

Meeting Report

# Abstracts of the 43rd Annual Scientific Meeting of the Nutrition Society of Australia

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Received: 27 January 2020; Accepted: 7 February 2020; Published: 21 February 2020

**Abstract:** The 43rd Annual Scientific Meeting of the Nutrition Society of Australia was held in Newcastle, Australia, from 2 to 5 December 2019. The theme of the meeting was Nutrition: The Epicentre of Health. Abstracts were submitted from 24 countries. The conference was attended by 250 registrants and 208 papers were presented consisting of 16 plenary, 91 oral and 101 poster presentations. This issue presents the proceedings of this meeting in the form of abstracts of papers presented at the conference.

**Keywords:** ageing; agriculture and farming; chronic diseases; communication and education; food security; genomics; gut microbiota; micronutrients; nutrition; public health

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## 1. Plenary Presentations

### 1.1. Sustainability Implications of Different Food Production Systems

Mario Herrero

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Our food system, while providing food for billions of people, is currently malnourishing us. It directly affects one in three people around the world, causing stunting, wasting or obesity. The way in which we currently produce food is having substantial negative impacts on the environment in many parts of the world, and is trespassing several planetary boundaries. A global acceptance of the need for more sustainable food systems has emerged. We are beginning to gain a greater understanding of how our food systems and diets impact our health and the environment. For example, we have reached consensus that dietary changes will be needed. The EAT-Lancet Commission on healthy diets from sustainable food systems advocates for largely a plant-based diet, with consumption of whole grains, vegetables, fruits and nuts at the centre, and plant- and animal-sourced protein in judicious quantities. It recognises that regions will need different approaches to attain a healthy diet; some regions such as Sub-Saharan Africa and the Pacific will need to increase consumption of animal-sourced foods to meet basic nutrition standards, while higher-income countries will need to reduce consumption of animal-sourced foods. To make our food systems more sustainable, we also need to carefully consider how we produce food. Increasing productivity will remain essential, but also reducing waste significantly will be necessary. Some of these waste streams will need to be reintroduced in the food system through circular economy principles. There is no silver bullet to attain sustainable and healthy food systems—we need an arsenal of approaches to be able to achieve a more healthy and sustainable food system.

### *1.2. Salt, Blood Pressure and Cardiovascular Disease*

Feng He

Wolfson Institute of Preventive Medicine, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, UK

Salt reduction lowers blood pressure and reduces the risk of cardiovascular disease (CVD) and mortality. The World Health Organization (WHO) has set a global target of reducing salt intake to <5 g/d. This has been challenged by several cohort studies which suggested a J-shaped relationship between salt and CVD. However, these studies had methodological problems, e.g., reverse causality, biased estimations of salt intake. Findings from such studies should not be used to derail critical public-health policy. Gradual, stepwise salt reduction as recommended by the WHO remains an achievable, affordable, effective, and important strategy to prevent CVD worldwide. The question now is how to reduce salt intake. In most developed countries, salt reduction can be achieved by a gradual and sustained reduction in the amount of salt added to food by the food industry. The UK has pioneered a successful salt-reduction programme by setting incremental targets for >85 categories of food; many other developed countries are following the UK's lead. In developing countries where most of the salt is added by consumers, public-health campaigns have a major role. Every country should adopt a coherent, workable strategy. Even a modest reduction in population salt intake can lead to major improvements in public health and cost-savings.

### *1.3. Assessing Dietary Patterns and Diet Quality and Associations with Health Outcomes*

Sarah McNaughton

Institute of Physical Activity and Nutrition, Deakin University, Burwood, Australia

Dietary intake is a complex exposure, with multiple layers reflecting a continuum from nutrients to foods to eating occasions to overall dietary patterns. Conceptually, dietary patterns examine the combinations, types and amounts of foods consumed in the diet and reflect a measure of total diet. There is now a global consensus that food and nutrition policies should be informed by evidence regarding dietary patterns and nutritional epidemiology has a critical role to play in providing this evidence. Dietary patterns are assessed using two main approaches, namely, data-driven approaches based on multivariate statistical techniques as or investigator-defined patterns commonly based on 'a priori' dietary guidelines or recommendations (e.g., diet quality scores). Dietary patterns research has developed substantially in the last 15 years and research shows that dietary patterns are important predictors of chronic disease and all-cause mortality. However, there are still significant knowledge gaps. There is still a lack of primary studies for some health outcomes and population groups and fundamental questions relating to the application of dietary pattern methodologies. Fundamental work to understand the impact of different methods, and the development of consensus around use and reporting of dietary patterns primary studies is required to fully optimise the use of dietary-pattern evidence in the development of dietary guidelines.

### *1.4. Maternal Diet Quality and Cardiovascular Consequences for the Next Generation*

Michael Skilton

Charles Perkins Centre, University of Sydney, Sydney, Australia

Cardiovascular diseases, including heart disease and stroke, are a leading cause of morbidity and mortality in Australia. Early life exposures are emerging risk factors for adult cardiovascular disease, with a robust body of evidence causally linking impaired fetal growth with adult cardiovascular disease. Diet during pregnancy can affect fetal growth and risk of developing gestational diabetes. As such, it stands to reason that maternal dietary quality during pregnancy may be a powerful modifiable risk factor for long-term health and disease of the offspring. However, associations of maternal dietary intake with offspring cardiovascular outcomes may be confounded

by the shared environment and learned lifestyle. Determining the aspects of maternal dietary intake that directly influence cardiovascular health in the offspring is potentially important from a life course perspective. Early life markers of cardiovascular health, such as non-invasive measures of atherosclerosis, are particularly useful for studying these potentially direct effects, as are established cardiovascular risk factors and mechanistic risk factors. Using this approach, there is a growing body of literature that indicates that dietary quality, particularly carbohydrate quality and dietary fatty acid profile, are maternal dietary characteristics which may have a direct intergenerational effect on cardiovascular risk.

### *1.5. Cardiovascular Health Following Hypertensive Disorders of Pregnancy*

Melinda Hutchesson

University of Newcastle, Callaghan, Australia

Over half a million Australian women have cardiovascular disease (CVD), and three in 10 deaths among women are as result of CVD. Some risk factors for CVD are unique to women, including hypertensive disorders of pregnancy, such as pre-eclampsia. Women with a history of hypertensive disorders of pregnancy are four times more likely to have hypertension and two times more likely to die of CVD than women with normotensive pregnancies. Up to 10% of pregnancies are impacted by hypertensive disorders and, therefore, each year a large number of women's CVD risk is inevitably amplified. Clinical practice guidelines recommend women with a history of hypertensive disorders of pregnancy receive counselling regarding modifiable risk factors for CVD (i.e., poor diet, excess body weight, physical inactivity and smoking). However, many women who have experienced hypertensive disorders during pregnancy are unaware of their increased risk of CVD, and most report they have not received counselling from health professionals about modifiable risk factors as recommended. My presentation will discuss emerging research of the influence of modifiable risk factors on the cardiovascular health of women following hypertensive disorders of pregnancy, including CVD prevention strategies currently being evaluated.

### *1.6. Aiming to Improve the Outcomes of Mothers and Babies through Nutritional Interventions*

Karen Best

South Australian Health and Medical Research Institute, Adelaide, Australia

Omega-3 long chain polyunsaturated fatty acids are found in every cell in the body and have the potential to influence several biological processes. An increased intake of omega-3 fatty acids during the prenatal period has been linked to improvements in number of maternal and infant outcomes. To reconcile uncertainty about some of these benefits, from 2005 to 2008 we conducted a randomised controlled trial including 2399 pregnant women to determine whether prenatal omega-3 supplementation reduced the incidence of postnatal depression, improved infant neuro-development and reduced childhood allergic disease. Although we found no significant difference between the intervention and control groups in these outcomes, women receiving omega-3 had a lower risk of early preterm birth, a secondary outcome. To confirm our findings, from 2013–2017 we conducted the “Omega-3 to Reduce the Incidence of Preterm birth” randomised controlled trial including 5544 pregnant women. We found no significant difference in the incidence of early preterm birth in the omega-3 group compared to control. Based on our findings we would not recommend population-based omega-3 supplementation during pregnancy to prevent preterm birth. Preliminary work, however, suggests that women with low total omega-3 status may benefit from supplementation suggesting a more targeted approach is needed.

### *1.7. Brain Inflammation, Circadian Timing and a Novel Nutraceutical: Crucial in the Fight against Metabolic Disease*

Alexander Tups

Centre for Neuroendocrinology and Brain Health Research Centre, Department of Physiology, School of Biomedical Sciences, University of Otago, Dunedin, New Zealand

The brain plays a crucial role in regulation of body weight and glucose homeostasis as well as in integrating metabolic cues with circadian timing. In mice, we established that disruptions of the circadian rhythm are detrimental for metabolic health. We could show that frequent disruption of the circadian rhythm led to weight gain, severe diabetes symptoms and changes in the brain to process metabolic cues. We also found that popular dieting strategies such as time-restricted eating patterns, e.g. to restrict caloric intake to 8 h a day, are dependent on circadian timing. The ability of the brain to respond to the body weight regulatory hormone leptin varies throughout the day and it appears that eating patterns have to be aligned with the circadian rhythm to maintain a healthy metabolism. Targeting brain inflammation as a root cause of diabetes, we identified a novel nutraceutical that reverses high-fat diet-induced brain inflammation and improves glucose homeostasis in mice. In a pilot randomised controlled cross-over trial of participants with pre-diabetes or type 2 diabetes mellitus (T2DM) we tested safety and efficacy of the extract in humans. No adverse effects were observed and preliminary results suggest that glucose excursion may be improved in patients with established T2DM.

### *1.8. Consequences of Eating Around the Clock*

Maxine Bonham

Department of Nutrition, Dietetics and Food, Monash University, Clayton, Australia

Many physiological processes in our body such as energy regulation and metabolism are governed by endogenous circadian rhythms. Staying awake and eating during a circadian phase that is set for fasting and sleeping may have implications for weight gain and perturb glucose and lipid metabolism. This is relevant as people consume up to 40% of their energy intake during the night. Acute experimental trials have shown that energy expenditure at rest, and after eating, is typically more efficient in the morning than later in the day. These findings are supported by cross-sectional data which indicate that consuming a high proportion of energy intake later during the day is associated with increased weight. Eating the same meal at night-time, compared to during the day, is associated with increased glycaemic excursions and reduced insulin sensitivity. In populations who regularly eat overnight, such as shift workers, increased risks of type 2 diabetes and cardiovascular disease have been observed. Loading energy intake to earlier during the day, maintaining a period of fasting overnight and careful consideration of macronutrient choice at night are potential strategies to target for those who have no choice but to eat at night.

### *1.9. Severe Versus Moderate Energy Restriction for Weight Loss—Which Approach Is Better?*

Amanda Sallis

Boden Institute of Obesity, Nutrition, Exercise and Eating Disorders, University of Sydney, Sydney, Australia

It is often assumed that the healthiest way to lose excess weight is via moderate restriction of energy intake, resulting in 'slow and steady' weight loss. While severe energy restriction—often resulting in fast weight loss—is a motivating option for weight loss, long-term effects on body composition and eating behaviour are unknown. This talk outlines findings from the TEMPO Diet Trial (Type of Energy Manipulation for Promoting optimal metabolic health and body composition in Obesity), a National Health and Medical Research Council funded randomised controlled trial comparing the long-term (36-month) effects of severe versus moderate energy restriction for weight loss on body composition, eating behaviour, and cardio-metabolic health in 101 postmenopausal

women with obesity (Australia and New Zealand Clinical Trials Registry Reference Number 12612000651886). Participants were randomised to either 16 weeks of severe (60%–69%) energy restriction, followed by 36 weeks of moderate (24%–33%) energy restriction, or 52 weeks of moderate energy restriction. To help preserve lean mass, supplemental protein was added so that both diets had a prescribed protein intake of 1 g/kg body weight per day. Physical activity was recommended but not supervised. Gold-standard measures of body composition (including dual energy X-ray absorptiometry of the total body and hip bone, magnetic resonance imaging and magnetic resonance spectroscopy), as well as functional assessment of muscle strength and eating behaviour, were determined for up to 36 months.

### *1.10. Nutritional Strategies to Combat Inflammaging*

Phillip C. Calder

Human Development and Health, Faculty of Medicine, University of Southampton, Southampton, UK

The inflammatory response is beneficial as an acute, transient reaction to harmful conditions, facilitating the defense, repair, turnover and adaptation of many tissues. However, chronic and low-grade inflammation is likely to be detrimental for many tissues and for normal functions. Chronic low-grade inflammation has been linked with increased risk and progression of many common diseases and with increased mortality. Ageing is characterised by an increase in the concentration of a number of inflammatory markers in the bloodstream, a phenomenon that has been termed “inflammaging”. This process negatively influences mental health and well-being, metabolic homeostasis and infections. Hence slowing (i.e., preventing), controlling or reversing low-grade inflammation is likely to be an important way to prevent, or reduce the severity of, age-related functional decline and the onset of conditions affecting health and well-being in older people. Many nutrients have been demonstrated to modify inflammation, some acting to enhance inflammation and others to reduce it. Simple sugars and saturated fat can increase inflammation while omega-3 fatty acids, plant polyphenols and antioxidants can decrease inflammation. Consequently, particular foods and dietary patterns are associated with differences in blood markers of inflammation. The gut microbiota seems to also play a role in controlling both gut and systemic inflammation. Hence foods and nutrients that modify gut microbiota are also likely to be relevant to inflammaging.

### *1.11. Nutrition and Cognitive Decline*

Louise Dye

School of Psychology, University of Leeds, Leeds, UK

The relationship between diet and cognitive function is becoming clearer. There is also increasing interest in identifying natural products that can support the improvement of mental performance and/or prevent age-related cognitive decline but the evidence for these is limited. Mid-life obesity has been cited as a significant risk factor for Alzheimer’s disease and vascular dementia in later life and this risk is reported to be independent of comorbidities. The development of abdominal adiposity is exacerbated by stress which in itself can adversely affect cognitive function. Moreover, obesity is also associated with many comorbidities known to adversely impact cognitive function such as type 2 diabetes mellitus (T2DM), hypertension, hypercholesterolaemia, and insulin resistance. Type 2 diabetes has been associated with impairments across a wide range of cognitive domains. Studies in impaired glucose tolerance suggest that pre-diabetes affects some cognitive domains. However, it is difficult to untangle these relationships. This presentation examines the interrelationship between obesity, stress, impaired glucose tolerance and diabetes in terms of cognitive function. It will consider the potential impact of nutritional interventions (whole diet and specific ingredients) in reducing the cognitive consequences of these increasingly prevalent conditions in the ageing Western population.

### 1.12. Addictive Eating and Mental Health

Tracy Burrows

Faculty of Health and Medicine, University of Newcastle, Callaghan, Australia

Food addiction is a controversial area of research and practice. Epidemiological research shows that the term food addiction or addictive eating are terms that many individuals in the community identify with and support. Reviews suggest that it is an issue that affects around 20% of the population; however, this varies by population group with the condition more common in those individuals who are overweight and with obesity, or experiencing mental health conditions, in particular anxiety or depression. However interestingly it is not synonymous to these groups in that it also occurs in those who are of healthy weight. Food addiction is commonly defined as a compulsive consumption of foods, for example processed foods that may be high in sugars, fats and salt. The symptoms of food addiction can be assessed by standardised tools some of which align with the Diagnostic Statistic Manual (DSM) for other addictions. Symptoms include craving, withdrawal, and repeated attempts to cut down on the consumption of particular foods with no success and giving up social activities. My team's research has focused on identifying possible problematic foods (and not sole substances) to better assist in the development of possible treatments. While there is individual variation, our research shows that the most addictive-like foods are those containing both sugars and fats, and also those individuals endorsing symptoms of food addiction tend to have an overall poorer diet quality and/or dietary patterns. Large population-based studies show that there is a strong belief in food addiction and those who consider themselves to be food addicted are looking for answers and support. We have recently conducted a review of web-based treatments for food addiction identified that the majority of programs are not evidence-based, rarely involve credentialed health professionals, and have not been evaluated for their outcomes. My team is currently trialing the first intervention of its kind based on personality traits to assist in treatment management of addictive eating, and in addition we are exploring possible biomarkers that may be associated with the condition. These biomarkers include the use of techniques of brain imaging through magnetic resonance imaging (MRI) scans, hormones, peptides, in addition to less invasive measures such as eye-tracking and heart rate variability.

