and dessert, in a cold buffet offering healthy and non-healthy foods. A score of 0 was given to non-healthy choices and a score of 1 was attributed to healthy choices. A global score (0 to 4) was then calculated. No difference was observed between the three groups for the global score (p=0.64). However, pleasure- and health-oriented messages positively influenced the choice of the main course since a greater proportion of people chose a healthier main course under the health and the pleasure condition than under the control condition (condition’s effect, p=0.0131). We also found a marginal effect of the messages among participants with suboptimal dietary habits (median HEI score < 56.3; p=0.0665), participants with lower HEI who read the health or pleasure leaflet made healthier food choices compared to participants from the control group. Findings suggest that pleasure-oriented messages may positively influence the quality of subsequent dietary choices similarly to more traditional health messages.

Genotype imputation from genome-wide association study hits uncovers new variants in IQCJ-SCHIP1 associated with plasma triglyceride levels in response to an omega-3 fatty acid supplementation

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Numerous factors can affect the metabolic response to a dietary intervention. In many cases, genetic factors contribute to the large inter-individual variability of metabolic responses. Yet, genetic factors are often overlooked. A recent genome-wide association study (GWAS) conducted by our research group demonstrated that four single nucleotide polymorphisms (SNPs) in the IQCJ-SCHIP1 gene (rs2621308, rs1449009, rs61332355 and rs2621309) may modulate the plasma triglyceride (TG) response to an omega-3 (n-3) fatty acid (FA) supplementation. The aim of this study was to test whether imputation analyses could identify additional IQCJ-SCHIP1 SNPs associated with the TG response. To do so, our group supplemented 141 individuals with n-3 FA for a 6-week period, providing 3g/day of n-3 FA (1.9-2.2g of EPA and 1.1g of DHA). TG levels were measured before and after the intervention. Genotypes of 1684 SNPs in IQCJ-SCHIP1 originally used to conduct the GWAS (Illumina Infinium Omni5 BeadChip) were used to perform imputation analyses. By referring to 1000 Genomes project data (release 1000G Phase I v3, updated 26 Aug 2012), further genotypes were then inferred using IMPUTE2 algorithms. Association studies based on allele frequency differences between responders (showing a reduction in plasma TG of at least 0.01 mmol/L) and non-responders (no change or increase in plasma TG ≥ 0.01 mmol/L) were then executed in a dominant model with PLINK software. Statistical significance was set at p<10-5. A total of 5242 genotypes were inferred out of GWAS markers after quality control. Association studies identified 12 hits for which allele frequency was significantly different between the two subgroups. Among them, four were already identified in the GWAS, thus revealing eight novel SNPs associated with the plasma TG response to n-3 FAs. Several of these SNPs were in linkage disequilibrium (r2>0.8). The most strongly associated SNP was rs2621307 (p=3.06e-06). In conclusion, genotype imputation refined GWAS signals by identifying novel SNPs in the IQCJ-SCHIP1 gene that may modulate plasma TG levels following an n-3 FA supplementation. (Supported by CMDO-FRQS.)

Examining the nutritional quality of products marketed to children on websites of top food companies in Canada

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Objective: This study aimed to assess the nutritional quality of food and beverage products marketed to children on websites of major food companies in Canada. Methods: The largest packaged food (n=16), beverage (n=12) and chain restaurant (n=13) companies in Canada were selected according to national market share. In Summer 2017, Canadian company websites were scanned for child-directed products and evidence of marketing of such products to children. The saturated fat, sodium and total sugars content of products marketed to children on websites (n=240) was evaluated using thresholds of 5% and 15% of the Daily Value (DV), as outlined in Health Canada’s consultation document on restricting unhealthy food and beverage marketing to children. Nutritional information was sourced from company websites and Nutrition Facts tables on product packaging. The proportion of products exceeding 5% and 15% of the DV for saturated fat, sodium and total sugars was calculated for different food categories. Products for which nutritional information could not be retrieved were excluded (n=23, 10%). Results: In total, 217 products were marketed to children on websites of 32% of companies (n=12). Bakery (n=77) and dairy products (n=45) were most commonly marketed. Overall, 97% (n=211) of products marketed to children exceeded the 5% DV for at least one of saturated fat, sodium or total sugars, while 60% (n=131) of products also surpassed the 15% DV for one or more of these nutrients. The saturated fat, sodium and total sugars content of products varied among food categories. The 5% DV for saturated fat, sodium and total sugars was exceeded by 49%, 39% and 76% of products marketed to children, respectively. Additionally, 32%, 15% and 39% of marketed products contained more than 15% of the DV for saturated fat, sodium and total sugars, respectively. Conclusions: The vast majority of products marketed to children on websites of top food companies in Canada exceed 5% of the DV for one or more nutrients of public health concern, with most also surpassing the 15% DV threshold. These findings support recommendations for government regulations on the nutritional quality of products marketed to children on food company websites. (Funding: CIHR.)
Role of form of dairy products on short-term satiety and post-prandial glycaemic response in young and older healthy adults

