groups \((p = 0.39)\). Over the three-year timespan there was a slight but significant increase in intake of cheese and dairy-based foods (e.g. fromage frais and custards) but time spent outside reduced significantly (both \(p < 0.001\)). Sun protection behaviours differed between summer and winter only \((p < 0.001)\).

**Conclusions:** The major behavioural change responsible for increased vitD status post-study was the increase in supplement use.

**Funding source(s):** Clifford Craig Medical Research Trust.

**LOW CALCIUM INTAKE IS RELATED TO CORTICAL POROSITY IN WOMEN OVER 80 YEARS OF AGE**

S. Iuliano 1, R. Zebaze 1, A. Ghasem-Zadeh 1, E. Seeman 1, 1 Department of Endocrinology, University of Melbourne / Austin Health, Heidelberg, Australia

**E-mail:** sandrabib@unimelb.edu.au (S. Iuliano)

**Background/Aims:** About 85–90% of the skeleton in over 80-year-olds is cortical because most trabecular bone has been resorbed. High remodelling is exacerbated by secondary hyperparathyroidism likely contributed to by low calcium intakes. We hypothesized that cortical porosity will be higher in older women and more severe in those with elevated parathyroid hormone (PTH) and low calcium intakes.

**Methods:** We imaged distal tibial microstructure in 36 elderly women (mean ± SD age 89 ± 4 years) and 73 post-menopausal women (age 60 ± 5 years) using high-resolution peripheral quantitative computed tomography (HR-pQCT) and quantified porosity using StrAxi.0. We used t-tests for group comparisons, and regressions to determine variable relationships.

**Results:** Despite similar bone area, in older compared with younger women respectively, cortical area was ~12% smaller \((101 ± 24 vs. 114 ± 17 \text{ mm}^2)\), ~21% less dense \((586 ± 90 vs. 745 ± 75 \text{ mgHA/cc})\) and porosity ~25% higher \((60.9 ± 8.7 vs. 45.4 ± 7.4\%)\) \((p < 0.01)\). In older women, PTH was elevated \((9.0 ± 4.4 vs. 4.5 ± 1.8 \text{ pmol/L, } p < 0.001)\) and dietary calcium intake low \((636 ± 175 \text{ mg/day})\) with 2/3 consuming <600 mg/day. PTH levels in the elderly women were systematically elevated, and the small sample size may have limited the ability to detect a relationship with porosity. Dietary calcium in the elderly was related to porosity in those with intakes below 600 mg/day \((r = 0.47, p = 0.05)\).

**Conclusions:** We infer that a reduced calcium intake independently contributes to deficits in cortical bone by influencing intracortical remodelling. Studies are needed to examine the effects of calcium intakes below 600 mg/day on bone loss and the effects of repletion in the elderly.

**Funding source(s):** Six dairy organisations from the US, Europe and Australia.

**PLASMA IRISIN LEVELS ARE INVERSELY RELATED TO INSULIN AND HOMA-IR IN HEALTHY SUBJECTS**

F. Jameel 1, 2, B. Plunkett 1, 2, L.G. Wood 2, M.L. Garg 1, 2, 1 Nutraceuticals Research Group, University of Newcastle, Australia; 2 School of Biomedical Sciences & Pharmacy, University of Newcastle, Australia

**E-mail:** Fazzan.Jameel@newcastle.edu.au (F. Jameel)

**Background/Aims:** Irisin, a myokine encoded by fibronectin type III domain containing 5 (FNDC5) gene, expressed and produced by human muscle and adipose tissue, has been reported to stimulate conversion of white adipose tissue to brown adipose tissue and increase the expression of uncoupling protein 1. Health beneficial effects of exercise are thought to be mediated via increased production of irisin. This study aimed to assess the association between plasma irisin levels and anthropometric measurements and glycaemic indices in healthy adults.

**Methods:** Forty nine free living healthy male and female adults were recruited. Body weight, height, and body composition measurements were taken. Fasting blood samples were collected for the analysis of glucose, insulin and irisin levels. Insulin resistance score, HOMA-IR, was calculated using fasting blood glucose and insulin values. The relationship between plasma irisin level and anthropometric measurements, glucose, insulin and HOMA-IR was determined using Pearson’s bivariate correlation test.

**Results:** A significant inverse relationship was found between plasma irisin levels and insulin \((r = -0.380; p = 0.007)\) and HOMA-IR \((r = -0.362; p = 0.011)\). No significant relationship was apparent between irisin and blood glucose level, BMI, waist/hip ratio, muscle mass or fat mass.

**Conclusions:** This study reports an inverse relationship between plasma irisin levels versus fasting insulin levels and HOMA-IR in healthy subjects in support of a link between circulating levels of irisin and insulin resistance.