### 1.13. The Unique Health Effects of the Dairy Matrix

Michelle McKinley

Centre for Public Health, School of Medicine, Dentistry and Biomedical Science, Queen's University Belfast, Belfast, UK

Milk and dairy foods make a large contribution to population intakes of a wide range of nutrients. Each of the individual nutrients found in milk and dairy foods has an important function in the body. As well as considering the effects of isolated nutrients on health, it is important to evaluate the effects of whole foods in order to account for the effect of the food matrix. The concept of the food matrix encompasses the interactions between the food structure and the nutrients that sit within it. The nature of the food matrix will influence digestion, absorption and, ultimately, bioavailability of nutrients; thus, the health effects of food may differ from what is predicted based on our knowledge of its nutrient content. In relation to milk and dairy foods, the concept of the dairy matrix proposes that the unique combination of nutrients and bioactive factors interact with each other and the physical structure they sit within to promote health, with the combined effects of the matrix extending beyond the sum of the individual parts. This presentation will review the evidence for the dairy matrix having a unique effect on health.

### *1.14. Non-Coeliac Gluten Sensitivity, Irritable Bowel Syndrome and Functional Dyspepsia: Management Challenges*

Nicholas J. Talley

University of Newcastle, Callaghan, Australia

The irritable bowel syndrome (IBS) and functional dyspepsia (FD) are syndromes comprising distinctive unexplained lower and upper gut symptoms, and consensus symptom-based diagnostic criteria have been developed (Rome criteria). One in three are affected and until recently our understanding was very limited. IBS and FD often overlap, quality of life is frequently impaired, and psychological distress is common. The recognition that IBS and FD symptoms usually follow food ingestion has helped revolutionise our understanding, and they likely arise from a number of different disease processes. Acute gastroenteritis can initiate chronic symptoms despite infection disappearing. Increasing evidence implicates immune activation and low-grade inflammation (e.g., duodenal eosinophilia), changes in the gut microbiome and non-IgE food allergy. Some cases may reflect chronic infection (e.g., colonic spirochaetosis). One in four Australians restrict wheat, many because they develop symptoms. Patients without coeliac disease who associate adverse physiological symptoms with ingestion of wheat/gluten are labelled as non-coeliac gluten sensitivity (NCGS); 50% have IBS and/or FD by Rome criteria. The components of wheat that may contribute to gut symptom generation include wheat proteins inducing immune activation, and fructans and other FODMAPs (fermentable oligosaccharides, disaccharides, monosaccharides and polyols). Diet therapy is likely to become the mainstay of treatment for IBS and FD.

### *1.15. Microbial Manipulation Through Nutrition*

Dragana Stanley

Central Queensland University, Rockhampton, Australia

The advancements in sequencing technology and development of the novel biomarkers for microbial identification brought about the so-called “golden age of microbial ecology.” In the last decade, we learned considerably about our intestinal microbiota; however, despite all the new knowledge, we are still not able to control colonisation and manipulate maturation of intestinal microbial communities. Some of the most common ways to achieve this are the fecal transplant and probiotics; both are mostly attempted as a remedy for the existing dysbiotic state. Research shows that the colonisation process takes off immediately after birth and microbiota matures very fast. In humans, the microbiota is considered mature around the toddler age, in some animals, it can be as low as three days. This leaves a very small window for manipulating microbiota towards healthy, balanced and diverse microbiota. Japanese hospitals have made the first steps in controlling the colonisation in premature infants, and successful attempts are also reported in animals. Undeniably, providing the early access to the gut selectively to beneficial bacteria has to team up with providing the right nutrients for those selected species to thrive and colonise the gut. At the same time, strategies for limiting pathogen access are also essential.

### *1.16. Gut Microbiota Responses to Changes in Diet and Exercise*

Claus Christophersen

School of Molecular and Life Sciences, Curtin University and School of Medical and Health Sciences, Edith Cowan University, Perth, Australia.

The gut microbiome responds to radical changes in diet within a few days. The response in the microbiome can be a change in diversity and/or a metabolic change. A change in the metabolic profile of the gut microbiome is more likely to have a profound effect on the host. Hence, it is important to consider these changes when we measure “response” of the gut microbiota and in our definition of gut health. Adherence to a particular diet pattern, excluding food groups, can have a negative impact on gut health. Supplementation with dietary fibre, like resistant starch, can have

beneficial effects on the gut microbiome, not only in adults but also in infancy. Similar to gut microbiome changes in response to diet, a response to exercise is also evident. Not only can exercise change the gut microbial composition, but it can also change the metabolic profile independent of diet. Consequently, there is a potential to use exercise medicine to improve or prevent conditions within and outside the gut. In this presentation, I will attempt to demonstrate some of the effects diet, supplementation and exercise can have on the gut microbiome.

## 2. Oral Presentations

### 2.1. *The Innate Immune Response to Influenza A Virus Is Impaired in Peripheral Blood Mononuclear Cells Isolated from Obese Women*

Lily M Williams <sup>1</sup>, Peter AB Wark <sup>1,2</sup>, Kristy S Nichol <sup>1</sup>, Bronwyn S Berthon <sup>1</sup>, Lisa G Wood <sup>1</sup>

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Obesity is a growing global epidemic associated with increasing healthcare costs. Epidemiological evidence suggests obesity impairs antiviral responses to influenza infection. The aim of this study was to evaluate the response of peripheral blood mononuclear cells (PBMCs) to influenza exposure and compare the responses of cells from obese and non-obese women. PBMCs were isolated from (i) non-obese (body mass index (BMI) < 30 kg/m<sup>2</sup>; *n* = 8) and (ii) obese (BMI ≥ 30 kg/m<sup>2</sup>; *n* = 16) female adults. Cells were cultured *ex vivo* with influenza virus strains A/H1N1/Auckland/2011 and A/H3N2/Victoria/210/2009 for 48-h. Interferon (IFN)-α, IFN-γ, interleukin (IL)-6, IL-1β and IL-10 were measured in cell-culture supernatants. Phosphorylated signal transducer and activator of transcription 1 (pSTAT1) and unmodified STAT1 were measured via Western blot. After 48-h influenza exposure, cells from obese women had significantly greater inflammatory responses (H1N1 IL-1β, *p* = 0.048; H1N1 IL-6, *p* = 0.011; H3N2 IL-1β, *p* = 0.047; H3N2 IL-6, *p* = 0.011) and a reduced type I IFN response (H1N1 IFN-α, *p* = 0.047) compared to non-obese women. STAT1 phosphorylation was also impaired in cells from obese women following influenza infection. Peripheral immune cells from obese women demonstrate reduced antiviral immunity and increased inflammatory responses to influenza. These novel observations suggest a mechanism by which obese individuals are more susceptible to respiratory virus infections.

### 2.2. *Food Fix: A Personality-Based Intervention for Addictive Eating*

Tracy Burrows <sup>1</sup>, Rebecca McKenna <sup>2</sup>, Megan Rollo <sup>2</sup>, Leanne Hides <sup>3</sup>, Mark Leary <sup>2</sup>

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Twenty percent of adults meet criteria for addictive eating with very few evidence-based treatments. This project aimed to determine the feasibility and acceptability of a personality-targeted motivational interviewing intervention to adults with addictive eating behaviours to improve lifestyle behaviours. Fifty overweight adults with addictive eating characterised by the Yale Food Addiction Survey (YFAS) were randomised to either the intervention or 3-month waiting list that served as controls. The 3-session intervention with a dietitian was delivered by telehealth. Outcomes were assessed at baseline and 3 months and included: addictive eating (YFAS), percent energy from core and non-core foods in addition to diet quality (food frequency questionnaire). At follow up there were significant reductions in YFAS symptoms (Intervention baseline: 8.04% ± 0.5%, 3 m 6.5% ± 0.8%, Control baseline 8.08% ± 0.5%, 3 m 7.14% ± 0.8%, *p* < 0.017). Specifically changes were seen in the symptoms failure to fulfil role obligations and reductions in the persistent desire. These changes were coupled with decreases in the percent energy from non-core foods (Intervention baseline 48% ± 3.0% E, 3 m 38% ± 2.0% Control baseline 41.8% ± 2.9%, 3 m 38% ± 3%, *p* < 0.001). This eating



behaviour intervention modelled on successful interventions for alcohol addiction shows promising results in reducing addictive eating behaviours in overweight adults.

### 2.3. Bitter Taste Polymorphisms Are Associated with Body Mass Index (BMI) in an Elderly Cohort

Alexandria Turner <sup>1</sup>, Martin Veysey <sup>2,3</sup>, Simon Keely <sup>4,5</sup>, Mark Lucock <sup>1</sup>, Chris J Scarlett <sup>1</sup>, Emma L Beckett <sup>1,5</sup>

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Two thirds of Australian adults are overweight or obese, leading to increased risk of chronic illness and early mortality. Obesity is a complex disease; factors such as diet and lifestyle alone do not fully explain risk. The bitter taste (TAS2R) family of receptors, expressed throughout the gastrointestinal tract, respond to bitter compounds. TAS2Rs may be involved in modulating dietary intake and metabolic processes linked to obesity. TAS2R4 and TAS2R5 detect bitter epicatechins, which are antioxidants found in foods such as green tea and cocoa, with a potential protective effect in obesity. Therefore, this study aimed to assess whether the presence of polymorphisms in TAS2R4 (rs2234001) and TAS2R5 (rs2227264) were associated with body mass index (BMI). Genotyping (Taqman quantitative polymerase chain reaction (qPCR) assays) was performed on DNA extracted from blood samples (QiAMP™ DNA Mini Kit;  $n = 319$ ) from an elderly cohort. The presence of the TAS2R5 variant allele (G) was associated with lower BMI in both heterozygotes (GT = 26.08) and homozygotes (GG = 26.63) compared to TT = 31.72 ( $p = 0.007$  and  $0.01$ , respectively). Homozygosity for the TAS2R4 ancestral allele (C) was associated with significantly lower BMI (GG = 30.19 vs. CC = 23.12,  $p = 0.003$ ). This suggests a link between TAS2R polymorphisms and risk for obesity, however further investigations are necessary to confirm this association and mechanism.

### 2.4. Examining the Efficacy of a Multi-Component M-Health Dietary, Physical Activity, and Sleep Intervention on Dietary Intake in Overweight/Obese Adults: A Randomised Controlled Trial

Sasha Fenton, Mitch J Duncan, Tracy L Burrows

University of Newcastle, Callaghan, Australia

Physical inactivity, poor diet and poor sleep increase chronic disease risk. Interventions targeting these behaviours have the potential to reduce chronic disease risk. Few studies comprehensively examine the impact of multiple behaviour interventions on dietary intake, and few examine the potential role of sleep on diet. This study aimed to compare the efficacy of a multi-component behaviour change weight-loss intervention on dietary outcomes, relative to a waiting list group that served as controls. The secondary aim was to compare the efficacy of a dietary, physical activity and sleep intervention (enhanced) on dietary outcomes, compared to a dietary and physical activity intervention (traditional). Overweight/obese adults (19–65 y) ( $n = 116$ ) were randomised to one of three intervention arms; 81 completed the 6-month assessment. A range of dietary outcomes were assessed at baseline and 6-months using the Australian Eating Survey. At 6 months there were greater decreases for the pooled intervention group compared to the control in energy intake ( $p = 0.031$ ) and sodium intake ( $p = 0.026$ ), and a greater increase in percentage of energy from fruits ( $p = 0.039$ ). There were no significant differences in dietary intake between the enhanced and traditional groups. This intervention was efficacious in reducing energy and sodium intake. Targeting sleep health did not result in significant differences in dietary intake.

### 2.5. Association between Weight Status, Omega 3 Fatty Acids (N-3PUFA) and Omega 3 Index in Healthy Young Women

Isabel Young<sup>1</sup>, Helen Parker<sup>1</sup>, Nicholas O'Dwyer<sup>1</sup>, Rebecca Cook<sup>1</sup>, Helen O'Connor<sup>1</sup>, Kate Steinbeck<sup>2</sup>, Cheyne Donges<sup>3</sup>, Manohar Garg<sup>4</sup>

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Obesity has been shown to negatively impact omega 3 index (O3I) in older adults and children. This relationship has not yet been shown in young women, a particularly vulnerable and understudied group. Data from the cross-sectional Food, Mood and Mind Study, which recruited healthy young women (18–35 y;  $n = 300$ ), was analysed including fasting blood samples (O3I, C-reactive protein (CRP), omega 3 fatty acids (n-3PUFA)) anthropometric parameters (body mass index (BMI), waist circumference (WC)) and fish oil supplement and food intake data (food frequency questionnaire). Participants with high levels of inflammation (CRP > 10) were excluded. Data reported mean + standard deviation (SD). Included participants ( $n = 244$ ) had a mean age, BMI and WC of  $26 \pm 5.14$  y,  $27 \pm 7$  kg/m<sup>2</sup>,  $82.3 \pm 16.8$  cm, respectively. BMI and WC were significantly, negatively associated with O3I (BMI:  $p < 0.0005$ , WC:  $p < 0.0005$ ) and docosahexaenoic acid (DHA) (BMI:  $p < 0.0005$ , WC:  $p < 0.0005$ ). When stratified into quartiles, BMI had a significant, negative, linear relationship with n-3PUFA ( $p < 0.005$ ) which was independent of dietary n-3 PUFA intake. CRP was also significantly negatively correlated with n-3PUFA ( $p < 0.0002$ ). Taking fish oil supplements resulted in significantly higher O3I ( $p = 0.024$ ). This study demonstrates a significant, negative association between O3I and n-3PUFA with BMI and WC in healthy young women, regardless of dietary n-3PUFA intake.

### 2.6. Short-Chain Fatty Acids as an Anti-Inflammatory Agent in Overweight and Obesity: A Systematic Review and Meta-Analyses

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Obesity is characterised by chronic systemic inflammation, which increases chronic disease risk. Short-chain fatty acids (SCFAs) derived from microbial fermentation of prebiotic soluble fibres may protect against obesity-induced systemic inflammation. Relevant studies from 1947 to March 2019 were collected from CINAHL, EMBASE, MEDLINE and Cochrane databases. Eligible studies examined the effect of SCFAs or prebiotic interventions on biomarkers of systemic inflammation in obese humans or animal models. Fifty-five studies were included. In humans, 4 studies examined SCFAs, 22 prebiotics and 1 examined propionate in vitro. Three of 4 SCFA interventions and 12 of 22 prebiotic interventions reported a significant decrease in  $\geq 1$  biomarker of systemic inflammation. Of the 28 animal studies included, 8 of 9 SCFA interventions and 16 of 19 prebiotic interventions reported a reduction of  $\geq 1$  biomarker of systemic inflammation. Meta-analysis revealed that prebiotics in humans reduced plasma high sensitivity C-reactive protein (hsCRP) (standard mean difference (SMD):  $-0.85$ ; 95% confidence interval (CI):  $-1.60, -0.11$   $p = 0.02$ ) and plasma lipopolysaccharide (SMD:  $-1.30$ ; 95% CI:  $-1.97, -0.62$ ;  $p < 0.01$ ) and tumor necrosis factor alpha (TNF- $\alpha$ ) in animals (SMD:  $-0.63$ ; 95% CI:  $-1.19, -0.07$ ;  $p = 0.03$ ). While heterogeneity across studies was significant, evidence supports the use of SCFAs and prebiotics as a novel approach for treating systemic inflammation in obesity.

