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### Concurrent session 3: Nutrition and chronic disease THE PREVIEW STUDY: METABOLIC OUTCOMES IN OVERWEIGHT, PREDIABETIC INDIVIDUALS AFTER AN 8-WEEK LOW CALORIE DIET

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**Background/Aims:** The PREVIEW intervention study ([www.previewstudy.com](http://www.previewstudy.com)) is the largest study aiming to prevent T2D among pre-diabetic individuals with a combination of diet, exercise and behaviour modification. Prior to weight maintenance, participants follow a low-calorie diet (LCD). **Methods:** Participants received LCD (810 kcal daily) for 8 weeks (Cambridge Weight Plan<sup>®</sup>). Those who achieved 8% WL were analysed. Two-sided t-tests and linear regression.

**Results:** The weight loss phase was successfully completed by 1,842 (79%) participants. At baseline, mean  $\pm$  SD age was  $51.6 \pm 11.6$  years, BMI  $35.3 \pm 6.5$  kg/m<sup>2</sup>, fasting plasma glucose (FPG)  $6.2 \pm 0.7$  mmol/L, and fasting serum insulin (FSI)  $13.4 \pm 7.8$  mU/L. Average WL was  $10.6 \pm 4.0$  kg, with men losing  $12.7 \pm 4.2$  kg and women  $9.6 \pm 3.4$  kg (gender difference,  $p < 0.001$ ). FPG decreased by  $0.57 \pm 0.7$  mmol/L in men, and by  $0.37 \pm 0.6$  mmol/L in women ( $p < 0.001$ ). FSI decreased by  $5.8 \pm 7.4$  mU/L in men and by  $3.8 \pm 5.4$  mU/L in women ( $p < 0.001$ ). The linear model showed an association of the % weight loss as well as gender on FPG and FSI changes.

**Conclusions:** LCD intervention resulted in marked decreases in body weight, FPG and FSI among prediabetic subjects.

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### THE EFFECT OF MEAL TIMING ON POSTPRANDIAL GLUCOSE AND INSULIN RESPONSE: A CROSSOVER TRIAL IN HEALTHY VOLUNTEERS

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**Background/Aims:** Shift workers have a higher risk of T2DM and CVD compared to non-shift workers. Dietary factors, particularly at night, may be important factors in helping to reduce disease risk. This study examined the postprandial response to an OGTT and a low GI meal eaten at night compared with the morning.

**Methods:** Participants fasted for 10 hours before each meal in each trial. Trial 1 participants ( $n = 10$ ) consumed a glucose solution (75 g in 400 mL) at 8 am and 8 pm. Trial 2 participants ( $n = 9$ ) consumed a low GI meal at 8 am, 8 pm and midnight. Blood was collected for 2 hours (finger prick) and 3 hours (intravenous) for Trial 1 and Trial 2, respectively. Changes in postprandial blood glucose and insulin were examined using iAUC and compared using the Wilcoxon-signed rank test for Trial 1 and the Friedman Test for Trial 2. A  $p$  value  $< 0.05$  was taken as significant.

**Results:** Trial 1, median (IQR) glucose iAUC was significantly greater at 8 pm compared to 8 am (331.88, 166.22 mmol/L·2 hours vs. 181.17, 160.32 mmol/L·2 hours;  $p = 0.007$ ). Trial 2, glucose iAUC at midnight (252.75, 84.80 mmol/L·3 hours) and 8 pm (176.25, 331.21 mmol/L·3 hours) were both greater than 8 am (27.90, 40.98 mmol/L·3 hours),  $p = 0.021$  and 0.008, respectively; but not between the 8 pm and midnight ( $p = 0.594$ ). The same findings were observed for postprandial insulin.

**Conclusions:** Night time eating is associated with reduced glucose tolerance and insulin sensitivity. This study demonstrates timing of food intake may be a new risk factor for CVD and diabetes in shift workers.