**Funding source(s):** Hunter Medical Research Institute.

**ZINC INTAKE IN OBESE ADOLESCENTS AT RISK OF TYPE 2 DIABETES ON LOW-ENERGY DIETS**

M. Ho 1, 2, A.L. Heath 3, L.A. Baur 1, 2, 4, C.T. Cowell 1, 2, 4, S. Samman 3, S.P. Garnett 1, 2, 4, 1 The Children’s Hospital at Westmead Clinical School, University of Sydney, Australia; 2 Institute of Endocrinology and Diabetes, The Children’s Hospital at Westmead, Australia; 3 Department of Human Nutrition, University of Otago, New Zealand; 4 Kids Research Institute, The Children’s Hospital at Westmead, Australia

**E-mail:** sarah.garnett@health.nsw.gov.au (S.P. Garnett)

**Background/Aims:** Zinc has a critical role in metabolism, growth and development. In adults, impaired zinc metabolism is associated with heart disease and T2DM. This study aimed to assess zinc intake, zinc bioavailability (phytate:zinc molar ratio) and the prevalence of inadequate zinc intake in obese adolescents consuming low-energy diets differing in macronutrient composition.

**Methods:** Participants were 96 obese adolescents (ages 10 to 17 years; 54 girls; mean ± SD BMI z-score 2.2 ± 0.37) with prediabetes and/or clinical insulin resistance. Adolescents were randomised to a low-energy diet (6.0 to 8.0 MJ), which was either high carbohydrate or moderate carbohydrate with increased protein. Zinc and phytate intakes were estimated from three 24-hour dietary recalls at 6, 9 and 12 weeks after randomisation.

**Results:** Boys reported a higher absolute and energy-adjusted zinc intake than girls, median 11.0 vs. 8.1 mg, \(p < 0.001\), and 1.6 vs. 1.4 mg/MJ, \(p = 0.025\), respectively. Zinc intake did not differ between the two diet groups \((p = 0.523)\). However, adolescents in the high-carbohydrate group had a higher median phytate intake than adolescents in the increased-protein group \((804 vs. 671 \text{ mg, } p = 0.009)\). The prevalence of low zinc bioavailability (phytate:zinc ratio > 18) was \(18\%\) vs. \(6\%\), \(p = 0.113\) and the prevalence of inadequate absorbable zinc intake, \(22\%\) vs. \(13\%\), \(p = 0.275\).

**Conclusions:** Obese adolescents consuming low-energy diets are at risk of inadequate absorbable zinc intake. Future studies should collect serum zinc concentration data to confirm the zinc status in this high risk group.

**Funding source(s):** Meat & Livestock Australia; Bupa Foundation Pty Limited; Diabetes Australia Research Trust; NHP.

**CUT-OFF POINTS FOR ASSOCIATIONS BETWEEN VITAMIN D AND MUSCULOSKELETAL OUTCOMES VARY IN WOMEN AGED 36–57 YEARS**

F. Wu 1, K. Wills 1, L. Laslett 1, B. Oldenburg 2, M. Seibel 3, G. Jones 1, T. Winzenberg 1, 1 Menzies Research Institute Tasmania, University of Tasmania, Hobart, TAS, Australia; 2 School of Public Health and Preventive Medicine, Monash University, Australia; 3 Bone Research Program, ANZAC Research Institute, The University of Sydney, Australia

**E-mail:** Feitong.Wu@utas.edu.au (F. Wu)

**Background/Aims:** To describe associations between serum 25-hydroxyvitamin D \([25(\text{OH})D]\) and musculoskeletal outcomes in middle-aged women.

**Methods:** This cross-sectional analysis from a cohort of 348 women (mean age 50 years) used nonlinear least-squares estimation to determine flexion points for associations of 25(\text{OH})D with lumbar spine (LS) bone mineral density \((\text{BMD})\), femoral neck \((\text{FN})\) BMD, lower limb muscle strength \((\text{LMS})\), timed up and go test \((\text{TUG})\), functional reach test \((\text{FRT})\), lateral reach test \((\text{LRT})\) and step test \((\text{ST})\) and piecewise regression to determine how association of 25(\text{OH})D levels differ.

**Results:** Mean \((95\%\text{CI})\) flexion points were 25 \((16, 33), 42 \((16, 68), 26 \((20, 32), 41 \((23, 60), 18 \((12, 24), 48 \ ((15, 254)\) and 24 \((12, 35)\) nmol/L for FN BMD, LS BMD, TUG, ST, FRT, LRT and LMS, respectively. Significant associations between 25(\text{OH})D and musculoskeletal outcomes occurred only in participants with low 25(\text{OH})D. Differences in slope between 25(\text{OH})D groups became statistically significant at 35 nmol/L for FN BMD, \(b_{\text{low}}\) (in low group) = \(-0.0044\) \((95\%\text{CI: -0.0098, -0.0078})\), between-group difference in \(b\) \((\Delta b)\) = \(-0.0044, p = 0.028\); and TUG, \(b_{\text{low}}=-0.027\) \((\text{0.052, -0.002})\), \(b\) = \(-0.0300, p = 0.028\); 30 nmol/L for LS BMD, \(b_{\text{low}} = 0.0059\) \((0.0002, 0.0117)\).