### 2.7. Investigating the Effect of Consuming Beer versus Non-Alcoholic Beer on Food Energy and Protein Intake in Men: A Randomised Crossover Trial

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Snacking with alcohol consumption may increase overall energy intake. Snack composition has been shown not to influence the amount eaten after consumption of wine. This study aimed to compare whether drinking alcoholic or non-alcoholic beer influenced total snack energy consumed, of snacks that differed in protein content. A randomised single-blind four-arm crossover trial with 29 male participants aged 18–37 years, was conducted. Participants attended four separate testing sessions, where they ingested either alcoholic beer (30 g alcohol) or non-alcoholic beer and were offered ad libitum access to either higher protein snacks with a protein-fortified dip or standard protein snacks with a dip. Food intake and subjective appetite ratings were measured. Mean intake of food energy, protein, fat and mean fullness ratings were increased following alcoholic beer consumption compared with non-alcoholic beer (all  $p < 0.05$ ). No differences were observed between the snack conditions for mean food energy intake and subjective appetite ratings (all  $p > 0.05$ ). However, mean protein intake was increased with the higher-protein snack conditions ( $p < 0.001$ ). This exploratory study demonstrated that consuming alcoholic beer increased snack intake, regardless of the snack composition. Further research on the impact of consuming different types of alcohol on appetite and food intake is warranted.

### 2.8. Understanding Weight Loss Maintenance in Children and Adolescents: A Qualitative Systematic Review

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To date there is a limited understanding of young people's experiences of maintaining weight and sustaining lifestyle change following a weight-loss intervention. This qualitative systematic review explored young people's perceptions of maintaining their weight following intentional weight loss. OvidMedline in Process, EMBASE, CINHALL, PsycInfo, Ovid Emcare, and Scopus were systematically searched for studies describing children and adolescents (<25 years, previously or currently above a healthy weight) experiences of weight loss maintenance. Seventeen articles met the inclusion and exclusion criteria. Synthesised study findings indicated that a transformative experience and transition through education or employment often promote lifestyle change. Young people benefit when taking ownership and responsibility for lifestyle changes. Nevertheless, young people often require a broader support system to help them to maintain lifestyle change. Family and peers can play a supportive role or challenge the young person's ability to maintain change. Finally, young people can struggle to maintain change during periods of stress. In conclusion, young people are likely to face unique challenges when maintaining lifestyle changes for weight management. Weight-loss interventions need be cognisant of the dilemmas that maintaining weight loss brings and equip young people and their families with practical strategies to sustain behaviour change long-term.

### 2.9. Associations Between Dietary Inflammatory Index, Brain Volume and Small Vessel Disease

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People with type 2 diabetes (T2D) are at higher risk of developing dementia. An inflammatory diet is related to poorer cognition; but the underlying brain pathways are unknown. We aimed to examine associations between the dietary inflammatory index (DII®) and brain structure in people with and without T2D. Participants (no T2D  $n = 333$ ; T2D  $n = 309$ ) were from the Cognition and Diabetes in Older Tasmanians study. The Energy adjusted DII (E-DII) (a literature-derived dietary index) was computed from responses to the 80-item Cancer Council Food Frequency Questionnaire. Brain volume (grey, white matter, white matter hyperintensities), infarcts and microbleeds were obtained from magnetic resonance imaging. Logistic and linear regression were performed to examine associations between E-DII and brain measures, adjusting for relevant confounders. An E-DII  $\times$  T2D interaction term was tested in each model. The mean age of participants was 69.9 (SD 0.3) years. There was a significant interaction between T2D and the E-DII in the model for grey matter volume ( $p < 0.05$ ). E-DII was negatively associated with grey matter volume in people without T2D ( $\beta = -4.3$  95% confidence interval (CI):  $-8.3, -0.4$ ), not in those with T2D ( $\beta = 2.0$  95% CI:  $-2.9, 6.9$ ). Inflammatory diet may be an important factor related to brain health in people without T2D.

#### 2.10. Systematic Literature Review of the Efficacy of Probiotics and Prebiotics on Depression and Anxiety Symptoms

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Mental health is estimated to impact almost half of all Australians in their lifetime. Research into nutritional treatments is increasing with many studies finding prebiotics and probiotics a promising alternative to chemical antidepressants. This systematic literature review evaluates the efficacy of pre/probiotics in attenuating symptoms of depression and/or anxiety. A review of 6 databases on pre/probiotics interventions in human/mice/rat populations with depression/anxiety yielded 604 studies. Studies included 3 prebiotic and 11 probiotic interventions in human/mice/rat populations; single and multiple strain interventions; 12 days to 12 weeks; participants with no symptoms of depression/anxiety through to major depressive disorder. Following the exclusion process, 14 studies were included. All 3 prebiotic interventions showed a significant reduction in symptoms of depression/anxiety. Three rat, 4/7 human and 1/2 mice trials showed reduced symptoms of depression/anxiety with probiotic intervention. No patterns were identified when strains, doses, delivery method or intervention duration were analysed. Pre/probiotic interventions may attenuate symptoms of anxiety and depression, however, the mechanism remains unclear due to inconsistent study designs. While the results indicate future potential for pre/probiotic treatment, further studies are needed into the gut microbiota and mental health relationship before it can be recommended as a chemical treatment replacement.

#### 2.11. Beliefs and Expectations of Dietary Treatment in Patients with Functional Gastrointestinal Symptoms Pre- and Post-Treatment: A Prospective Study

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Functional gut symptoms (FGS) including pain and altered bowel function severely impact quality of life. Management includes a low FODMAP (fermentable oligosaccharides, disaccharides, monosaccharides and polyols) diet. However, 30% of individuals do not respond to this treatment. Pre-treatment beliefs are a major predictor in the success of treatment and final outcomes. This study aimed to investigate the treatment beliefs of individuals with FGS, pre- and 4-weeks post- (4 wp)

their first dietitian appointment for low FODMAP diet intervention. Adults (>18 y) with FGS were recruited from dietetic clinics and via social media. Treatment beliefs, expectations and gut symptom severity were assessed using visual analogue scales (0 = poor/none; 100 = greater) administered pre and 4wp initial dietitian consult. Twenty-seven participants (85% F) showed significant improvement in their belief that low FODMAP diet would reduce symptoms ( $59.9 \pm 18.5$  pre vs.  $69.7 \pm 19.1$  4 wp  $p = 0.04$ ). Severity of abdominal pain and distention significantly decreased between timepoints ( $35.5 \pm 22.0$  pre vs.  $21.4 \pm 21.4$  4 wp,  $p = 0.00$  and  $38.3 \pm 24.8$  pre vs.  $23.3 \pm 21.8$  4 wp,  $p = 0.00$ , respectively). This interim analysis showed that individuals with FGS who believed dietary change would improve symptoms experienced a greater decrease in pain severity and distention. This highlights the importance of the underlying integration of physiological and psychosocial factors for treatment efficacy.

### 2.12. Long-Term Resveratrol Supplementation Improves Cognition and Overall Well-Being in Elderly Postmenopausal Women

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With increasing life expectancy, post-menopausal women are more vulnerable to circulatory and cognitive impairments resulting in poorer quality of life. In a pilot study, we showed cognitive and cerebrovascular improvements in postmenopausal women following 14 weeks' supplementation with a low dose of resveratrol, a phytoestrogen. We have now confirmed these benefits in 125 women aged  $64 \pm 1$  years,  $15 \pm 1$  years postmenopausal and not taking hormone therapy who were randomised in a  $2 \times 12$ -month crossover trial to take 75 mg trans-resveratrol or matching placebo twice daily. A battery of cognitive tasks was administered to assess 7 cognitive domains. Transcranial Doppler ultrasound measured the magnitude of vasodilator responsiveness (CVR) during hypercapnia and neurological stimuli, i.e. neurovascular coupling (NVC). Well-being measures including pain and menopausal symptoms were also examined. Compared to placebo, resveratrol significantly improved overall cognitive performance ( $d = 0.269$ ,  $p = 0.002$ ), CVR to hypercapnia ( $d = 0.361$   $p = 0.027$ ) and NVC during a visuospatial task ( $d = 0.417$ ,  $p = 0.013$ ), although overall NVC was unaltered ( $d = 0.128$ ,  $p = 0.383$ ). In addition, overall well-being was improved by resveratrol ( $d = 0.200$ ,  $p = 0.005$ ), including reductions in pain ( $d = 0.422$ ,  $p = 0.002$ ) and menopausal symptoms ( $d = 0.223$ ,  $p = 0.024$ ). This confirms our pilot results showing multiple benefits of resveratrol, thereby highlighting a potential non-pharmacological approach to prolong independent living in elderly postmenopausal women.

### 2.13. A Nice Upper Tea? Acute Mood, Attention and Cardiovascular Effects of Green and Black Tea

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Components of both green and black tea have been shown to acutely improve aspects of mood, cognition and cardiovascular function. Research has not, however, directly compared these effects across different types of tea. Fourteen healthy young adults consumed green tea, black tea or placebo (water), according to a double-blind, randomised, placebo-controlled, balanced, cross-over design. Sensory characteristics of the drinks were masked. Mood and cognition were measured at baseline then 90 min post-treatment, cardiovascular function was assessed post-dose only. Compared with placebo, green tea was associated with higher alertness ( $p < 0.05$ ). Both black tea and green tea significantly improved digit vigilance accuracy ( $p < 0.01$ ) and increased central peripheral diastolic pressures ( $p < 0.01$ ). Black tea also significantly increased central systolic pressure compared to green tea and placebo ( $p < 0.05$ ). Analysis of treatment guessing suggested that the masking procedure was effective. Since black tea contains higher levels of caffeine, enhanced alertness following green tea likely involves non-caffeine mechanisms. Improved vigilance is

consistent with caffeine effects. Cardiovascular findings are opposite to those following chronic tea interventions. Acute cognitive and cardiovascular effects of tea merit further investigation both in the presence and absence of caffeine.

#### 2.14. Feasibility and Preliminary Efficacy of a Ketogenic Diet for Reducing Migraine Frequency, Severity and Duration

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Migraine shares a similar pathophysiology to epilepsy and research suggests ketogenic diet therapy (KDT) may reduce episodes of epilepsy. Therefore, the aim was to investigate the feasibility and preliminary efficacy of KDT for reducing migraine frequency, severity and duration compared to common nutrition recommendations for migraine. This pilot 12-week randomised controlled crossover trial (RCT) included two, four-week dietary interventions (ketogenic diet [KD] and anti-headache diet [AH]), with a four-week washout period separating the two test diets. Adults with a history of at least two episodes of moderate-intensity migraine, or at least five episodes of mildly intense headaches in the previous four weeks were included. Twenty-four subjects (92% female) with a mean age of  $42.5 \pm 11.1$  commenced the study, while only 14 (58%) completed. It took an average of  $2.2 \pm 1.1$  days for subjects to reach ketosis during the KD (range 1–5 days). Comparing total migraine episodes during each 4-week dietary intervention, there were significantly less migraine episodes following the KD ( $4.4 \pm 1.1$  compared to AH  $6.6 \pm 1.6$ ;  $p = 0.037$ ). There were no differences in migraine severity or duration between the two diets. Preliminary evidence suggests KDs may reduce migraine frequency. However, further research including larger RCTs are required.

#### 2.15. Sour Taste Genetics (KCNJ2) Predict Cognitive Function in the Elderly

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Differences in taste thresholds have been found to be associated with mental health and cognitive decline. Taste receptor genetics and neurotransmitter levels are determinants of taste thresholds. The neurotransmitters serotonin, gamma-aminobutyric acid and norepinephrine have modulatory roles in mental health and are released from Type-III taste cells after stimulation by sour compounds. However, the direct relationship between sour taste genetics and cognition is yet to be elucidated. Therefore, we investigated the relationship between cognition using Mini-Mental Health State Examination (MMSE) scores and the carriage of the KCNJ2 variant allele (rs236514), in a cohort of adults over 65 years ( $n = 524$ ). Results showed a greater probability of having an MMSE score indicative of cognitive decline ( $\leq 25$ ) in the presence of the KCNJ2-A allele ( $\chi^2 = 4.2$ ,  $p = 0.04$ ). This association remained statistically significant when adjusted for age, sex, education and diet quality ( $p = 0.02$ ). This study suggests a relationship between sour taste genetics and cognitive decline in an elderly population that is independent of age, sex and diet quality. Further investigations are needed to determine if KCNJ2 genetics modify particular dietary factors or if biological mechanisms involved in sour stimulation of Type-III taste cells, such as neurotransmitter release, are mechanisms linking taste to mental health.

### 2.16. Exploring Barriers to Fruit and Vegetable Intake in Australian Adults: A Mixed-Methods Approach

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Few qualitative studies have investigated barriers to meeting guidelines for fruit and vegetable intake by population subgroups. This study aimed to identify perceived barriers to fruit and vegetable intake and to explore differences by sex, age and socioeconomic groups. Data on adults from the cross-sectional Greater Bendigo Active Living Census 2014 were used. Participants self-reported intake of fruit and vegetables. Participants who reported difficulties eating the recommended servings completed an open-ended question on perceived barriers. Leximancer was used for thematic analysis of barriers. Of the 13,788 individuals (54% female, 52.1 (standard deviation (SD) 17.7) years) included in the quantitative analyses, 5649 individuals provided qualitative data on barriers. Only 7% of participants met recommended intakes for fruit and vegetables. Themes identified were lack of time, guidelines perceived as unachievable, wide variety of other foods available and high cost and limited availability of fresh fruit and vegetables. Key barriers by subgroups were taste (males), lack of hunger (females), lack of time (young to middle-aged), lack of appetite (older aged) and cost and availability of fresh fruits and vegetables (rural and disadvantaged groups). Findings have implications for the design of healthy eating strategies, which may benefit from being tailored to population groups.

### 2.17. Effect of Australian School Vegetable Education Program on Factors Associated with Vegetable Consumption in Children: A Cluster Randomised Controlled Trial

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Children's consumption of vegetables is too low. A matched-schools pilot demonstrated that a Vegetable Education Resource (VER) for Australian primary schools (framework of sensory education and scientific evidence to increase children's vegetable acceptance) positively predisposed children towards vegetable consumption. This study aimed to evaluate: 1) large-scale effectiveness using a randomised controlled trial (RCT) and, 2) two forms of teacher training on intervention effectiveness. A cluster-RCT amongst schools with three conditions: 1 = control; 2 = teaching VER preceded by online teacher training; 3 = as 2 with additional face-to-face teacher training. Pre-test, post-test and 3-month follow up measures (knowledge, verbalisation ability, vegetable acceptance, behavioural intentions, willing to taste, new vegetables consumed) were collected from students ( $n = 1639$ , 25 New South Wales / South Australian schools). Data were analysed using mixed model analysis. No difference in intervention effectiveness was found between the two training methods. Compared to control, the VER significantly increased all outcome measures after intervention ( $p < 0.01$ ) with knowledge sustained at 3-month follow up ( $p < 0.001$ ). The Vegetable Education Resource was effective in achieving behavioural change amongst students in factors known to be positively associated with vegetable consumption.

### 2.18. Food Intake at Snack-Eating Occasions and Associations with Energy Intake and Adiposity: A Latent Variable Mixture Modelling Approach

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We applied a novel latent variable mixture modelling (LVMM) approach to understand combinations of foods at snack-eating occasions (EO), and examined associations with energy intake and adiposity. Dietary intake at snack EO ( $n = 17,191$ ), collected via 24-h recall during the National Nutrition and Physical Activity Survey (2011–2012), was examined. Two-part LVMM, appropriate for use with semi-continuous data, was used to determine distinct snack food profiles. Multivariate regression models were used to estimate differences in energy intake and adiposity (body mass index (BMI), waist circumference) between profiles ( $n = 6445$  adults  $\geq 19$  y). Four distinct profiles were identified. Two were labelled: “Coffee/tea, milks and sweet cereal products” and “Breads/crispbreads and spreads”. Among men, an “Alcohol” profile and a “Mixed” profile were also identified. Two profiles unique to women were characterised by “Fruit” and “Unhealthy foods/beverages”, respectively. Among both sexes, the “Breads/crispbreads and spreads” profile contributed the highest mean energy intake at snack EO, whereas the “Coffee/tea, milks and sweet cereal products” (men) and “Fruit” (women) profiles contributed the lowest (all  $p < 0.001$ ). No differences in adiposity measures were observed. We identified four snack food profiles in adults that varied by their contribution to energy intake but not adiposity. LVMM is a useful approach to provide novel insight into eating behaviours at EO.