**Funding source(s):** N/A

### RESISTANT STARCH AMELIORATES HEAT TREATED DIET-INDUCED GUT PERMEABILITY AND RENAL DYSFUNCTION IN EXPERIMENTAL DIABETES

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**Background/Aims:** Heat treating foods leads to the formation of advanced glycation end-products (AGEs) which contribute to chronic renal injury. Recent research implicates gut dysbiosis in the progression of diabetic nephropathy. This study investigates whether excess consumption of dietary AGEs causes gut dysbiosis, exacerbating renal injury in a type 2 diabetes mouse model.

**Methods:** Six week old diabetic (db/db) and non-diabetic (db/h) mice were randomised ( $n = 12$ /group) to receive a low AGE (LAGE, unbaked rodent chow) or a high AGE diet (HAGE, baked at 160°C for 1 hour), with or without resistant starch (RS) for 10 weeks. 24-hour urine was collected and albuminuria was measured. Intestinal permeability was assessed *in vivo* by the clearance of FITC-labelled dextran (500 mg/kg body weight). Statistical differences were assessed by one-way ANOVA.

**Results:** The high AGE diet exacerbated albuminuria in db/db mice (mean  $\pm$  SD, db/db HAGE:  $874.4 \pm 154.8$  vs. db/db LAGE:  $536.2 \pm 96.5$   $\mu$ g/24h;  $p < 0.05$ ), and RS attenuated this AGE-induced increase (db/db HAGE:  $874.4 \pm 154.8$  vs. db/db HAGE+RS:  $515.5 \pm 71.9$   $\mu$ g/24h;  $p < 0.05$ ). db/db mice had greater gut permeability compared to db/h mice (db/db LAGE:  $2.38 \pm 0.32$  vs. db/h LAGE:  $1.05 \pm 0.11$   $\mu$ g/mL;  $p < 0.01$ ). db/db HAGE-fed mice trended towards increased gut permeability (db/db HAGE:  $3.43 \pm 0.43$  vs. db/db LAGE:  $2.38 \pm 0.32$   $\mu$ g/mL;  $p = 0.06$ ), an effect not observed in RS-fed db/db mice.

**Conclusions:** Heat-treated diets led to increased intestinal permeability and worsening albuminuria in db/db mice. RS was protective against high AGE-induced albuminuria in db/db mice. These preliminary studies support the notion that dietary AGEs contribute to renal disease via alterations in gut homeostasis.

**Funding source(s):** N/A

### EFFECT OF DIETARY PREBIOTIC SUPPLEMENTATION ON METABOLIC BIOMARKERS IN ADULTS WITH PREDIABETES – A CROSSOVER RCT

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**Background/Aims:** Modulation of the human colonic microbiota by the dietary consumption of prebiotics has been shown to confer a number of metabolic health benefits to the host, and may reduce risk factors for type 2 diabetes in susceptible individuals. A double-blind randomised placebo-controlled trial was designed to determine the effect of 12 week consumption of a prebiotic dietary supplement on serum lipids, insulin sensitivity and chronic low-grade inflammation in adults with pre-diabetes.

**Methods:** Twenty-seven adults with pre-diabetes (Impaired Glucose Tolerance or Impaired Fasting Glucose) aged between 40–60 years were randomly assigned to receive either 10 grams of prebiotic supplement (inulin-enriched oligofructose) or 10 grams placebo (maltodextrin) daily for 12 weeks. After a 2-week washout period, study subjects crossed over to receive the alternative dietary treatment for 12 weeks.

**Results:** Intention-to-treat analyses using paired samples t-tests indicated a statistically significant difference in serum HDL cholesterol ( $+0.07$  mmol/L;  $p < 0.05$ ) and waist circumference ( $-1.1$  cm;  $p < 0.05$ ) following prebiotic supplementation. There were no significant differences between prebiotic

and placebo treatments for Homeostatic Model Assessment-Insulin Resistance (HOMA-IR) or high sensitivity C-Reactive Protein (hsCRP). Prebiotic consumption was associated with an increase in gastrointestinal side effects such as borborygmi ( $p = 0.01$ ), frequency of bowel actions ( $p = 0.001$ ) and flatulence ( $p = 0.002$ ).

