

indicated that bodily pain significantly worsened in both groups, with a significant interaction for physical functioning, role physical, bodily pain and physical component ( $p < 0.05$  for all). Further analyses revealed greater improvements in physical functioning, role physical and physical component in the RT+meat vs. RT+C group ( $p < 0.05$ ).

**Conclusions:** Combining progressive resistance training with a protein-enriched diet led to improved measures of physical quality of life in elderly women, whereas there were no improvements in resistance training alone.

**Funding source(s):** Meat and Livestock Australia.

#### THE INFLUENCE OF AGE ON THE BMI AND ALL-CAUSE MORTALITY ASSOCIATION: A META-ANALYSIS

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**Background/Aims:** A healthy body weight range for adults is defined as a BMI ( $\text{kg}/\text{m}^2$ ) between 18.5 and 24.9, however, our meta-analysis for those  $\geq 65$  years, indicated a greater risk of mortality at a BMI  $< 23$ . Our aim was to clarify if there is a clear age-related difference in the BMI mortality association in cohort studies spanning the whole adult age range.

**Methods:** A sub-group analysis of studies included in our meta-analysis spanning the whole adult age range. We included studies of community-living adults that included cohorts both  $\geq$  and  $< 65$  years. The reference BMI value used was  $23.5 \text{ kg}/\text{m}^2$ . Two-stage random-effects meta-analysis was used to examine a potential nonlinear relation between BMI and all-cause mortality risk.

**Results:** Seven studies were identified including a total of 254,954 subjects  $< 65$  years with 17,633 deaths and 54,221 subjects  $\geq 65$  years with 9,652 deaths. Mortality risk tended to fall at BMIs lower than 23 in the younger group and increased in the older group e.g. BMI range 20.0–20.9:  $< 65$  years: HR 0.94 (95%CI: 0.85, 1.05);  $\geq 65$  years: HR 1.16 (1.07, 1.25). In the younger group mortality increased from BMI range 28.0–28.9, HR 1.16 (1.00, 1.35) but mortality did not tend to increase in the older group until a BMI 35.0–35.9, HR 1.03 (0.81, 1.33).

**Conclusions:** Age significantly alters the BMI mortality association and this effect is evident in cohort studies that span the whole adult age range, confirming that the recommendation for optimal BMI for older adults is different from that of younger adults.

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#### DIET DURING PREGNANCY AND FOETAL GROWTH AND BODY COMPOSITION IN WOMEN AT RISK OF GESTATIONAL DIABETES MELLITUS

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**Background/Aims:** To explore the effect of maternal nutrition on foetal growth in a self-selected sub-group of women who participated in a randomized controlled trial comparing the effect of a low glycaemic index (low-GI) diet vs a healthy diet (HD) in women at risk of GDM ( $n = 139$ ).

**Methods:** Fifty nine women (mean  $\pm$  SD age  $35.2 \pm 3.8$  years, pre-pregnancy BMI:  $25.8 \pm 5 \text{ kg}/\text{m}^2$ ) joined the sub-study. Dietary data were collected using 3-day food records. Differences between groups were tested using ANCOVA. Linear regression was used to assess the general effects of maternal diet ( $n = 96$ ) on offspring body composition, assessed by air-displacement plethysmography.

**Results:** Dietary GI was significantly different between groups (low-GI  $51 \pm 1$  vs. HD  $57 \pm 1$ ,  $p < 0.001$ ). Birth weight z-score was lower in the low-GI ( $0.17 \pm 0.15$ ) compared to the HD group ( $0.65 \pm 0.16$ ,  $p = 0.037$ ), as was birth length z-score (low-GI  $0.25 \pm 0.17$  vs.  $0.85 \pm 0.15$ ,  $p = 0.016$ ). Maternal carbohydrate intake (%E) in early pregnancy was inversely related to

offspring fat free mass (FFM) index ( $\beta = -0.196$ ,  $p = 0.050$ ,  $n = 96$ ). Fat and saturated-fat were positively associated with offspring FFM index (% fat,  $\beta = 0.241$ ,  $p = 0.016$ ; %saturated-fat,  $\beta = 0.250$ ,  $p = 0.012$ ,  $n = 96$ ). In late pregnancy, carbohydrate was inversely associated with offspring fat mass (FM) index, while fat and saturated-fat was positively associated with offspring FM index (%carbohydrate,  $\beta = -0.243$ ,  $p = 0.037$ ; %fat,  $\beta = 0.224$ ,  $p = 0.037$ ; %saturated-fat,  $\beta = 0.216$ ,  $p = 0.036$ ,  $n = 88$ ). Higher GI was associated with lower FFM index ( $\beta = -0.267$ ,  $p = 0.013$ ).

**Conclusions:** Maternal diet and GI influence foetal growth and body composition.

**Funding source(s):** NHMRC

#### TIME TRENDS IN PLASMA CHOLESTEROL AND TRIACYLGLYCEROL FROM 1991 TO 2013 IN TERTIARY STUDENTS

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**Background/Aims:** Monitoring time trends in blood lipids in young adults are informative of lifestyle changes because use of cholesterol-lowering medication in this age group is uncommon. The aim of this study was to examine the time trends in plasma cholesterol and TAG concentrations in young adults.