### 2.19. The Relevance of Whole-Grain Food Definitions in Estimation of Whole-Grain Intake

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Recommendations for whole-grain intake are based on population intake values determined through the use of inconsistent definitions of whole grain foods. The European-based Healthgrain Forum have recommended a definition for global application, however, the impacts of this definition on whole-grain intake measurement, compared to calculation of total grams irrespective of the source, was unknown. The Australian whole-grain database was expanded to identify foods that comply with the Healthgrain definition. Secondary analysis of the National Nutrition and Physical Activity Survey (2011–2012) involved whole-grain intake calculation based on intake from foods complying with the Healthgrain definition and compared to intake values where grams of whole grain in any food were included. In result, 214 of the 609 foods containing any amount of whole grain were compliant with the Healthgrain definition. Significant mean differences (all  $p < 0.05$ ) of up to 6.25 g of whole-grain intake/day (9.44 g/day energy adjusted) were found when applying the Healthgrain definition in comparison to values from foods containing any whole grain. Application of a whole-grain food definition substantially decreases estimates of population whole-grain intakes. This may impact identification of associations with health outcomes, and subsequently influence public-health messaging.

### 2.20. Interventions for Increasing Fruit and Vegetable Consumption in Children Aged 5 Years and Under: Systematic Review

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Insufficient consumption of fruits and vegetables in childhood increases the risk of future non-communicable diseases. Interventions to increase consumption of fruit and vegetables, such as those focused on specific child-feeding strategies and parent nutrition education interventions in early childhood may, therefore, be an effective strategy in reducing this disease burden. A Cochrane systematic review was conducted to assess the effectiveness of interventions to increase fruit or vegetables' consumption in children aged five years and under. Any randomised trial of interventions aiming to increase the intake of fruit or vegetables for children aged five years and under that assessed intake was eligible. Trial effects were synthesised via meta-analyses using random-effects models. Sixty-three trials with 178 trial arms and 11,698 participants were included. Child-feeding practice and multicomponent interventions were found to have a small positive effect on children's intake of fruit and vegetable (by 3.50 g and 0.37 cups per day, respectively). No evidence of effect was evident for parent nutrition education interventions. The evidence for how to increase children's fruit and vegetable consumption remains limited. Future intervention research adopting more rigorous methods to advance the field is required.

#### *2.21. Increasing Early Childhood Education and Care Service Food Budgets Will Improve Food Provision Compliance*

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Healthy eating is a public health issue for 1.3 million children attending Early Childhood Education and Care (ECEC) services. Literature benchmarking ECEC service food budgets is limited. This research captured food provision expenditure and makes recommendations to achieve >50% of food group provision for children 2–3 yrs. Two days of mealtime ingredients were weighed and costed from 30 metropolitan long-day care services and expenditure calculated. Differences in food group servings among services categorised by their food expenditure was undertaken using multivariate analysis of variance (MANOVA). Logistic regression (LR) modelling determined whether year, service type, socioeconomic status (SES), food expenditure influenced compliance. Daily expenditure ranged from \$1.17–\$4.03 (mean \$2.00/child/day). Twenty services spent \$1.50–2.50; 5 services <\$1.50 or >\$2.50/child/day. Food group provision was associated with increased expenditure ( $p = 0.014$ ) even after adjustment for year, service type and SES; <50% provision of meat/alternatives ( $p = 0.025$ ) and dairy ( $p = 0.032$ ) was associated with reduced expenditure. The multivariable LR model suggests an additional \$0.50/child/day would increase the odds of a service meeting the recommendations across 4 or more core food groups by 4-fold ( $p = 0.03$ ). Daily food budgets average \$2/child/day. Budgets vary greatly, those <\$1.50/child/day impact overall diet quality. An increase of \$0.50/child/day, from the average spent, would improve food provision.

#### *2.22. Higher Processed Meat Consumption among Self-Reported Low-Carbohydrate and High-Fat (LCHF) Dieters in Australia*

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Low-carbohydrate and high-fat (LCHF) diets have re-emerged in the public spotlight and are popular among those attempting weight loss. The impact of these diet trends on the diet quality of individuals and the general population is unknown. Food-consumption data of self-reported LCHF dieters from a recent online survey of Australians adults attempting to lose weight ( $n = 229$ ) were used in this secondary analysis. Mean weekly food serve scores among LCHF weight-loss group ( $n = 46$ ) and other diets group ( $n = 183$ ) were compared, using Independence  $t$ -tests. As expected, the LCHF group consumed less bread, cereal, pasta; cakes, biscuits and pastry; and soft drinks, and more meat, fish and poultry. However, the mean score for consumption for processed meats was

higher in the LCHF group (Mean difference:  $-1.1$ , 95% confidence interval (CI)  $-2.1$ ,  $-0.11$ ,  $p = 0.031$ ). No statistically significant differences were found in vegetable and fruit consumption, dairy, hot chips and takeaway food. The higher consumption of processed meats among LCHF dieters is disturbing and exposes them to a high risk of ill health. Emerging diets trends such as 'dirty keto' are alluring (but ill-informed) as they offer the prospect of losing weight while still eating a variety of "junk foods" such as highly processed meats and fats.

### 2.23. *Are Improvements Maintained Following a 6-Month Home-Based Diet and Lifestyle Intervention in Rural Adults with or at Risk of Metabolic Syndrome?*

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A 6-month diet and physical activity (PA) intervention consisting of printed and online resources and motivational support was implemented in adults with, or at risk of, metabolic syndrome. Significant improvements were observed in diet, PA, anthropometry, blood pressure (BP) and fasting lipid profile. This study aimed to investigate whether these improvements are maintained post-intervention. Following the initial intervention, participants in the intervention group ( $n = 151$ ) were tested at 6 and 12 months. Diet, PA, BP, anthropometry and fasting lipid profile (12 months post-intervention only) were measured. Paired sample *t*-tests and repeated measures analysis of variance (ANOVA) were performed to assess changes between the three time-points. Improvements in diet, PA, anthropometry, systolic BP and lipid profile were maintained in the intervention group during the follow-up period, with a further marginal decrease in waist circumference ( $p = 0.001$ ). However, a modest increase in diastolic BP was observed ( $p = 0.01$ ). The improved diet, PA and lipid profile were maintained for an additional 12 months. Although waist circumference was the only outcome measure that continued to improve during follow up, it is possible that other measures were improved relative to a control group, and this warrants further investigation.

### 2.24. *Association between Sodium to Potassium Ratio and Blood Pressure in Adults: A Systematic Review and Meta-Analysis*

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Diet plays an important role in the regulation of blood pressure (BP), but the relative contribution of sodium to potassium intake has not been sufficiently investigated. A systematic literature review (PROSPERO; CRD42016035296) was conducted to evaluate the association between urinary sodium to potassium ratio (Na:K) and systolic and diastolic BP. Three scientific databases (MEDLINE, Scopus, Web of Science) were searched to December 2018 accompanied by hand searching of references in cited studies. Randomised controlled trials (RCTs), cohort and cross-sectional studies in adults that assessed urinary excretion were included. Quality assessment was conducted using GRADE criteria. Random effects meta-analysis was conducted on RCT data to assess weighted mean differences in BP according to urinary Na:K. Findings are reported according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Thirty-eight studies were included. Meta-analysis of five RCTs found a lower urinary Na:K to be associated with a significantly greater reduction in systolic and diastolic BP compared to a higher urinary Na:K (Weighted mean difference:  $-4.38$  [95% confidence interval (CI):  $-5.90$ ,  $-2.87$ ] and  $-2.60$

[95% CI: -3.73, -1.48] mmHg, respectively). The current body of evidence demonstrates that dietary strategies to achieve a lowered urinary Na:K excretion ratio would be beneficial in lowering BP.

#### 2.25. Comparing Whole-Grain with Cereal Fibre—Associations with Cardiovascular Disease (CVD) Risk Markers in the UK National Diet and Nutrition Survey and the Australian Health Survey

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Whole-grain intake is associated with lower risk of cardiovascular disease (CVD). Cereal fibre may be responsible, although it is unclear to what extent. Cross-sectional analyses of the National Diet and Nutrition Survey (NDNS) Rolling Programme (2008–2014) and the 2011–2013 Australian Health Survey (AHS) examined associations between whole-grain and cereal fibre intakes and CVD risk markers using multivariate regression analysis. NDNS participants with the highest whole-grain intake (Q4) had lower waist-hip ratio (Q1 0.872; Q4 0.857;  $p = 0.04$ ), Hemoglobin A1c (HbA1c) (Q1 5.66%; Q4 5.47%;  $p = 0.01$ ) and homocysteine (Q1 9.95  $\mu\text{mol/L}$ ; Q4 8.76  $\mu\text{mol/L}$ ;  $p = 0.01$ ) compared to participants with the lowest intake (Q1) after adjustment for cereal fibre intake. AHS participants with the highest whole grain intake had lower waist circumferences ( $p = 0.03$ ), HbA1c ( $p = 0.03$ ) and fasting glucose ( $p = 0.048$ ) compared to non-whole grain consumers, after cereal fibre intake adjustment. Cereal fibre intake was inversely associated with waist-hip ratio ( $p = 0.03$ ) and homocysteine ( $p = 0.002$ ) (NDNS), and body mass index (BMI,  $p < 0.0001$ ) and waist circumference ( $p = 0.0008$ ) (AHS). Similar inverse associations between intakes and CVD risk markers suggest cereal fibre may play a role in protective associations of whole grains. However, whole-grain associations often remained significant after adjustment for cereal fibre intake, suggesting additional constituents may be relevant.

#### 2.26. Acceptability of a Web-Based Lifestyle Intervention for Women with a History of Preeclampsia: The Be Healthe for Your Heart Study

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Women with a history of preeclampsia are at greater risk of cardiovascular disease (CVD). Best-practice guidelines recommend women with a history of preeclampsia receive counselling about modifiable risk factors for CVD. This study aimed to evaluate the acceptability of a lifestyle intervention for women with a history of preeclampsia (Be Healthe for your Heart: BH4YH). Women aged 18–45 years, with recent preeclampsia were randomly allocated to BH4YH or a control group. BH4YH is a 3-month program delivered via a website and email. BH4YH supports changes to modifiable risk factors for CVD (diet, physical activity, weight and stress). Program components include: a screening tool with feedback (How Healthy is your Heart?), goal-setting (My Goals), self-monitoring (Track my Progress), educational resources, and email newsletters. Intervention acceptability was evaluated after 3 months via an online survey. Sixteen participants were allocated

to BH4YH, and 13 (81.3%) completed the study. Most participants (11/13) agreed they were satisfied with the program. Participants reported high satisfaction with email newsletters (mean:  $4.2 \pm 0.7$ , maximum 5), How Healthy is your Heart? ( $4.2 \pm 0.4$ ) and educational resources ( $4.0 \pm 0.6$ ), and moderate satisfaction with (My Goals  $3.7 \pm 0.4$ ) and Track my Progress ( $3.6 \pm 0.8$ ). The findings provide insights from end-users to help shape intervention refinements.

### 2.27. Nitrate Intake Is Inversely Associated with Cardiovascular Disease Mortality: The Rotterdam Study

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One component of vegetables that has attracted research attention in the past decade is nitrate. We aimed to examine the association of nitrate intake with cardiovascular disease (CVD) mortality in a large cohort of Dutch men and women, The Rotterdam Study. Dietary intake was assessed using validated food-frequency questionnaires. Nitrate intake from vegetables was estimated using a comprehensive vegetable nitrate database. Nitrate intake from other food sources was estimated using published data. CVD mortality data were obtained from municipal records and automatic linkage of general practitioner files. Data were analysed using Cox regression analysis adjusting for lifestyle and CVD risk factors. Mean (SD) age, total and vegetable nitrate intake was 64.1 (8.7) yrs, 102.8 (66.7) and 87.3 (65.2) mg/d, respectively; 1243/9701 (12.8%) died from CVD during a median follow-up of 13 years (range: 0–24). Participants in quintile 3 of total (76.7–95.6 mg/d) and vegetable (61.7–80.1 mg/d) nitrate intake had 17%–18% lower risk of dying from CVD compared to those with the lowest total (<59.5 mg/d) and vegetable (<45.7 mg/d) nitrate intake ( $p < 0.05$  for both). Our findings support the hypothesis that diets with adequate nitrate intake, derived primarily from vegetables, may reduce the risk of CVD mortality.

### 2.28. Effects of Medium-Chain Saturated Fatty Acids and/or Omega-3 Polyunsaturated Fatty Acids on Postprandial Lipaemia in Healthy Individuals

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Long-chain omega-3 polyunsaturated fatty acids (LCn-3PUFA) and medium-chain saturated fatty acids (MCSFA) have been shown to reduce postprandial lipaemia. This study aimed to investigate the complementary and/or synergistic effects of fish oil and/or coconut oil on postprandial triglycerides (TG). Fifteen healthy volunteers were randomised in a double-blinded, placebo-controlled, cross-over trial to consume a standard meal fortified with placebo, coconut oil (15 g MCSFA), fish oil (2.94 g LCn-3PUFA) and coconut + fish oil on 4 test days separated by a 1-week washout. Capillary blood samples were collected after an overnight fast and at 6-time intervals between 0–300 min after meal consumption. Area under the curve (AUC) was calculated by trapezoidal rule using STATA Software. The placebo resulted in a significantly larger AUC [396 (517.80)] compared to fish oil [379.5 (298.2),  $p < 0.05$ ] and coconut + fish oil [313.35 (299.25),  $p < 0.05$ ]. Post TG peak (180 min), the change in TG concentrations after fish oil were significantly less at 240 min, 270 min and 300 min compared to placebo, and at 270 min and 300 min compared to coconut oil ( $p < 0.05$ ). Change in TG after coconut + fish oil was significantly less at 270 min and 300 min compared to placebo ( $p < 0.05$ ). LCn-3PUFA, but not MCSFA lowers postprandial TG response in

healthy individuals and no complementary and/or synergistic lipid-lowering effects were apparent at the doses tested.

### *2.29. Association between Flavonoid Intake and Risk of Hypertension among Middle-Aged Australian Women: A Longitudinal Cohort Study*

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Epidemiological evidence suggests higher dietary flavonoid intake is associated with lower risk of several chronic diseases. This study aimed to investigate the association between intake of flavonoids and their subclasses, and incidence of hypertension among middle-aged Australian women. This population-based study included 6599 women from the Australian Longitudinal Study on Women's Health. Women were aged 52 years (SD 1.5) at baseline in 2001 and followed-up for 15 years across six surveys. Food-frequency questionnaires were used to quantify intake of flavonoids by cross-referencing with the PhenolExplorer food composition database. Generalised estimating equation analyses investigated associations with incident hypertension, adjusting for demographic and dietary variables and hypertension risk factors. There were 1645 cases (24.9%) of hypertension during 15 years' follow-up. Intakes of total flavonoids, anthocyanins, flavanols and flavonols were not associated with incidence of hypertension. Higher intakes of flavones (adjusted relative risk for intake quintile 5 vs. 1: 0.82, 95% confidence interval (CI): 0.70–0.97), isoflavones (0.86, 0.75–0.99) and flavanones (0.83, 0.69–1.00) were associated with a reduced risk of hypertension. Higher intakes of flavones, isoflavones and flavanones, attributed mainly to orange, orange juice, apples, nuts and soy, are associated with a reduced risk of hypertension among middle-aged women in Australia.