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Dairy proteins are known to reduce appetite and improve post-prandial glycaemic response in adults. However, few studies have explored form of dairy as usually consumed in both young and older adults. Additionally, studies have yet to be designed to test the feasibility of Health Canada’s draft guidance documents for food health claims for satiety and the reduction in post-prandial glycaemia. Therefore, this study was also designed to evaluate the potential for dairy products to carry comparative health claims. We report here the effect of form of dairy products on post-ingestion subjective appetite and glycaemic control in young and older adults. In a randomized cross-over design, 29 healthy young adults (23.6 ± 0.6 y old; BMI 21.8 ± 0.4 kg/m²) and 30 healthy/overweight older adults (65.2 ± 0.5 y old; BMI 24.7 ± 0.6 kg/m²) consumed one serving (according to Health Canada’s reference amounts) of skim milk (0.1% M.F.; reference food), whole milk (3.25% M.F.), plain Greek yogurt (2% M.F.), cheddar cheese (31% M.F.), and water (energy-free control) after a 12 hour fast. Subjective appetite was measured every 15-30 minutes over 3 hours; blood glucose and insulin were measured at baseline and every 15-30 minutes over 2 hours in a subset of 23 participants (young, n=11 and old, n=12). All dairy treatments reduced post-treatment subjective appetite AUC over 3 hours by 8-17%, more than water. Greek yogurt reduced appetite 3 hour AUC more than skin and whole milk by 9 and 7%, respectively (P<0.001). Post-treatment blood glucose 2 hour AUC was lower in young compared to older adults by 39% (P=0.005). It was also lower after cheese and Greek yogurt compared to skin milk by 75 and 39%, respectively (P<0.0001). Post-treatment insulin AUC after cheese was 7-10 fold less than after skin and whole milk, and Greek yogurt (P<0.0001). We conclude that form of dairy may merit consideration for health claims in managing satiety and glycaemia. (Funding: Supported by a contribution from the Dairy Research Cluster Initiative (Dairy Farmers of Canada, Agriculture and Agri-Food Canada, and the Canadian Dairy Commission).)

Adipose tissue morphology and inflammation after high-dose DHA vs. EPA supplementation: the compared study

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Knowledge, attitudes and perceptions of carbohydrates among nutrition-major and nutrition-elective undergraduates in Canada

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Background: Nutrition professionals play an important role in improving Canadians’ health by communicating evidence-based food and nutrition information. Students enrolled in a Canadian university nutrition degree program (referred to as nutrition-major students) gain knowledge from nutrition courses and develop critical thinking skills required for future careers as dietitians or other nutrition professionals. However, these students may also be influenced by competing information online and in mainstream and social media that is not always based on scientific consensus. Objective: This study aimed to assess knowledge, attitudes and perceptions of carbohydrates, including sugars, among Canadian undergraduate nutrition-major students compared to those taking nutrition electives but not enrolled in a nutrition program (referred herein as nutrition-elective students). Methods: Cross-sectional surveys were distributed in nutrition classes to students at eight Canadian universities (January 2016-February 2017). The survey contained 32 questions on student demographics, knowledge and perceptions of carbohydrates and sugars. Descriptive analyses and statistical testing for the differences between nutrition-major and elective students in responses to survey questions were performed using SPSS. Results: A total of 1207 students (58% nutrition-major students) participated in the survey. Internet-based sources accounted for one-third of the sources where students obtained nutrition information. About 61% of internet-based sources that students listed were “online” or “website” with no specific qualifiers; about 25% were social media sources such as Twitter, Facebook and YouTube. A significantly higher percentage of nutrition major students correctly answered basic carbohydrate-related questions compared to nutrition-elective students (p<0.01); no difference was observed for sugars-related questions. Sugars-related perceptions were generally negative among both nutrition-major and nutrition-elective students, and frequently similar to popular opinions available on the internet. Conclusions: Certain knowledge gaps and common attitudes on topics related to carbohydrates and sugars were identi-
fied among Canadian undergraduates taking nutrition courses. Nutrition information obtained in the classroom (e.g. textbooks, lectures) is facing increasing competition from internet sources, leading to greater challenges in identifying credible information and questioning personal biases. These results highlight the importance of students developing critical thinking skills to effectively identify evidence-based nutrition information from a variety of resources and opinion outlets.

**Effectiveness of using cell phone messaging to enhance a nutrition and horticulture intervention on knowledge, attitudes, and practices of Kenyan women**