**Conclusions:** Dietary prebiotic consumption was associated with improvements in HDL cholesterol and waist circumference in adults with prediabetes. Longer term intervention studies are required to determine whether this is sufficient to prevent or slow the development type 2 diabetes.

**Funding source(s):** NHMRC

#### EFFECT OF RED AND PROCESSED MEAT AND REFINED GRAINS ON INSULIN SENSITIVITY IN INSULIN RESISTANT SUBJECTS

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**Background/Aims:** Epidemiologic studies indicate an association between red and processed meat and refined grains and incident type 2 diabetes. Interventions are limited. The aim is to compare the effect on insulin sensitivity of two diets; a diet high in red and processed meat and refined grains (HMD) vs. a diet high in whole grains, nuts, dairy and legumes (HWD).

**Methods:** A randomized crossover study was undertaken in 49 subjects without diabetes (15 men and 34 women, age  $35.6 \pm 15.7$  years, BMI  $27 \pm 5.9$  kg/m<sup>2</sup>) consisting of two 4-week weight-stable dietary interventions. The insulin sensitivity index (ISI) was calculated from the last 30 minutes of a continuous low-dose insulin (25 mU/kg·h) and glucose (4 mg/kg·min) infusion test (LDIGIT<sub>120-150min</sub>) at the end of each diet. Differences between groups were tested by T-tests and repeated measures ANOVA.

**Results:** Groups were categorized *a posteriori* on insulin levels during the LDIGIT HMD: group 1 < 56 pmol/L ( $n = 24$ ) and group 2 > 56 pmol/L ( $n = 25$ ). In group 2, median insulin (153, IQR 180 vs. 123, 149 pmol/L;  $p = 0.019$ ) and mean  $\pm$  SD glucose ( $7.4 \pm 1.3$  vs.  $6.7 \pm 1.2$  mmol/L;  $p = 0.05$ ) were higher in HMD vs. HWD, leading to a decreased log ISI (21.1, 34.2 vs. 31.6, 39.4;  $p = 0.014$ ). Log ISI HMD was correlated with BMI ( $p = 0.009$ ) and fat mass ( $p = 0.004$ ). In both groups, total cholesterol ( $p = 0.01$ ) and triglyceride ( $p = 0.05$ ) were higher after HMD than after HWD. Log ISI HWD was positively correlated with the amount of carbohydrates in HWD after adjustment for log ISI HMD ( $t = 3.5$ ;  $p = 0.001$ ).

**Conclusions:** HMD decreases insulin sensitivity compared with HWD but only in insulin-resistant individuals.

**Funding source(s):** NHMRC, UniSA

#### METABOLIC EFFECTS OF PHYCODIGEST EXTRACT IN OVERWEIGHT OR OBESE INDIVIDUALS

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**Background/Aims:** Few studies have investigated the health benefits of seaweed extracts in human clinical trials. This study investigated the metabolic effects of a sulphated polysaccharide extract, PhycoDigest, from an Australian chlorophycean seaweed, in an overweight and obese population.

**Methods:** The 64 overweight and obese participants were randomly assigned into 3 groups: 2 gram or 4 gram doses of extract or a placebo (rice flour) for 6 weeks. Fasting blood samples and an OGTT were conducted at baseline and post-intervention. Blood samples were used to measure plasma lipids, fasting and 2-hr glucose and insulin, C-peptide and C-reactive protein (CRP). ANOVA and Kruskal-Wallis tests were used to test for differences between groups.