### *2.30. A Methodological Approach to Identify the Most Reliable Human Milk Collection Method for Compositional Analysis: A Systematic Review*

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Breast-milk composition varies within and between days and even across a single feed. Thus, the method of sample collection can have a significant impact on the results of compositional analyses and relationships to infant outcomes. The aim of this study was to undertake a systematic analysis of the different sampling methods used in breast milk composition studies and determine the impact of method choice on the breast-milk macronutrient composition. Following a systematic search of EMBASE, MEDLINE/PubMed, Cochrane Library, Scopus, Web of Science, and ProQuest databases, 5297 publications were identified, of which 101 studies were included (5053 breastfeeding women). The most frequently used method was collection of a full expression at one time point (26 studies, 1377 participants), followed by pooling of all full expressions across 24 h (16 studies, 616 participants) and collection of pre-and post-feed samples at one time point (12 studies, 612 participants). Fat content varied according to method of collection, while protein and lactose content appeared relatively consistent. Our review reinforces the need for establishing a standardised method for breast-milk collection to ensure accurate analysis of milk components with respect to infant outcomes and combining of data to enhance replicability and knowledge in the field.

### 2.31. Monounsaturated Fat Intake May Protect against Poor-Quality Sleep during Pregnancy

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Sleep disturbance is associated with decreased diet quality. Sleep disturbance is common in pregnancy. The aim of this study was to investigate the relationship between sleeping behaviour and macronutrient intake of pregnant women. This was a cross-sectional analysis of pregnant women ( $n = 437$ , aged 31–36 yrs) in the Australian Longitudinal Study on Women's Health, Survey 5, in 2009. Participants self-reported sleep and dietary data. Latent class analysis derived sleeping behaviour patterns. Relationships between sleep and diet were investigated through multivariate linear regression controlling for confounders including: area of residence, body mass index, depression, difficulty managing on income, education level and parity. Latent class analysis identified three sleeping behaviour patterns: (LC1) average sleep (~7.8 h) with no adverse sleep-related symptoms ( $n = 167$ ); (LC2) average sleep (~8.3 h) with adverse sleep symptoms ( $n = 193$ ); and (LC3) short sleep (~6.6 h) with adverse sleep symptoms ( $n = 97$ ). After adjusting for potential confounders, LC2 was associated with lower percentage energy (%E) total fat ( $b = -0.032$ ,  $p = 0.039$ ) and %E monounsaturated fat ( $b = -0.050$ ,  $p = 0.005$ ) and higher %E carbohydrate ( $b = 0.031$ ,  $p = 0.020$ ), compared to LC1. No differences were found between LC1 and LC3. Higher monounsaturated fat intake, at the expense of carbohydrate intake, may prove protective against poor sleep quality in pregnancy.

### 2.32. Determinants of Maternal Omega-3 Status in Pregnancy

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The importance of omega-3 docosahexaenoic acid (DHA) in reducing early preterm birth is well known. However there is limited knowledge of the influence of lifestyle, sociodemographic and pregnancy-related factors on maternal omega-3 status during pregnancy. The aim of this research was to systematically evaluate the relationship between these factors and maternal DHA/other omega-3 status during pregnancy. Medline, Embase, Amed, and CINAHL databases were searched. Studies were included if they reported DHA as a maternal venous blood concentration and included data for a lifestyle/sociodemographic/pregnancy factor. Forty-three studies were included in the final analyses. Many findings were inconsistent, however a majority of studies showed that maternal alcohol intake, smoking, body mass index (BMI), gestational diabetes and parity were associated with lower levels of DHA and other omega-3 polyunsaturated fatty acids (PUFA). Meanwhile, other studies reported that higher maternal fish consumption, dietary PUFA intake, education and a longer inter-pregnancy interval were associated with higher levels of DHA and other omega-3 PUFA. Our findings indicate the presence of important relationships between sociodemographic and pregnancy-related characteristics of women, and their omega-3 PUFA status, but also highlight the lack of consistency in findings between individual studies. Further investigation is required to clearly identify those factors that may influence maternal status.

### 2.33. In Pregnancy Maternal HDL Is Enriched in Docosahexaenoic Acid, but Not Arachidonic Acid, and Carries the Largest Fraction of These Fatty Acids in Plasma

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Arachidonic acid (AA) and docosahexaenoic acid (DHA) are important for neurological development. The aim was to determine the distribution and relative enrichment of AA and DHA among the five lipoprotein fractions prior to pregnancy, throughout gestation and in the post-partum period. Our hypothesis was that in pregnancy as compared to the non-pregnant state, AA and DHA are carried in highest concentration in the VLDL lipoprotein fraction. Two independent prospective, observational cohort studies carried out in Glasgow, one early in pregnancy ( $n = 24$ ) and one later in pregnancy ( $n = 20$ ), were combined. Across the pregnancy timeline (8 time-points) plasma lipoproteins were isolated using sequential ultracentrifugation, fatty acids were extracted and analysed by gas chromatography. Analysis of variance (ANOVA) was used to determine significant differences. HDL had the highest concentration of AA (ranging from 191–253 nmol/ml plasma) and DHA (58–174 nmol/ml plasma) compared to other lipoproteins. HDL AA per HDL-cholesterol did not differ across the pregnancy timeline ( $p = 0.28$ ), however HDL DHA per HDL-cholesterol ( $R^2$  adjusted = 13%,  $p < 0.0001$ ) became progressively enriched at 16 weeks' gestation, peaked at 25 weeks, and returned to baseline at 13 weeks postpartum. DHA is carried primarily in HDL possibly because HDL has important anti-oxidant, anti-inflammatory and vasodilatory properties that are potentially accentuated in pregnancy.

#### 2.34. Micronutrient Intake Inadequacy at 9 Months among Indigenous Children in the Gomeri Gaaynggal Cohort

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Quality complementary food prevents malnutrition and improves early childhood growth and development. Optimal nutrient intake from first foods is important among children in order to meet their nutrient requirements in accordance with the Australian Guide to Healthy Eating. Twenty-four-hour dietary recalls of Indigenous children aged 9 months in the Gomeri gaaynggal cohort were collected and analysed. Descriptive statistical analysis was performed using Stata/IC (15.1) to determine total nutrient intake, which was compared with the Australian Nutrient Reference Values to determine adequacy of intake. Forty-nine recalls were obtained showing few infants consumed breast-milk at this age ( $n = 9$ ; 4%). All infants met their protein requirements while most met their carbohydrate ( $n = 39$ ; 80%) and total fat ( $n = 29$ ; 69%) requirements. No infant met their omega-3 fatty acid requirements. A significant number met their micronutrient requirements such as zinc ( $n = 47$ ; 90%) however few infants met their iron requirements ( $n = 23$ ; 47%). The majority of children did not meet requirements for micronutrients which are important for cognitive function and prevention of anaemia. Intervention strategies to be trialed for acceptability in infant intakes could include foods or fortified foods and supplements rich in iron and omega-3 fatty acids.

#### 2.35. Opportunities to Shape Children's Vegetables Preference Development in the Early Years: A Review of Reviews

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Less than 5% of Australian children meet vegetable recommendations. Food preferences are shaped during pregnancy, lactation and complementary feeding. There may be opportunities to strengthen public-health action in the early years to foster lifelong vegetable acceptance and intake. The aim of this umbrella review was to summarise the evidence on vegetable preference development in first years of life. Databases were searched (MEDLINE, Scopus, WOS, PsycINFO, EMCARE, ERIC, JBI, Cochrane, DARE) for systematic reviews published in English that investigate the psychological or sensory factors influencing children's vegetable preferences (antenatal to three years). Extracted data were assessed on the strength of evidence, methodological quality and mapping against a framework to identify effective strategies at each development stage. Eleven reviews were included. Repeated exposure, role modelling, vegetable availability and non-food rewards demonstrate a positive effect on children's liking and consumption of vegetables. Strategies that show promise include in-utero exposure, breastfeeding duration, offering vegetables as first food and increasing familiarity through vegetable-based picture books. There is some evidence that flavour-nutrient conditioning has a negative impact. Several effective strategies that positively influence children's vegetable preference development across key early-life developmental phases can provide a foundation for strengthening policy and guideline advice and informing intervention research.

### 2.36. Maternal Metabolic Syndrome and Accelerated Aging in Children

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Offspring exposed to adverse intrauterine exposures such as raised glucose or hypertension are at greater risk for future cardiometabolic diseases. Intrauterine exposures can program telomere length, a biomarker of molecular aging, in later life. The study aims to determine whether metabolic syndrome (MetS), a clustering of cardiovascular risk factors, in pregnancy associates with accelerated aging as measured by telomere length in 10-year-old children. Maternal and child data ( $n = 255$ ) from the Adelaide cohort of the international Screening for Pregnancy Endpoints (SCOPE) study. Metabolic health markers were assessed at the first antenatal visit. DNA was isolated from child saliva, and telomere length was measured using quantitative real-time polymerase chain reaction (PCR). Adjusted linear regression analysis was used. Twenty percent of the women had MetS in pregnancy. On adjusted analysis, 10-year-old children of mothers who had MetS in pregnancy had a mean 0.39 shorter relative telomere ratio than children of mothers without MetS (mean  $\pm$  standard error of the mean (SEM),  $2.05 \pm 0.26$  vs.  $2.44 \pm 0.22$ ,  $p = 0.032$ ). Ten-year-old children of mothers who had MetS in pregnancy show accelerated aging. Early antenatal screening for adverse metabolic profiles and potential interventions may be clinically important to reduce future risk for cardiovascular disease in women and children.

### 2.37. Less is More: The Influence of Nitrogen Fertiliser Application on Anthocyanins in Sweet Cherries

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Sweet cherries are a rich source of anthocyanins, which are associated with fruit colour and human health benefits. The cherry variety determines the profile of anthocyanins which accumulate during ripening. However, the impact of orchard management practices including nitrogen (N) fertiliser application on anthocyanin content of cherries is unknown. A field trial in a commercial cherry orchard over two seasons assessed the impact of pre-harvest N fertiliser rates of 0, 23.5 and 45 kg N ha<sup>-1</sup> on the anthocyanin content of sweet cherries (“Lapins”). Anthocyanin profiles were determined by Ultra performance liquid chromatography-tandem mass spectrometry (UPLC-MS/MS) and contents by ultraviolet (UV)–visible spectroscopy (pH-differential method). Descriptive statistics were performed. Results indicate that cyanidin-3-rutinoside was the most abundant anthocyanin (82%), followed by peonidin-3-rutinoside (14%). Mean inter-seasonal differences in anthocyanin content were high (330 ± 154 and 48 ± 29 mg 100 g<sup>-1</sup>, respectively). In the second season, with the accumulative effect of treatments on cherry trees, cherries with increasing rates of nitrogen application showed decreased anthocyanin contents (60, 50, 33 mg 100 g<sup>-1</sup>, respectively). These results highlight for the first time that high pre-harvest N application reduces the anthocyanin content of cherries. This knowledge can inform orchard management decisions to regulate the fruit colour and anthocyanin content of sweet cherries.

### 2.38. Energy Substrate Use and Protein Metabolism in Cultured Juvenile Spiny Lobster *Sagmariasus Verreauxi* under Different Nutritional Conditions

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Investigating energy substrate use (ESU) and protein metabolism is crucial to understanding nutritional physiology and refining diets for aquaculture species. This study determined ESU by stoichiometry in cultured *Sagmariasus verreauxi* juveniles that were 10-day starved, 2-day fasted, or fed with squid, *Nototodarus sloanii*. Additionally, the contribution of protein synthesis to energy metabolism was considered in two ways: oxygen consumption pre- and post-injection of a protein synthesis inhibitor cycloheximide; measurement using a stochastic endpoint method in lobsters fed isoenergetic diets containing 40%, 50% and 60% protein. Stoichiometry and stochastic endpoint methods have been extensively used in human and terrestrial animal research, but not in aquatic ectotherms. During starvation, lipid was the primary energy substrate whereas during fasting, protein was the primary substrate (65% of oxygen consumption), with lipid accounting for the remainder (35%). Following feeding, protein contribution remained at over 50%, while lipid (0%–43%) and carbohydrate (0%–37%) provided considerable energy at different times. The contribution of protein synthesis to energy metabolism in starved, fasted and fed lobsters was 13%, 29% and 96%, respectively. Different dietary protein levels did not affect protein synthesis. Overall, this study illustrated the potential of a sophisticated nutritional physiological approach for developing cost-effective aquafeeds.

### 2.39. How Do Consumers Define, Identify, and Source Regionally Grown Fruits and Vegetables? A Cross-Sectional Study in Two Agricultural Regions of Australia

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Regional food systems are complex networks with numerous retail sources that underpin a local economy. However, evidence is limited regarding consumer perceptions of how to define,

identify, and source regionally grown fresh fruits and vegetables (RGFFV). This study aimed to determine how RGFFV are defined and identified by consumers, and where they are sourced in two agricultural regions of Australia. A cross-sectional, quantitative survey was conducted using a convenience sample of adults in Tasmania and South West Western Australia (WA). Survey data (total  $n = 243$ ; Tasmania  $n = 120$ , South West WA  $n = 123$ ) identified that consumers had mixed perceptions of how RGFFVs are defined, including produce sold at farmers markets (37%), grown within a geographic boundary (27%), available at local supermarkets (21%), and to a lesser extent, sold at farm-gates. RGFFVs were most commonly identified through product labelling (60%). Consumers reported purchasing RGFFVs at supermarkets (80%), greengrocers (68%) and farmers markets (63%), and a high proportion grow their own (67%). While supermarkets offer convenience, consumers enjoy the experience of farmers markets and growing their own produce. These findings assist in identifying gaps and opportunities for improving the consumption of fresh produce, which may positively influence regional economic growth and population health and wellbeing.

#### *2.40. Meat Substitutes in the Flexitarian Age: An Audit of Products on Shelves in Australian Supermarkets*

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Demand for meat substitutes is growing globally for nutritional, environmental, and ethical reasons, with Australia the third-fastest growing vegan market worldwide. This study aimed to outline available meat substitutes (designed to mimic meat) in Australia, compared with 2015 data. An audit undertaken in May 2019 in four metropolitan Sydney supermarkets (Coles, Woolworths, Aldi, Independent Groceries Association), collected nutrition and on-pack data including Health Star Rating (HSR) from 120 products (47 burgers, 10 mince, 25 sausages, 20 chicken, 6 seafood, 12 other). Mean and range was calculated for protein, saturated fat, and sodium. Overall, 81% were a source of protein (1.2–26.4 g/100 g), and 75% were low in saturated fat (0.1–13.2 g/100 g). Only 3% were low in sodium, and there was a wide range (58–1200 mg/100 g). HSR featured on 53%, with a mean score of 4.1 (2.5–5.0 stars). Top on-pack claims were vegetarian/vegan/plant-based (80%), protein (63%), non-genetically modified/organic (34%), and gluten free (28%). Compared with 2015, products captured more than tripled (↑328%), with burgers increasing by 570%. The plant protein trend has prompted innovation in meat substitutes by the food industry; however, wide nutrient ranges and higher sodium levels highlight the importance of nutrition professionals' involvement in their development to ensure equivalence with animal-based proteins.

#### *2.41. Food Analysis for Nutrition Labelling—beyond Composition*

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Studies of relationships between food structure and health biomarkers show that food molecular composition alone is not sufficient to predict nutritional value. This presents a challenge for food labelling to provide analytical measures that, in addition to composition, can form the basis for informed purchase decisions and dietary recommendations. For such analytical measures to be useful they need to be (i) measured reproducibly on foods with precision and accuracy, (ii) intuitively understood by consumers, (iii) relevant to all food types, and (iv) related to risk factors for major health challenges. Energy release rate (or similar) is proposed as a measure that fulfils all of these criteria. Here 'energy' refers to the sum of carbohydrate, protein and fat energy, although there may be foods where quoting one or more individual macronutrient release rate could be appropriate. Energy release rate would be measured in vitro using an internationally agreed standard protocol that will require collaboration between scientists and regulatory agencies to be developed. The method should include both direct energy release and enzyme digestion in the

context of models for gastric and small intestinal processing including residence times. Challenges and steps required to develop energy release rate for food labelling will be discussed.