2. In middle-aged women, the point at which relationships between 25(OH)D and musculoskeletal outcomes change varies for different outcomes. The current cut-off of 50 nmol/L appears too high for some outcomes but reasonable overall to optimise bone and balance in this population.

**Funding source(s):** NHMRC and RACGP / Osteoporosis Australia Bone Health Research Grant.

**GLYCATED ALBUMIN: SAMPLE STABILITY OF AN EMERGING GLYCAEMIC CONTROL BIOMARKER**  

A.N. Reynolds 1, B.J. Venn 1, J.J. Cottrell1, B.J. Leury1, S. Chauhan1, P. Celi1,2, A. Abrasaldo1, F.R. Houghton 2, 1 Department of Human Nutrition, University of Otago, New Zealand; 2 Department of Medicine, University of Otago, New Zealand  

E-mail: Andrew.Reynolds@otago.ac.nz (A.N. Reynolds)

**Background/Aims:** Glycated albumin (GA) is an emerging biomarker of glycemic control reflecting glycemia in the previous two weeks. It is the ratio of glycated to total albumin expressed as a percentage. It is stable to day-to-day fluctuations in glycemia; independent of plasma volume or albumin concentration; and unaffected by haemodialysis or haemoglobinopathies. Used clinically in India and China, GA correlates with Hba1c and fasting glucose. Validation of sample stability is required.

**Methods:** Three experiments were undertaken using plasma samples of people with type 2 diabetes. 1. Short-term stability of 15 samples undergoing freeze-thaw cycles. 2. Short-term stability of 15 samples stored at 4 °C for up to two days. 3. Long-term stability of 25 samples assayed 5 years ago and subsequently stored at -80 °C.

**Results:** The mean GA of fresh samples and those undergoing 1, 2, 5 and 10 freeze-thaw cycles were 18.15, 18.14, 18.08, 18.14, and 18.19%, respectively — values did not differ from baseline (p = 0.86). The mean GA of thawed samples stored at 4 °C for 12, 24 and 48 h were 17.36, 17.33, 17.37 and 17.61, respectively — the 48 h sample differed from baseline (p = 0.009). The mean GA of samples stored at -80 °C for 5 years (34.9%) was double that of the fresh samples (18.89%).

**Conclusions:** GA appears stable to multiple short-term freeze thaw cycles and to storage at 4 °C for up to 24 h. Long-term storage resulted in an appreciable increase in GA. Further work is required to characterise the stability of GA under various storage conditions.

**Funding source(s):** New Zealand Artificial Limb Board.

**SELENIUM OR VITAMIN E MITIGATES HYPERTHERMIA IN GROWING PIGS**  

F. Liu 1, J.J. Cottrell 1, B.J. Leury 1, S. Chauhan 1, P. Celi 1,2, A. Abrasaldo 1, F.R. Houghton 2, 1 Faculty of Veterinary & Agricultural Sciences, The University of Melbourne, Australia; 2 Faculty of Veterinary Science, The University of Sydney, Australia  

E-mail: faliu@student.unimelb.edu.au (F. Liu)

**Background/Aims:** An increasing prevalence of heat waves presents the challenge of managing hyperthermia, particularly in intensively farmed animals. Therefore the aim of this experiment was to quantify protective effects of anti-oxidants selenium (Se) or vitamin E (VE) during hyperthermia in growing pigs.

**Methods:** Thirty-six gilts (Large White × Landrace, 28 ± 4 kg) were fed control (0.24 ppm Se, 17 IU/kg VE), Se (1.0 ppm Se yeast, 17 IU/kg VE), or VE (0.24 ppm Se, 200 IU/kg VE) 80% restricted for 14 days, then exposed to thermoneutral (TN) vs. cyclic hyperthermia (HT) for seven days (20 °C vs. 35 °C 0900-1700h/28°C 00h). Hyperthermia was assessed by skin and rectal temperature (ST and RT), respiration rate (RR), heart rate (HR) and blood bicarbonate. Data were analysed using restricted maximum likelihood for the effects and interactions of diet, temperature, time.

**Results:** As expected with restricted feeding, feed intake was not affected, so effects could be ascribed to HT or antioxidants rather than to differences in feed intake. Despite similar feed intakes, HT increased body weight (p < 0.001). HT increased ST and RT (p < 0.001), and both were mitigated by Se (p = 0.019 and < 0.001). RR increased during HT (p < 0.001) which was ameliorated by Se, but elevated with VE (p = 0.006). HT reduced HR at 1600h, which was mitigated by Se and VE (p < 0.001). Also, VE protected reductions in blood bicarbonate during HT (p = 0.016).

**Conclusions:** Short term Se or VE supplementation ameliorated the effects of hyperthermia in growing pigs.

**Funding source(s):** Australian Pork Limited, Department of Agriculture, Fisheries and Forestry.