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Developed and developing nations are grappling with food insecurity that is associated with micronutrient malnutrition. In developing countries, where this nutrition problem is severe, food-based agricultural interventions have been shown to be effective in enhancing food availability, access, and, ultimately, micronutrient malnutrition. Current research indicates that the most successful of these interventions have a nutrition education component. There is little known, however, about whether the use of cell phone technology as a nutrition education strategy is effective in improving knowledge, attitudes, and practices among women in developing countries. The primary purpose of this study was to compare the dietary knowledge, attitudes, and practices of women trained using peer-led training sessions only (comparison group, n=29) to that of women who received nutrition-related text messages to augment these sessions (intervention group, n=24). The study was conducted in Naari, in rural Kenya among women belonging to two self-help groups, where there was very high penetration of cell phone ownership and use. The study employed a mixed methods research design to explore the impact of using cell phone messaging on knowledge, attitudes, and practices. After receiving a combined horticulture and nutrition education intervention, women were sent text reminders about key nutrition messages twice weekly over five weeks. Quantitative data were collected during home visits via questionnaire. Qualitative methods included focus groups and assessed the intervention group’s perceptions towards the intervention. Results indicate that attitudes towards nutrition messages relating to iron (p=0.0008) and protecting all nutrients through deworming (p=0.05) were higher in the intervention group than the comparison group. Similarly, a higher proportion of the intervention group reported implementing practices relating to protein (p=0.009) and vitamin A (p=0.02) than the comparison group. Although there were no significant changes in the intervention group’s knowledge, this group was generally more knowledgeable than the latter before and after the intervention. Results suggest that including a cell phone ‘booster’ session in a nutrition education and horticulture intervention can contribute to positive changes in nutrition-related attitudes and practices. (Funding: Queen Elizabeth II Diamond Jubilee Scholarship Program.)

**Effects of 1,25D3-MARRS expression on murine mammary gland development vary based on vitamin D3 status**

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The role of 1,25 dihydroxyvitamin D3 (1,25D3) has been expanded beyond regulation of blood calcium and phosphate homeostasis to include other effects such as cell growth inhibition, and induction of differentiation, depending on the target tissue. The membrane-associated rapid response steroid-binding (1,25D3-MARRS) receptor is credited as a separate 1,25D3 receptor working through rapid cell-signaling pathways. Previous studies have shown that 1,25D3-MARRS plays a promotional role in terminal end bud (TEB) proliferation during mammary gland (MG) development, and may have an impact on breast cancer risk later in life. The purpose of this study was to further elucidate the role of MARRS in the mammary gland under different vitamin D3 statuses using a conditional knockout mouse model. MARRS was reduced in epithelial cells of MGs using the Cre/lox system. Dams were weaned onto semi-purified diets with 10,000 IU/kg, 1,000 IU/kg, or 0 IU/kg of 1,25D3 for 4 weeks before being set up to breed. 4th MGs were collected from 6-week old female MMTV-Cre mice (n=92). MGs were whole-mounted and stained with carmine alum. Tissue growth was assessed by counting the number of TEBs of alveolar branches, measuring the length of the longest ductal extension, and measuring total ductal coverage of the fat pad. There was a significant interaction between genotype and diet concerning TEB formation (p=0.001). Knockout mice on the 1000 IU/kg diet had significantly fewer TEBs (p=0.009) and reduced ductal growth and extension compared to controls on the same diet. Mice on the 0 IU/kg diet had or improved QoL. Using an observational study design, 7 women and 2 men 61±5 years of age with an average BMI of 26±3.5, were administered a self-reported 3-day food recall, a 3-day sleep quantity and quality questionnaire, and a general health questionnaire. The average energy intake was 2155±390kcal, which was lower than the recommended intake (2267±484kcal); yet a significant correlation (R=0.75) was observed with QoL. The average protein intake was 82±18g, which was higher than the recommended intake (61±14g) and had no significant correlation (R=0.48) with QoL. The average vitamin D intake was 3±2.9mcg, which was significantly lower than the recommended intake (15.3mcg) and had no significant correlation (R=0.22) with QoL. The average calcium intake was 766±286mg, which was significantly lower than the recommended intake (1177±66mg) and had no significant correlation (R=0.31) with QoL. The average quantity of sleep was 7.0±0.7 hours, and the average sleep quality was 4.8±1.8 on a ten-point scale. Sleep quality had a significant correlation (R=0.69) with QoL. The average PA completed per week was 200±132-minutes, which had a non-significant correlation (R=−.004) with QoL. The average intensity of exercise was 3.4±2.1 on the Borg Scale, with a significant correlation (R=0.88) with QoL. The results suggest that older adults who: consume foods higher in energy, regardless of nutritional value; obtain higher quality of sleep, independent of quantity; and engage in moderate-to-high intensity PA for well-being, encompassing all aspects of one’s life. It has been found that moderate-to-high intensity physical activity (PA), adequate sleep (6-8 hours) with high quality, and healthy eating habits can maintain or improve QoL. Using an observational study design, 7 women and 2 men 61±5 years of age with an average BMI of 26±3.5, were administered a self-reported 3-day food recall, a 3-day sleep quantity and quality questionnaire, and a general health questionnaire. The average energy intake was 2155±390kcal, which was lower than the recommended intake (2267±484kcal); yet a significant correlation (R=0.75) was observed with QoL. 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The results suggest that older adults who: consume foods higher in energy, regardless of nutritional value; obtain higher quality of sleep, independent of quantity; and engage in moderate-to-high intensity PA for even shorter period; are more likely to be associated with a higher QoL. Our results with respect to energy intake is in line with several cohort studies indicating a significant reduction of energy intake in older adults. This reduced energy intake could have potentially led to inadequate intake of calcium and vitamin D. Further investigation with a larger sample size is required to elucidate the effects of dietary intake, PA, and sleep on QoL. (This study was not funded.)