#### 2.42. *The 'Great Food Transformation'. How Does the EAT-Lancet Planetary Health Recommended Diet Compare with the Australian Dietary Guidelines and Australian Diets in 2011–2012?*

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In 01/2019, the EAT-Lancet Commission released global scientific targets for a planetary health diet (PHD). As universal adoption by 2050 has been recommended, it is important to consider the dietary implications for Australia. This study aimed to compare the PHD with the 2013 Australian Dietary Guidelines (ADG) and Australian diets in 2011–2012. PHD scientific targets were extracted, scaled for energy equivalence, and compared with: (1) ADG recommendations; (2) 2011–2012 Australian National Nutrition Survey results. For adults (19–50 y), the PHD is lower in whole grains (33%), vegetables (36%–45%), fruit (54%), dairy (72%), fish (33%) and red meat (85%) than the ADG, and for women it is 92% higher in unsaturated oil and 300% higher in nuts. To meet the PHD targets, Australians (2 y+) would need to consume 150% more whole grains, 32% more non-tuber vegetables, 198% more legumes, 406% more nuts, 45% more unsaturated vegetable oil, 36% less fruit, 52% less dairy, 82% less red meat, 60% less poultry, 43% less eggs, 8% less fish and 52% less added sugar, compared with 2011–2012. In conclusion, there are substantial differences between the PHD, the ADG recommended diets and Australian diets in 2011–2012. Transitioning to the PHD would require major dietary transformation.

#### 2.43. *Can Australians Adhere to Principles of the Mediterranean Diet? What Is the Evidence From Clinical Trials Conducted in Australia?*

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The paradigm of assessing dietary patterns as a determinant of disease risk is the cornerstone of the Australian Dietary Guidelines (ADGs). However, recent trends in poor diet quality and prevalence of non-communicable disease (NCD) raise concerns. Adherence to a Mediterranean diet (MedDiet) is associated with a substantial reduction in the risk of multiple NCDs. We examined, synthesised, and developed a narrative review to explore the efficacy and adherence to a MedDiet adopted in clinical trials conducted in Australia. We report on a total of seven clinical trials conducted in Australia with sample sizes ranging from 27 to 137 middle-aged and older adults. Consistent with previous literature, studies included in the present review reported improvements in glycemic control, reductions in cardiovascular disease risk markers, improved cognition and depressive symptomology. All clinical trials reported impressive and sustained adherence to the MedDiet intervention, albeit with the use of aggressive, yet successful strategies to facilitate dietary compliance. Adapting a MedDiet to satisfy a population's nutritional requirements and traditional customs warrants further exploration. We present arguments into the possibility of translating key dietary principles of the MedDiet which could be used by policy makers in the next iteration of the ADGs.

#### 2.44. *Study of Cooking Oils' Suitability for Teflon-Coated Cookware*

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There is a belief supported by manufacturers' specifications that oils with higher smoke points are more suitable for cooking with Teflon cookware (TC) and that extra virgin olive oil (EVOO)

could be damaging to their coating. Three brands of TC of varying price points were heated with water and vinegar (WV) solutions to promote release of chemical elements testing WV solutions before and after 6 cycles of heating with EVOO, olive, rice bran, canola and grapeseed oils. Combining all TC, no significant differences in the chemical elements content was observed between the final WV solutions from TC treated with the different oils. Considering each brand of TC, phosphorus levels were significantly higher between treatments when using rice bran oil in the average-priced TC (4.7 mg/L vs 2.5 mg/L). Silicon dioxide was not detected before treatment and significantly increased using olive (1.1 mg/L) and grapeseed (1.03 mg/L) oils in the lowest-priced TC. These results are limited considering the lifetime of the TC, but they indicate no initial impact of the oils' smoke point on the performance of the TC and that EVOO performs similarly to the other oils under normal cooking conditions.

#### *2.45. Gut Microbiome Outcomes Associated with Dietary Intake of Cereal and Grain Foods: A Systematic Review*

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Obesity and its sequelae contribute to metabolic syndrome, a condition associated with increased non-communicable disease risk. Increasingly, the role of cereal fibres in modulating the gut microbiome and associated inflammatory processes is hypothesised as a mechanism for reducing metabolic syndrome onset. A systematic literature review was conducted to evaluate the effect of cereal fibre on the gut microbiome, including changes to microbiota diversity or composition, in addition to markers of metabolic syndrome. Review protocol followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) format. Included studies were of randomised control design and provided cereal fibre-based intervention through dietary counselling or provision of foods or supplements. Initial searches identified 4947 papers after duplicate exclusion. Following screening and review, 49 primary, and two secondary publications were included. A total of 1922 participants between 12.6 years to 65.5 years were included with mean body mass index (BMI) ranging from 18.7–39.4 kg/m<sup>2</sup>. Studies included whole food interventions comparing either wholegrains to refined grains or high cereal-fibre intakes compared to low or supplemented cereal fibres including resistant starches, brans, beta glucans, arabinoxylans, oligosaccharides and mixed cereal sources. The effects of cereal fibres on microbiome diversity, composition, short-chain fatty acids (SCFA) production and metabolic syndrome indicators were found to be dependent on fibre type, quantity and individual variation.

#### *2.46. Tastant-Induced Gut–Brain Signals*

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The bidirectional, neurohumoral communication system between the gut and the brain (gut–brain axis) is crucial for appetite regulation. Understanding the role of different dietary components on underlying gut–brain signalling effects remains incomplete. Bitter tastants are increasingly studied for their effects on appetite modulation and altered gastric motility. The aim of this review article was to provide an update into the integration of gut–brain signals induced by bitter tastants. A series of recent studies using intragastric administration of bitter tastants (quinine-hydrochloride or denatonium benzoate) assessing physiological (gastric motility via manometry), behavioural (appetite-related sensations via questionnaires; food intake via ad-libitum food tasks), neuropsychological (brain activity via functional magnetic resonance imaging) and biochemical (circulating gastric hormone levels via validated kits) methods were reviewed. Intragastric administration of the bitter tastants decreased antral motility, decreased prospective and actual food intake by altering activity in homeostatic and hedonic brain regions, and was mediated by a reduction in the orexigenic hormones, ghrelin and motilin. These studies have increased the

knowledge on the anorexigenic properties of bitter tastants and highlight the integration of key central and peripheral mechanisms along the gut–brain axis. These findings also warrant future research into the potential application of bitter tastants for obesity management.

#### 2.47. Alignment of Dietary Assessment and Symptom-Reporting Capture Periods in Studies Assessing Associations between Food and Functional Gastrointestinal Disorder Symptoms

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Food ingestion is strongly associated with the induction of symptoms of irritable bowel syndrome (IBS) and functional dyspepsia (FD), which affect over a third of adults in developed countries. The primary aim of this study was to assess alignment of dietary assessment and symptom-reporting capture periods in diet-related studies on IBS or FD in adults. Secondary aims were to compare the degree of alignment, validity of symptom-reporting tools and reported significant associations between food and gastrointestinal symptoms. A five-database systematic literature search resulted in 40 included studies, from which data were extracted and collated. The food/diet and symptom capture periods matched exactly in 60% ( $n = 24$ ) of studies, overlapped in 30% ( $n = 12$ ) of studies, and were not aligned in 10% ( $n = 4$ ) of studies. Thirty percent ( $n = 12$ ) of studies reporting significant associations between food and global gastrointestinal symptoms used a validated symptom-reporting tool. Of the 30 (75%) studies that reported significant associations between individual gastrointestinal symptoms and dietary intake, only 4 (13%) used a validated symptom-reporting tool. To minimise discrepancies in alignment of food and symptom tools and progress food-related functional gastrointestinal disorder research, guidelines for matching validated symptom-reporting tools with fit-for-purpose dietary assessment methods are needed.

#### 2.48. Relationship of the Commensal Bacteria *Akkermansia Muciniphila* with Obesity Status in Australian Men

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The presence of the bacterium *Akkermansia muciniphila* (*A. muciniphila*) in the gut microbiome has been linked to various aspects of body composition and metabolism. This study aimed to assess the relative abundance of *A. muciniphila* in both healthy and overweight/obese Australian men, with consideration of diet, medications, and lifestyle. This cross-sectional study included diet and lifestyle data, clinical measures, and faecal samples from 158 male participants in the Geelong Osteoporosis Study. We determined from 16S rRNA sequencing performed on bacterial DNA from stool samples the relative abundance of *A. muciniphila*, and the anthropometry and dual-energy X-ray absorptiometry-derived fat mass index (FMI, kg/m<sup>2</sup>) was the outcome in regression analyses. No dietary variables were identified as confounders, while reflux medications and physical activity related to both FMI and *A. muciniphila* abundance. Participants were divided into negligible (<0.1%,  $n = 56$ ) or detectable *A. muciniphila* (>0.1%,  $n = 94$ ), and the detectable *A. muciniphila* group exhibited

significantly lower FMI compared with the negligible *A. muciniphila* group ( $\beta = -1.42$  (95% confidence interval (CI)  $-2.45, -0.50$ ),  $p = 0.003$ ), which remained significant in a model adjusted for reflux medications and physical activity. The relative abundance of *A. muciniphila* may be of relevance to obesity status in Australian men.

#### 2.49. Effect of Anthocyanin-Containing Queen Garnet Plum Juice on Cognition, Blood Pressure and Gut Microbiota in Healthy Older Adults: A Randomised Crossover Trial

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Anthocyanins are a subclass of flavonoids that provide red, blue and purple pigments in fruits and have demonstrated beneficial health effects. Using a randomised crossover study design, the effect and within-subject variance on cognition and 24 h ambulatory blood pressure in older adults (55+ years) without cognitive impairment ( $n = 28$ ) was studied following daily consumption of 200 mL low-dose anthocyanin Queen Garnet plum juice or raspberry cordial (control) for 8 weeks. Secondary outcomes included inflammatory markers (C-reactive protein), nerve growth factor (BDNF), urinary anthocyanin metabolites and gut microbiota (16S rRNA gene sequencing). A repeated measures analysis of variance (ANOVA) was used to analyse results. There was no significant difference across treatment periods on the different parameters studied. No intervention effect was found for genera or classes of gut microbes, but there was a trend towards significance in total bacterial count between the control arm and the intervention arm ( $p = 0.06$ ). In this group of healthy older adults, anthocyanins provided from Queen Garnet Plum juice did not have any significant effects on the studied parameters but may influence gut microbiota population in the long-term.

#### 2.50. The 'In Situ' Prebiotic Content of Foods Affect the Gut Bacterial, Archaeal and Fungal Communities in Healthy Australian Adults

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Prebiotics can stimulate growth of "beneficial" gut bacteria. Little research attention has been given to foods that naturally contain 'in situ' prebiotics and how these may affect entire gut microbiome (bacteria, archaea and fungi). Eighteen healthy adults were randomised to either a diet low (Low Prebiotics 1–3 g/day oligosaccharides; 0.27 g/day polyols) or moderate (Moderate Prebiotics 6–8 g/day oligosaccharides; 4.3 g/day polyols) in prebiotics for 3 weeks before crossing over to alternate diet. Majority of food was supplied and there was a 1-week washout period. Stool samples were collected after consumption of diets. Stool microbiota was examined using 16S rRNA (prokaryote) and ITS-2 (fungal) taxonomy profiling; shotgun metagenomic sequencing (MGS) was performed to examine functional gene content. Both 16S rRNA and MGS data analyses showed that while genes encoding polyol metabolism and *Bifidobacterium* spp. were significantly increased with MP diet, bacterial richness was reduced. *Saccharomyces* spp. were most abundant fungi, but both diets supported distinct prokaryote-fungal networks. A moderate daily intake of prebiotics in healthy subjects increases *Bifidobacterium* abundance but reduced bacterial diversity. Archaeal and

fungus communities were also impacted by prebiotic content of the diet. These inter-domain relationships warrant further examination in the context of gut function.

### *2.51. Dietary Intervention that Increases Exposure to Short-Chain Fatty Acids (SCFA) Alters the Phenotypic Patterns of Adaptive Immune Cells in Healthy Humans*

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Immune-modulating effects of short-chain fatty acids (SCFA) in animal disease models have not been demonstrated in humans. This study aimed to determine whether increased exposure to SCFA via dietary manipulation previously shown to increase colonic and systemic delivery of SCFA modulates the phenotypic patterns of peripheral blood immune cells. Healthy subjects ( $n = 20$ ) underwent a blinded, randomised dietary intervention, consuming for 21 days a high SCFA-producing diet, containing 38 g/day total fibre (including 10 g resistant starch and 8 g inulin) with 20 mL apple cider vinegar 3 times/day, or matched placebo diet, containing 20 g/day fibre with pH-matched apple juice drink, with 21-day wash-out between. Blood and 3-day total faecal output were collected at baseline and in each dietary period. Preliminary results show median faecal SCFA (gas chromatography) was greater in the high- than low- SCFA diet (14.8 vs. 8.7 mmol/day;  $n = 8$ ;  $p = 0.20$ ). Immunophenotyping of blood cells (flow cytometry) in 17 subjects revealed lower median frequency of B-cells (173 vs. 199 cells/ $\mu$ L,  $p = 0.02$ ) and CD8<sup>+</sup> T-cells (491 vs. 574 cells/ $\mu$ L,  $p = 0.09$ ) after the high- vs. low-SCFA diet. Greater exposure to SCFA over 21 days via dietary manipulation modulates the distribution of adaptive immune cells, a novel function for SCFA in human health.

### *2.52. In Atopic Dermatitis, Does Adjunct Probiotic Therapy Compared to Monotherapy of Standard Treatment Improve Symptom Severity or Patient Quality of Life?*

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Atopic dermatitis (AD) is an increasingly prevalent inflammatory skin disease significantly affecting patients' quality of life (QOL). The postulated involvement of intestinal biota in the immune system has led to increased consideration of probiotics as an adjunct to standard treatment. A literature review was conducted to update the understanding of probiotics' effectiveness as adjunct therapy on AD severity and QOL. From searches using PubMed and CINAHL, eight double-blind placebo-controlled trials were deemed eligible. Despite great heterogeneity in the studies, most studies used topical corticosteroids and Scoring Atopic Dermatitis (SCORAD). Overall, five of the eight studies showed clinically relevant and significantly greater effectiveness of probiotics over placebo as an adjunct to standard treatment. Probiotics' effect on QOL was inconclusive. Probiotics may be more beneficial in children, moderate-severe patients and in Asians and Europeans in reducing severity with a daily dose of 2–10 billion colony-forming units (CFUs) administered for 8–12 weeks. The results need interpretation with caution due to the heterogeneity of synthesised studies including sample age and strains with potential confounders e.g., atopic constitution and risks of bias e.g., potential intergroup imbalance. Further research is required to strengthen the evidence of the effectiveness of probiotics on AD severity and patients' QOL.

### *2.53. Sleeping Behaviour in Women with and without Polycystic Ovary Syndrome (PCOS) and Their Association with Lifestyle Factors (Diet, Physical Activity and Sitting Time)*

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Sleep disturbances are a risk factor for poorer lifestyle behaviours. While polycystic ovary syndrome (PCOS) is associated with a higher prevalence of sleep disturbances, the relationship between sleep and lifestyle behaviours is unknown in PCOS. Self-reported data from the Australian Longitudinal Study on Women's Health young cohort (31–36 years,  $n = 6067$ ,  $n = 464$  PCOS,  $n = 5603$  non-PCOS) were collected on PCOS, anthropometry, physical activity, sedentary behaviour, diet (74-item validated food frequency questionnaire) and sleeping behaviour (sleep quantity and adverse sleep symptoms). Multivariable regression models controlled for sleeping behaviour, body mass index (BMI), age, marital status, education, income and area of residence. Women with PCOS reported greater adverse sleep symptoms, higher energy intake, diet quality (Dietary Guidelines Index (DGI)), fibre intake and sedentary time and lower glycaemic index, compared to women without PCOS. This was not maintained for energy intake and sedentary behaviour on adjustment for confounders. For diet quality, there was an interaction between PCOS and sleep disturbances. Only for women with fewer sleep disturbances (~8 h sleep/no adverse sleep symptoms) was PCOS associated with better diet quality (DGI higher by  $3.14 \pm 0.86$ ,  $p < 0.001$ ), with no differences in diet quality for women with poorer sleep. Lifestyle behaviours in women with PCOS appear to be influenced by sleep quality and quantity.