**Methods:** Participants in this cross-sectional survey were students enrolled in undergraduate nutrition papers at the University of Otago sometime between 1991 and 2013. Blood was collected from volunteers after they had fasted overnight for 10 h or more. Plasma total cholesterol and TAG concentrations were measured using Roche diagnostic kits on automated Cobas instruments. Univariate and multiple linear regression were used to examine time trends in plasma lipid concentrations.

**Results:** There were 2027 plasma cholesterol and 1990 plasma TAG measurements included in the unadjusted analysis. Plasma total cholesterol concentration decreased by  $0.18 \text{ mmol}/\text{L}$  every 10 years ( $p < 0.001$ ; 95%CI:  $-0.24, -0.11$ ) and plasma TAG concentration decreased by 8.3% every 10 years ( $p < 0.001$ ; 95%CI:  $-11.2, -5.3$ ). Further adjustment for sex, age and BMI in the regression model increased the reduction in total cholesterol and TAG concentration to  $0.27 \text{ mmol}/\text{L}$  ( $p = 0.029$ ; 95%CI:  $-0.50, -0.03$ ) and 12.0% ( $p < 0.012$ ; 95%CI:  $-20.3, -2.7$ ) per 10 years increment, respectively.

**Conclusions:** Plasma cholesterol and triacylglycerol concentrations in Otago tertiary students enrolled in nutrition have declined since 1991, probably from dietary changes. These time trends may differ slightly from those in the general population.

**Funding source:** University of Otago.

#### DOES INCREASED DAIRY PROTEIN INTAKE IMPROVE STRENGTH AND LEAN MASS IN OLDER ADULTS?

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**Background/Aims:** It is important to maintain muscle mass and strength into older age to maintain health. The aim was to evaluate whether consuming dairy protein immediately after exercise stimulates greater increases in strength in older adults compared with soy protein or a lower protein control diet.

**Methods:** Healthy older adults ( $n = 179$ , mean  $\pm$  SD age  $61.5 \pm 7.4$  years, BMI  $27.6 \pm 3.6 \text{ kg}/\text{m}^2$ , 81 males and 98 females) were randomised to one of three 12-week isocaloric dietary treatments designed to maintain energy balance: high dairy protein (HP-D, delivering  $> 1.2 \text{ g}/\text{kg}$  body weight of protein per day;  $\sim 27 \text{ g}$  dairy protein); high soy protein (HP-S, delivering  $> 1.2 \text{ g}/\text{kg}$  body weight of protein per day;  $\sim 27 \text{ g}$  soy protein); typical protein intake (TP, delivering  $< 1.2 \text{ g}/\text{kg}$  body weight of protein per day). All participants undertook the same progressive resistance exercise training program three times per week. Muscle strength and body composition were assessed at Week 0 and 12 and treatments effects were analysed using two-way ANOVA.

**Results:** Eighty three participants completed the intervention (HP-D = 34, HP-S = 26, TP = 23). Strength increased in all treatment groups, but the increase was significantly less in HP-S compared with HP-D and TP ( $p = 0.006$ ; HP-S,  $63.0 \pm 23.8\%$ ; HP-D,  $92.1 \pm 40.8\%$ ; TP,  $92.3 \pm 35.4\%$ ). There was no difference between HP-D and TP ( $p = 0.99$ ). Lean body mass increased and fat mass decreased ( $p = 0.006$ ), with no differential effect between any treatments ( $p = 0.06$ ).

**Conclusions:** Increased intake of soy protein attenuated gains in muscle strength compared with increased intake of dairy protein or a typical protein intake.

**Funding source(s):** Dairy Health & Nutrition Consortium.

## Concurrent session 5: plant foods

### THE IMPACT OF FRUIT FLAVONOIDS FROM CHERRIES ON MEMORY AND COGNITION IN OLDER ADULTS WITH MILD TO MODERATE DEMENTIA

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**Background/Aims:** A high consumption of dietary flavonoids, including anthocyanins, show promising results for improving cognitive outcomes, and may be beneficial for the prevention and treatment of dementia. We aimed to assess whether further cognitive decline could be delayed or prevented in dementia patients through daily intake of anthocyanin-rich cherry juice. Secondary outcomes included blood pressure and anti-inflammatory effects.

**Methods:** A 12-week randomised controlled trial assessed multiple cognitive outcomes in older adults ( $n = 49$ ) with mild to moderate Alzheimer's type dementia (70+ years) after consumption of 200 mL/day of either cherry juice or a control juice with negligible anthocyanin content. Repeated measures ANCOVA were performed. Blood pressure and inflammatory markers [C-reactive protein (CRP), IL-6] were measured at 6 and 12 weeks.

**Results:** Cognitive improvements were seen in tasks relating to verbal fluency ( $p = 0.014$ ), short term memory ( $p = 0.014$ ) and long term memory ( $p < 0.001$ ) in the cherry juice group. There was a trend for systolic ( $p = 0.038$ ) and diastolic ( $p = 0.160$ ) blood pressure reduction in the intervention group. Markers of inflammation (CRP and IL-6) were not altered in either group.