**Results:** Overweight participants showed a 10% reduction in non-HDL cholesterol ( $-0.37 \pm 0.3$  mmol/L, 2 g dose;  $p = 0.02$ ) and a 30% reduction in

CRP ( $-0.78 \pm 1.0$  mg/L, 4g dose). In addition, the Atherogenic Index (2 g dose) trended to improve by 50% ( $p = 0.05$ ) and the 2-hr insulin levels (4 g dose) trended to decrease by 12% ( $p = 0.05$ ). For the obese category, only inflammation (CRP) showed a strong but non-significant trend and decreased by 30% (2 g dose;  $p = 0.058$ ).

**Conclusions:** The antilipidemic, anti-inflammatory and metabolic effects of this specific algal polysaccharide extract, PhycoDigest, are consistent with findings of animal and *in vitro* studies of similar molecules. However, to our knowledge, this is the first clinical study that demonstrates significant metabolic effects from this type of seaweed extract in humans.

**Funding source(s):** Australian Post Graduate Award and Venus Shell Systems Pty Ltd.

#### ORAL $\alpha$ -GALACTOSIDASE IMPROVES GASTROINTESTINAL TOLERANCE TO A DIET HIGH IN PREBIOTIC FIBRE (GALACTO-OLIGOSACCHARIDES)

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**Background/Aims:** Galacto-oligosaccharides (GOS) are indigestible short-chain carbohydrates (FODMAPs) associated with gastrointestinal symptoms in irritable bowel syndrome (IBS). This study aimed to assess whether oral  $\alpha$ -galactosidase enzyme co-ingestion with high GOS foods would reduce symptoms and breath hydrogen production in a double-blind, placebo-controlled, cross-over trial.

**Methods:** Patients with IBS (using Rome III criteria) who produced  $\geq 10$  ppm hydrogen on two consecutive breath samples following 10 g fructan were recruited. Participants were randomly assigned to full-dose enzyme (300 mg  $\alpha$ -galactosidase "Vitacost Gas Enzyme"), half-dose (150 mg) and placebo (glucose). Following a 3-day low FODMAP run-in, participants consumed high GOS diets for another 3-days. Gastrointestinal symptoms were measured daily using a 100 mm visual-analogue-scale, analysed using Wilcoxon signed-rank tests. Hourly breath samples taken on the second last day were analysed as area-under-the-curve using paired samples *t*-tests.

**Results:** Thirty-one participants with IBS (20 IBS-D, 4 IBS-C, 7 IBS-M) completed the study. Addition of high GOS foods increased overall symptoms (median 13.0, IQR 1.5-22.0 mm vs. 35.5, 12.8-54.0;  $p < 0.001$ ) with 22 participants exhibiting GOS-sensitivity ( $> 20$  mm increase for overall symptoms). Of those, compared to placebo, full-dose enzyme reduced overall symptoms (5.3, 1.0-14.0 vs. 24.5, 16.0-34.6;  $p = 0.029$ ) and bloating (7.0, 1.5-15.4 vs. 20.5, 7.3-41.5;  $p = 0.026$ ). Breath hydrogen was minimal with no difference between full-dose and placebo (mean  $\pm$  SD 2086  $\pm$  1856 vs. 2457  $\pm$  2324 ppm·12h;  $p = 0.350$ ).

**Conclusions:** Oral  $\alpha$ -galactosidase taken with high GOS foods provides a clinically significant reduction in symptoms in GOS-sensitive individuals with IBS. This strategy can easily be translated into practice as an adjunct therapy to the low FODMAP diet to improve fibre intake.

**Funding source(s):** NHMRC

#### Concurrent session 4: Public health nutrition HAS MANDATORY FORTIFICATION WITH IODINE MADE A DIFFERENCE? RESULTS FROM TWO COHORT STUDIES IN THE DARWIN AREA

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**Background/Aims:** The re-emergence of iodine deficiency in Australia led to the mandatory fortification with iodine of salt used in bread making in 2010. We assessed urinary iodine concentration in two cohorts of young adults living in the Darwin area before and after fortification.

**Methods:** Spot urine samples were collected from participants in the Aboriginal Birth Cohort (urban and remote Aboriginal) and the Top End Cohort (urban non-Indigenous) as part of planned longitudinal follow-up.