#### 2.54. *The Measurement of Dietary Acculturation in East Asian Descent Immigrants: A Scoping Review*

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East Asian immigrants face greater risk of diabetes and cardiovascular disease compared with pre-immigration. The adoption of food and eating patterns of their host country (i.e., dietary acculturation) may contribute to this increased disease risk. To effectively examine the dietary acculturation–disease risk relationship, sensitive tools are necessary. A scoping review of the literature was undertaken to determine how dietary acculturation has been measured in East Asian immigrants. A systematic search returned a total of 3307 papers. Manuscripts were screened independently by two reviewers, resulting in final inclusion of 16 quantitative, 9 qualitative, and 1 mixed-methods study. Robust measures of dietary acculturation were lacking, with only 6 studies using validated tools. Most studies used self-reported cross-sectional surveys to enquire how the individual's diet had changed since immigrating, with responses provided on Likert scales. Only three longitudinal studies used prospective measures of diet change, through serial food-frequency questionnaires. Qualitative studies explored dietary acculturation and factors influencing change in diet. There is no consensus on how to measure the magnitude and process of dietary acculturation. Development of more comprehensive tools measuring dietary acculturation are needed to monitor the impact of interventions or policies aimed at reducing diet-related disease risk in immigrant populations.

#### 2.55. *Does Diet Quality Influence Telomere Length in Mid-Aged and Older Australian Adults?*

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Diet has been identified as a potential modulator of telomere length. The aim of this study was to investigate associations between diet quality and telomere length in mid-aged to older adults, as well as the impact of changing dietary exposure on telomere length. Participants ( $n = 145$ , 50–80 yrs) were randomised to consume almonds (ALM,  $n = 72$ ) or carbohydrate rich snacks (CHO,  $n = 73$ ) for 12 weeks and completed three-day weighed food records (WFR) at baseline and at the end of the intervention. Diet quality was assessed using a Dietary Guidelines Index (DGI) developed for application to WFR. Telomere length was measured in samples of whole blood, neutrophils and lymphocytes taken at baseline and week 12. After adjusting for age, sex and body mass index (BMI), there were no significant associations between diet quality and telomere length (from any sample) at baseline. Diet quality improved in ALM and decreased in the CHO group after 12 weeks (change from baseline ALM +9.7%, CHO -13.9%;  $p < 0.001$ ), but this was not associated with changes in telomere length. These findings suggest that small changes in diet quality may not impact on telomere length. Future studies should investigate the impact of more substantial dietary changes over longer periods of time.

#### 2.56. Prevalence of Chronic Conditions, Treatment Strategies and Sources of Nutrition Information Used by Masters Games Participants

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Masters athletes (MA) may have medical conditions that influence recommendations for optimising health and performance. This study examined prevalence of chronic conditions, treatment strategies and sources of nutrition information used by MA. MA competing at two Australian Masters Games competitions (2017, 2018) were invited to complete an online survey. Prevalence of chronic conditions was compared to Australian Health Survey data using chi-square goodness of fit or Fisher's exact test. Scores for 14 nutrition information sources were calculated by multiplying response number for each source by rank (1–5, ordered by importance). In total, 817 participants ( $53.7 \pm 10.6$  y, 60.8% female) responded. The prevalence of most chronic conditions was lower in Australian MA versus the general population (asthma, hypertension, hyperlipidaemia, type 2 diabetes, cancer, anxiety, osteoporosis, depression,  $p < 0.05$ ;  $n = 734$ ). While 40% of MA used exercise and 40% used diet to treat any condition, 38% used no treatment. The four most important sources of nutrition information were general practitioners (1196), the internet (1050), and sports or general dietitians/nutritionists (1031 and 927) (range: 287–1196;  $n = 757$ ). MA have a lower prevalence of chronic conditions than the general population. Some may benefit from tailored lifestyle education to support healthy ageing utilising experts including dietitians.

#### 2.57. A High-Fruit and -Vegetable Intervention Improves Lung Function and Decreases Asthma-Related Illness in Children With Asthma

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Children with asthma are at risk of life threatening exacerbations commonly triggered by virus infections. In a previous study of adults with asthma, a high-fruit and -vegetable (F and V) intervention reduced the risk of asthma exacerbations. This study aimed to examine the effect of a high-fruit and -vegetable diet in children with asthma. Asthmatic children (3–11 years) with a history of exacerbations and low F and V intake ( $\leq 3$  serves), were randomised to a high F and V diet ( $n = 22$ ) or control (usual diet  $n = 25$ ) for 6 months. At baseline, 3 and 6 months, lung function (impulse oscillometry) and plasma carotenoids (high performance liquid chromatography) were measured. The high F and V diet group had significantly less subjects with 2 or more asthma exacerbations/ respiratory infections during the trial (88.0% versus 63.6%,  $p = 0.049$ ). Plasma carotenoids increased in the high F and V group ( $p = 0.001$ ), which agreed with self-reported F and V intake ( $R_s = 0.41$ ,  $p = 0.005$ ). Lung function improved in the high F and V group, indicated by a decrease in airway resistance (R5–R20,  $p = 0.04$ ) and improvement in airway reactance (X5,  $p = 0.038$  and Ax,  $p = 0.001$ ). In conclusion, a high F and V diet may be an effective strategy for decreasing asthma-related illness and improving lung function in children with asthma.

### 2.58. Assessing the Diet Quality of People with Arthritis in the Australian Capital Territory Region

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Arthritis is one of the major causes of chronic pain and disability, however, little is known about the diet quality of people living with arthritis. This cross-sectional study assessed the dietary intake of people with arthritis (all forms) in the Australian Capital Territory region stratified by both arthritis severity and the Healthy Eating Index-2015 (HEI). Eighty-six participants ( $n = 71$  female) completed the Arthritis Impact Measurement Scales-2 Short Form (AIMS2-SF) and a validated FFQ. Data were grouped in tertiles by age; 18–44 years (y) ( $n = 31$ ), 45–64 y ( $n = 32$ ), and 65+ y ( $n = 23$ ). The HEI was rated as “fair” for the 18–44 y group compared with “good” for the 45–64 y ( $p = 0.004$ ) and 65+ y ( $p = 0.007$ ) groups. The 18–44 y group scored worse on “Seafood and Plant Protein” and “Refined Grain” intake than both other groups, and lower on “Fatty Acids” compared to the 65+ y group (all  $p$  values  $< 0.05$ ). No difference in HEI was observed by AIMS2-SF tertiles ( $p = 0.208$ ). However, the “Added Sugar” score was worse in the tertile with the lowest AIMS2-SF scores compared to the group with the best scores ( $p = 0.012$ ). The findings of this study suggest that people with arthritis may benefit from individual dietary advice, and individuals with higher arthritis severity are consuming more added sugar.

### 2.59. A High-Fruit and -Vegetable Diet Modulates Inflammation in Children with Asthma

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Epidemiological studies show that fruit and vegetable (F and V) intake is related to improved outcomes in asthma. This may be attributed to the intake of soluble fibre, which is fermented by gut bacteria to short-chain fatty acids (SCFAs). SCFAs exert anti-inflammatory effects via G protein coupled receptors' (GPRs) 41 and 43 and histone deacetylases (HDAC). This study investigated anti-inflammatory mechanisms of soluble fibre intake in children with asthma. Children (3–11 years) with asthma were randomised to a high ( $n = 22$ ) or low ( $n = 25$ ) F and V diet for 6 months. Systemic inflammation (plasma tumor necrosis factor alpha (TNF- $\alpha$ ), C-reactive protein (CRP), and IL-6) was measured by enzyme-linked immunosorbent assay (ELISA). Peripheral blood mononuclear cells were isolated from whole blood, and RNA and nuclear proteins were extracted. Gene expression of GPR41/43 was measured by quantitative polymerase chain reaction (qPCR), and HDAC enzyme activity by fluorescent assays. In the low F and V group, plasma CRP increased ( $p = 0.04$ ), with a decrease in GRP41 expression ( $p = 0.01$ ), and an increase in HDAC activity observed ( $p < 0.01$ ). These results demonstrate that a high F and V diet may be protective against an increase in systemic inflammation in children with asthma. Mechanisms contributing to the anti-inflammatory effect of F and Vs are likely to be mediated by SCFAs, which require further exploration.

#### 2.60. Taste Changes among Cancer Patients Undergoing Therapy: A Systematic Review

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Altered taste perception was reported in 37% of cancer patients undergoing therapy. This may decrease food enjoyment, lead to inadequate oral food intake, and subsequently weight loss or malnutrition. This systematic review aimed to investigate how cancer and its treatment affect taste function. A systematic literature review was conducted to identify studies on changes in taste sensitivity (detection and recognition thresholds) and food hedonics (food liking and preference) amongst cancer patients undergoing chemotherapy or radiotherapy published since 1980 in the Psycinfo, Embase and Pubmed databases. The search included peer reviewed studies, in the English language, and in adults aged over 18 years. Of the 5936 papers, 21 were included after full-text screening. Sixteen of 20 studies examined taste sensitivity as thresholds and reported taste changes in patients undergoing radiotherapy or chemotherapy. However, there were variations between these studies in terms of which taste qualities were affected by cancer treatment. Two studies that also measured food liking and preference reported decreased food hedonics during treatment. In conclusion, cancer treatment has an impact on all aspects of taste function including taste sensitivity and food hedonics. Practical solutions are needed to overcome taste changes and improve the nutritional intake of cancer patients undergoing treatment.

#### 2.61. Exploring In Vivo Dynamics of Bovine Milk-Derived Gangliosides

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Gangliosides are glycosphingolipids found in animal tissues and fluids. Their abundance in neural cell membranes suggests a role in neurological development. Human studies on health benefits of gangliosides are increasing, but knowledge gaps, important for designing human studies, exist. We aimed to investigate circulating ganglioside dynamics through, normal diurnal, day-to-day variation and acute impact of consuming bovine-derived gangliosides. Sixty-one women

(18–40 yrs, 18.5–≤30.0 kg/m<sup>2</sup>) attended the clinic on 3 occasions following overnight fasting. Serum and plasma gangliosides were analysed at 0, 1 h and 2 h (visit 1); hourly over 8 h (visit 2); and pre-meal, 0.5 h, and hourly over 1–8 h after consuming either a zero- or high-ganglioside meal (visit 3—preceded by 7-day low ganglioside diet). Serum and plasma monosialylated gangliosides were analysed by electrospray ionization mass spectrometry (ESI-LC MS/MS) after a protein precipitation/methanol extraction. Plasma and serum GM-gangliosides did not differ, and concentrations did not change diurnally, from day-to-day, in response to a high ganglioside versus low ganglioside meal or after 7-days low ganglioside versus habitual diet ( $p > 0.05$ ). Either serum/plasma are acceptable for GM-ganglioside analysis. Blood samples can be collected at any time of the day and participants do not have to be in the fasted state.

### 2.62. Major Sources of Calcium in the Diets of Young Adults

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Osteoporosis predisposes a person to bone fractures and is categorised by a reduction in bone mineral density. Dietary factors, especially calcium intake during adolescence and emerging adulthood have important consequences for peak bone mass attainment and lowering the risk of fracture. This study aimed to determine the major sources of calcium in the diet of young adults. A cross-sectional study was conducted among 189 diverse participants aged 18–30 years. Dietary data were collected by research dietitians using three consecutive 24-h recall telephone interviews. The reported consumption of calcium density (mg, per portion) and food groups defined by the Australian Bureau of Statistics were calculated. Milk products and dishes provided the highest calcium density mean (SD), 204.3 mg (212.1 mg) from the major food groups. The largest contributors of calcium were milk products and dishes (32.4%), including cheese (12.6%), milk (10.8%), yoghurt (3.9%) and flavoured milks (3.3%). Cereal-based products contributed (17.7%), including pizza (7.5%), followed by non-alcoholic beverages (15.0%), including coffee and coffee substitutes (6.3%). Milk products and dishes remain the highest contributors of dietary calcium. Although a substantial amount comes from cereal-based products and non-alcoholic beverages, it is the dairy component of these foods that is largely responsible.

### 2.63. How the Active Form of Vitamin D Might Affect Skeletal Muscle?

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The active form of vitamin D (1,25-OHD), also known as calcitriol, is a steroid hormone that has effects on protein synthesis and myogenesis; however, the mechanisms in human skeletal muscle cells are still unknown. Here we investigated the effects of vitamin D (Vit D) on AKT and mTOR downstream signaling cascades, myogenesis and protein synthesis in human primary skeletal muscle cells (HSMM). HSMM were treated with Vit D or vehicle control (0.1% ethanol) for 5 days and then harvested for Western blotting analyses, quantitative polymerase chain reaction (qPCR), microscopy imaging, and protein synthesis assay. Vit D enhanced ( $p < 0.01$ ) the gene expression of myogenic regulatory factors (Myogenin and Troponin T type 3) indicating the fusion of myoblasts into multinuclear myotubes ( $p < 0.05$ ). Vit D also increased the phosphorylation of GSK3 $\beta$ , ribosomal S6 protein, and AKT, when compared to the controls. VitD increased ( $p < 0.05$ ) mTOR (S2448) phosphorylation when associated with insulin treatment. Moreover, the synergistic effect of Vit D + insulin enhanced ( $p < 0.001$ ) protein synthesis, when compared with the controls. Overall, Vit D positively regulates HSMM differentiation, and also the AKT and mTOR signaling pathway as well as protein synthesis in HSMM. These results demonstrate an important physiological effect of Vit D on muscle metabolism and function in human skeletal muscle cells.

### 2.64. Association Between Increased Ultraviolet Radiation (UVR) Levels and Decreased Folate Levels in Elderly Australian Cohort Dependent on Folate-Related Genotypes

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Ultraviolet radiation (UVR) may adversely affect folate status, with exposure associated with decreased folate levels. The distribution of folate-related polymorphisms also reflects the UVR environment, indicating potential interactions between UVR and folate-related polymorphisms that may modify folate status. This study examined for interaction between UVR and folate-related polymorphisms on red blood cell (RBC) folate levels in an elderly Australian cohort ( $n = 439$ ). Polymorphisms MTHFR-C677T, MTHFR-A1298C, MTHFD1-G1958A, MTHFD1-T401C, TYMS-1494del6, TYMS-28bp2R/3R, MTRR-A66G, MTR-A2756G, RFC1-G80A, and DHFR-19bp del were assayed via restriction fragment length polymorphism (RFLP)/allele-specific polymerase chain reaction (PCR). The subjects' UVR exposure was assessed as the cumulative erythemal dose rate (CEDR) over 120 days prior to clinic. Multivariate analysis, correcting for confounders (sex, age, body mass index (BMI), smoking status, B vitamin and alcohol intake) found a negative association between CEDR and RBC folate ( $p < 0.0001$ ,  $\beta = -0.19$ ). Significant interactions were found between CEDR and MTR-A66G ( $p_{\text{interaction}} = 0.04$ ), and CEDR and MTHFR-A1298C ( $p_{\text{interaction}} = 0.04$ ). The relationship between CEDR and RBC folate was only significant in the presence of the MTRR-A66G variant ( $p < 0.0001$ ,  $\beta = -0.23$ ) or absence of the MTHFR-A1298C variant ( $p = 0.0002$ ,  $\beta = -0.26$ ), with the greatest effect seen in subjects with this combined genotype ( $p < 0.0001$ ,  $\beta = -0.32$ ). These findings highlight UVR exposure as an emerging determinant of folate status in the Australian population which may be modified by folate-related polymorphisms.

### 2.65. Dietary Adequacy and Nutritional Status of New Zealand Children with Autism Spectrum Disorder

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Children with Autism Spectrum Disorder (ASD) are susceptible to nutritional issues and poor diet quality, but there are no data available on New Zealand children with ASD. Children ( $n = 86$ ), 2.5–8.0 years with medical diagnosis of ASD were recruited in Auckland. Dietary adequacy/nutritional status was assessed (4-day estimated food records, nutritional biomarkers and anthropometrics). Out of 86 children, 4% were underweight and 33% were overweight or obese, 45% reported taking dietary supplements and 15% were on a special/exclusion diet. A large proportion did not meet the recommendations for vitamin D (adequate intake, AI, 96%), protein (estimated average requirement, EAR, 65%), and iodine (EAR, 54%). Dietary intake of fibre (AI, 43%) and vitamin E (AI, 37%) were not met by at least one third of children. All or most children exceeded the recommendations for sodium (100%), total saturated fat (80%) and sugar (52%). Approximately one third of children had serum 25(OH)D  $< 50$  nmol/L or omega-3 index  $< 4\%$ . The present study confirmed nutritional issues in children with ASD. Given the importance of nutrition in growth and

development and in the management of ASD, screening children with ASD for nutrient adequacy to reduce under- or over-consumption of nutrients is strongly recommended.