**Conclusions:** For older adults with dementia, the inclusion of an anthocyanin-rich beverage may be a practical way to improve their total flavonoid consumption, with potential to improve specific cognitive outcomes.

**Funding source(s):** Illawarra Health and Medical Research Institute.

### CELLULOSE CAN ATTENUATE GLUCOSE RELEASE FROM STARCHY FOODS

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**Background/Aims:** The present study investigates the mechanism and kinetics of insoluble fibres in attenuating the hydrolysis of starch by  $\alpha$ -amylase.

**Methods:** *In vitro* hydrolysis and Michaelis Menten kinetic parameters for inhibition of  $\alpha$ -amylase activity were determined using maize starch as a substrate in the presence of various concentrations of cellulose. Confocal microscopic techniques were used to visualise the amylase bound to cellulose

**Results:** We, for the first time, report on potential inhibition of  $\alpha$ -amylase activity by cellulose based on *in vitro* experiments. The presence of cellulose in the hydrolysing medium hindered the initial velocity of starch hydrolysis in a concentration dependent manner. Amylase adsorption to cellulose was reversible, attaining equilibrium within 30 minutes of incubation, and was faster at 37 °C compared to 20 and 0 °C. The adsorption

was almost unchanged in presence of maltose (2.5–20 mM) but was hindered in the presence of excess protein suggesting non-specific adsorption of  $\alpha$ -amylase to cellulose. Kinetic analyses of  $\alpha$ -amylase hydrolysing maize starch in presence of cellulose as inhibitor using Dixon and Direct Linear plots showed that the inhibition is of a mixed type. The dissociation constant ( $K_{ic}$ ) of the EI complex was found to be ca. 3 mg/mL.

**Conclusions:** The inhibition of  $\alpha$ -amylase activity suggests that cellulose in diet can potentially attenuate starch hydrolysis.

**Funding source(s):** ARC, University of Queensland.

### ASSOCIATIONS BETWEEN FRUIT AND VEGETABLE INTAKE AND QUALITY OF LIFE

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**Background/Aims:** Fruit and vegetable consumption plays an important role in promoting health. Good nutrition and functional health are essential for healthy ageing. This study investigates the relationship between fruit and vegetable intake and quality of life (QoL).

**Methods:** Men and women aged 55–66 years were recruited into the Wellbeing, Eating and Exercise for a Long Life study from the Australian Electoral Roll ( $n = 2384$ , 46.7% males). QoL using the RAND-36 item health survey, fruit and vegetable consumption and socio-demographic data were collected from postal surveys in 2010 and 2012. Associations between fruit and vegetable intake (serves/day) and variety in 2010 and QoL in 2012, were investigated using logistic regression models, stratified by sex and adjusted for potential confounders (socio-demographic factors, health and BMI).

**Results:** Fruit (men:  $p = 0.051$ ; women:  $p = 0.004$ ) and vegetable (men:  $p = 0.042$ ; women:  $p = 0.010$ ) intake were associated with general health perception for both men and women. Vegetable variety was associated with general health perception ( $p = 0.033$ ), vitality ( $p = 0.036$ ) and social functioning ( $p = 0.042$ ) for men, but not women. Fruit variety was associated with mental component summary score for men ( $p = 0.029$ ) and women ( $p = 0.057$ ), and the vitality subscale (men:  $p = 0.006$ , women:  $p = 0.009$ ).

**Conclusions:** Fruit and vegetable intake and fruit variety were associated with some aspects of QoL among older adults. Further research is needed to determine the mechanisms driving these influences.

**Funding source(s):** ARC, Diabetes Australia Research Trust.

### REGULAR CONSUMPTION OF LEGUMES REDUCES THE RISK OF CARDIOVASCULAR MORTALITY

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**Background/Aims:** Intervention studies have demonstrated beneficial effects of legume consumption on markers of chronic disease. The effect of regular legume consumption in Australian populations is not well understood. This study aimed to investigate the relationship between legume consumption and cardiovascular mortality among middle-aged adults.

**Methods:** Data from 40,625 participants from the Melbourne Collaborative Cohort Study were analysed. Baseline data were collected between 1990 and 1994; mortality data were matched up to December 2009. Participants completed a 121-item food frequency questionnaire with two items about legume consumption. Legume consumption was divided into three categories related to frequency of legumes consumed per week (never, 0 to 2,  $\geq 2$ ). Multivariate regression models were used to calculate cardiovascular mortality hazard risk ratios. Models were adjusted for age, and other lifestyle variables.

**Results:** During the 15.9 years of follow up, 5489 people died, with the primary cause of death as CVD ( $n = 1365$ ). After multivariate adjustment, participants who consumed legumes two or more times per week had significantly reduced risk of cardiovascular mortality (20%) when compared to those who never ate legumes (HR 0.80; 95%CI: 0.66, 0.97). A significant trend for reduced risk of cardiovascular mortality and increasing category of weekly legume consumption was also found ( $p_{\text{trend}} = 0.03$ ).