*2.66. Post-Menopausal Women with High Visceral-Fat Levels Exhibit Impaired Bone Turnover and Altered Bone Resorption in Response to Acute Calcium Consumption*

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Dietary calcium recommendations for postmenopausal woman do not take into account the effects of obesity. Obese women often present with higher bone mineral density (BMD) and yet report increased fracture risk. To assess the acute anti-resorptive effect of calcium in obese women, two forms of calcium were administered to 77 postmenopausal women with varying visceral adipose tissue (VAT). Each week, fasting participants were randomised to receive a single oral dose of either milk (1000 mg Ca), calcium carbonate tablet (1000 mg Ca), and fruit juice (no calcium). At each session, blood samples were collected at baseline and hourly for 5 h. Serum cross-linked telopeptides (CTX) and parathyroid hormone levels were measured along with baseline vitamin D, osteocalcin and bone-specific alkaline phosphatase. The mean age of participants was  $65.6 \pm 4.5$  years with body mass index (BMI) range 18.3–53.9 kg/m<sup>2</sup> and VAT range 91–3392 cm<sup>3</sup>. VAT levels correlated positively with BMD ( $p < 0.001$ ) and inversely with CTX ( $p = 0.002$ ) at baseline. While the maximum CTX-level reduction was similar in the high and low VAT groups, the absolute change in CTX was less in the highest quartile of VAT ( $p < 0.05$ ). Although obesity alters bone resorption at baseline, current dietary calcium recommendations remains effective in reducing bone resorption.

*2.67. Fibre Intake Is Associated with Exercise-Training Induced Improvements in Cardiorespiratory Fitness: Sub-Study of the PREDICT-High-Intensity Interval Training (HIIT) Trial*

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One in five adults report little to no improvement in cardiorespiratory fitness (CRF) following exercise training. Gut microbiome diversity has been associated with baseline CRF levels. Evidence suggests gut microbiome metabolites might influence exercise training-induced improvements in CRF. This sub-study aimed to compare the impact of dietary fibre intake on high-intensity interval training (HIIT)-induced changes in CRF (VO<sub>2max</sub>). Thirty-five apparently healthy participants (18–50 years) completed 6 weeks of HIIT (3×/week, 4 × 4 protocol) combined with either 8 weeks of a) 12 g/day chicory root (fermentable fibre), or b) 12 g/day maltodextrin. Fibre intake (24-h food diary; ASA24) and VO<sub>2max</sub> (cardiopulmonary exercise test) were assessed before and after the intervention. With groups pooled and adjusted for covariates (age, sex, baseline VO<sub>2max</sub>, weight change, body fat percentage change), participants ( $n = 22$ ) with a post-intervention fibre intake greater than the minimum Australian recommendations of 25 g/day had a significantly larger VO<sub>2max</sub> response to training (320 mL/min) than participants ( $n = 13$ ) consuming less than 25 g/day (61 mL/min;  $p < 0.05$ ). Fibre intake may have increased the availability of microbiome-accessible carbohydrates, resulting in greater training adaptations. Stool samples awaiting analysis may support these findings.

### 2.68. Omega-3 for Reducing Liver Fat in Adults: A Systematic Review of the Literature

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Non-alcoholic fatty liver (NAFL) is a major cause of liver injury worldwide, and exists in approximately 30% of adults, but up to 90% of individuals with obesity, yet effective and achievable treatments are lacking. Low omega-3 polyunsaturated fatty acids (PUFA) have been found in the liver and body tissues of those with NAFL, therefore omega-3 PUFA supplementation may be effective in treating NAFL. This systematic review conducted in July 2019 aimed to summarise the existing research concerning the effect of omega-3 supplementation on liver fat in adults. A systematic search of four databases located 1186 unique articles, of which 17 were included in this review. Omega-3 PUFA interventions ranged from 8 weeks to 18 months, in 11 to 181 participants, using daily doses of 1 g to 50 ml oil. Only 15 studies reported a calculable dose of eicosapentaenoic (EPA) and docosahexaenoic (DHA) acid: from 195–4626 mg/day EPA and 0–2240 mg/day DHA. Preparations of omega-3 included ethyl ester ( $n = 5$ ), fish oil, purified EPA, omega-3 carboxylic acids ( $n = 2$  each), and omega-3 capsules not further specified ( $n = 4$ ). About half the studies reported omega-3 reduced liver fat. Omega-3 is a promising treatment for NAFL; future research needs to elucidate the appropriate preparation, dose and duration for reducing liver fat.

### 2.69. Comparison of Body Composition, Strength and Function between Older Adults at Risk and Not at Risk of Sarcopenia

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Sarcopenia is the age-related loss of muscle mass, strength and function and is associated with increased risk of falls, hospitalisations and mortality. Sarcopenia is difficult to identify in the community, and screening based on lower protein intake and physical activity may be useful to target those who would benefit from intervention. The aim was to determine if these screening criteria can identify people at risk of sarcopenia. Participants ( $\geq 65$  years old) consuming  $<1$  g/kg body weight protein each day plus low-moderate physical activity levels ( $<150$  min moderate-intensity or  $<80$  min vigorous-intensity activity/week) were identified as at risk of sarcopenia ( $n = 15$ ). Those who consumed more protein and were more active were identified as not at risk of sarcopenia ( $n = 9$ ). Body composition was measured by dual energy X-ray absorptiometry. Those at risk of sarcopenia had lower handgrip strength [25.5 (21.5–28.5) versus 33.0 (28–35.5) kg,  $p = 0.0216$ ] a slower 30 second sit-to-stand result [ $12.7 \pm 2.1$  versus  $14.8 \pm 2.2$  stands,  $p = 0.0367$ ] and a poorer timed up and go result [ $7.4 \pm 0.8$  versus  $6.3 \pm 1.3$  seconds,  $p = 0.0332$ ]. Fat-free mass index did not differ between groups. Usual protein intake and physical activity levels appear to be useful for identifying those at risk of sarcopenia within the community.

### 2.70. Diet Quality and Cognitive Performance in Older Australian Adults: A Cross-Sectional Analysis in the Hunter Community Study Cohort

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The rapid increase in prevalence of cognitive impairment/dementia is a global concern. Diet is a modifiable risk factor. Dietary patterns, such as diets high in omega-3 polyunsaturated fatty acids or the Mediterranean diet, could prevent or delay cognitive decline. A cross-sectional analysis of data from the Hunter Cohort Study (HCS) was conducted comparing diet quality measured using the

Australian Recommended Food Score (ARFS) with validated cognitive performance measuring tools; audio-recorded cognitive screen (ARCS) and mini mental state examination (MMSE). Participants were randomly selected from the New South Wales electoral roll;  $n = 3253$ , mean age 66.3 years, 47% male, 53% female. Adjusted linear regression analysis showed that compared with the lowest ARFS quintile, those in the highest quintile had an ARCS score 5.883 units greater ( $p < 0.001$ ;  $R^2 = 0.0042$ ). ARFS quintile scores were tested against each ARCS sub-scale score, statistically significant associations were observed for Memory ( $\beta = 4.055$ ;  $p = 0.001$ ;  $R^2 = 0.0065$ ) and Attention ( $\beta = 4.136$ ;  $p = 0.002$ ;  $R^2 = 0.0047$ ) domains. There was no statistically significant association observed between quintiles of ARFS and MMSE score or between genders. Diet quality was shown to be associated with better cognitive performance in this sample of older Australians.

### 2.71. Nutritional Determinants of Musculoskeletal Health in Ageing—A Return to the Protein and Potassium Debate?

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Attenuation of age-related loss of muscle mass and performance is a key objective in addressing the chronic disease burden (sarcopenia, functional limitation, diminished bone integrity) and increased mortality from falls in ageing populations. Accordingly, targeted research has resulted in calls to increase dietary protein recommendations, given its anabolic effects. This prompts renewed debate regarding increased generation of acidic by-products parallel to higher protein diets and potential anti-anabolic impact which magnifies with ageing due to altered renal dynamics. A Pubmed search using the terms: acidosis; elderly; alkaline; skeletal muscle mass; potassium bicarbonate; urinary nitrogen; dietary animal protein; bone integrity, generated 11,040 articles, from which 17 key papers were identified. Research methodologies included epidemiological: cross-sectional (3), longitudinal (4), randomised controlled interventions (2) and reviews (8). While higher protein goals are now widely accepted for reduced morbidity and mortality in the aged, a similar positive relationship with potassium remains equivocal. Emerging research suggests positive musculoskeletal outcomes, including attenuated muscle mass loss and improved performance from protein interventions in ageing, that may be enhanced by coupling with adequate alkalis e.g.,  $\text{KHCO}_3$  and potassium-rich diets. Controlled trials of combined protein and alkali interventions in this age-group are needed to clarify these findings and optimal dietary approaches.

### 2.72. Changes in Circulating B Vitamins and Kynurenines with Ageing

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Tryptophan is metabolised to nicotinamide adenine dinucleotide+ via the kynurenine pathway and enzymes requiring vitamins B2 and B6. The flux of tryptophan through the pathway and production of neopterin are increased in inflammation, and both neopterin and the ratio of kynurenine to tryptophan (KTR) are considered markers of inflammation. We measured blood metabolites and vitamins in this pathway at baseline (1994–1998, mean age: 58 yrs) and follow-up (2003–2007, mean age: 69 yrs) in 1000 participants from the Melbourne Collaborative Cohort Study. Plasma concentrations of vitamins B2 and B6, neopterin and kynurenine metabolites were measured using liquid chromatography-tandem mass spectrometry (BeVital Norway). Over a median 11 years (range: 9.0–14.5, inter-quartile range (IQR): 10.5–12.2), tryptophan concentration decreased slightly while concentrations of kynurenine, kynurenic acid, xanthurenic acid, 3-hydroxyanththranilic acid, picolinic acid quinolinic acid, KTR and neopterin tended to increase. Total vitamin B2 (riboflavin, flavin mononucleotide (FMN)) changed little but levels of FMN decreased. Total B6 (pyridoxal 5'-phosphate, pyridoxal, 4 pyridoxic acid) increased. These patterns are consistent with increased



flux of tryptophan through the kynurenine pathway in response to inflammation occurring with aging. Further analysis will identify factors associated with these changes and help us understand their relationship with health.

### 2.73. Obesity, Energy Intake and Physical Activity in Older Australian Adults with Osteoarthritis

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The aim of this cross-sectional study was to assess lifestyle behaviours of a sample of older adults with knee osteoarthritis (OA) compared to public health guidelines. Adults with knee OA ( $n = 500$ ) were mailed surveys to complete and return. Survey items included diet, physical activity, anthropometry, and demographic information. One hundred complete responses were included in analysis. Mean age was 68 years, and the majority of participants were overweight or obese ( $n = 56$ ). Adults 50–64 years ( $n = 39$ ; body mass index (BMI): 33.0 kg/m<sup>2</sup>) achieved an average of 2.1 h of vigorous and 2.7 h of moderate intensity activity, with 12.2 h of walking per week, and average energy intake was 5593 kilojoules (kJ;  $n = 19$ ). Adults  $\geq 65$  years ( $n = 61$ ; BMI: 29.8 kg/m<sup>2</sup>) completed an average of 2.4 h of vigorous and 3.4 h of moderate intensity activity, with 6.7 h of walking per week, while average energy intake was 7874 kJ ( $n = 35$ ). The majority of overweight and obese participants (93%) did not meet physical activity guidelines, and on average had higher energy intakes, compared to healthy weight participants. Given the health implications of these behaviours and their contribution to weight gain, these findings indicate a need for targeted diet and physical activity interventions in the older OA population.

### 2.74. Effects of a Modestly Lower Carbohydrate Diet in Gestational Diabetes: MAMI1 Randomised Controlled Trial

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Lower carbohydrate diets potentially improve glycemia but may increase ketonemia in women with gestational diabetes (GDM). We conducted a pilot randomised controlled trial (MAMI1) to compare blood ketone levels of women assigned either a modestly lower carbohydrate (MLC, 135 g/day) diet or routine care (RC, 200 g/day). Forty-six women were randomised to MLC or RC, and their diet was assessed by a 3-day food record. Pregnancy outcomes were obtained from medical records. MAMI1 achieved a significantly lower mean  $\pm$  standard error of the mean (SEM) carbohydrate and total energy intake in the MLC vs. RC group (165  $\pm$  7 vs. 190  $\pm$  9 g; 7040  $\pm$  240 vs. 8230  $\pm$  320 kJ, both  $p < 0.05$ ), with no difference in blood ketones (0.1  $\pm$  0.0 vs. 0.1  $\pm$  0.0 mmol/L,  $p = 0.308$ ), % hemoglobin A1c (HbA1c) (5.1  $\pm$  0.1 vs. 5.3  $\pm$  0.1,  $p = 0.209$ ) or the need for insulin (14.6  $\pm$  1.8 vs. 21.2  $\pm$  3.9 units,  $p = 0.209$ ) at 36 weeks gestation. However, infant head circumference was significantly lower in the MLC group (33.9  $\pm$  0.1 cm vs. 34.9  $\pm$  0.3 cm,  $p = 0.046$ ), even with adjustment for gestational weight gain, weeks gestation at delivery and infant sex ( $p = 0.043$ ). Our findings

suggest the need for larger studies to assess the safety and risks associated with recommending MLC intake in GDM management.

#### *2.75. Resistant Starch Supplementation Is Not Associated with Protection against Diabetic Nephropathy in a Mouse Model of Type 1 Diabetes*

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The gut microbiota is increasingly recognised as a potential therapeutic target in diabetic kidney disease and animal studies using supraphysiological doses of dietary fibre have shown promise in reducing diabetic nephropathy. However, there are limited data on the effects of dietary fibre interventions in the physiological range. Six-week-old littermate C57BL/6J mice were randomised and half were rendered diabetic by streptozotocin. Mice received 24 weeks of regular chow or an isocaloric-resistant starch-supplemented diet (12.5% RS). Blood urea nitrogen (BUN), urinary MCP-1 and albuminuria were measured by enzyme-linked immunosorbent assay (ELISA). Periodic acid-Schiff stained kidney sections were scored for glomerulosclerosis. Crypt depth and villi length were measured on haematoxylin and eosin-stained ileum sections. Intestinal permeability was assessed in vivo by the clearance of fluorescein isothiocyanate (FITC)-labelled dextran. Diabetes was associated with increased albuminuria, BUN, urinary MCP-1 and glomerulosclerosis, none of which were reduced with RS supplementation. Diabetes was associated with increased villi height and a reduction in crypt depth, which was not altered with RS supplementation. Interestingly, despite these morphological changes in the intestine, neither diabetes nor RS supplementation was associated with changes of in vivo intestinal permeability. Supplementation with a diet containing 12.5% resistant starch was not protective against diabetic nephropathy.

#### *2.76. Web-Based Interventions for Dietary Behaviour in Adults with Type 2 Diabetes: A Systematic Review of Randomised Controlled Trials*

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Type 2 diabetes (T2D) is a metabolic health condition affecting more than 500 million people globally. Diet is a key aspect of T2D management. Web-based interventions provide a convenient method for delivering dietary education. This review aimed to determine the effectiveness of web-based interventions on dietary behaviour in adults with T2D. In accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, Medline, Embase, the Cochrane Library, and CINAHL databases were systematically searched for relevant studies. Randomised controlled trials of web-based interventions in adults with T2D with reported dietary assessment were included. Five studies comprising 1056 adults were included from 714 records. These studies measured dietary changes by assessing overall diet quality, changes in specific dietary components, or dietary knowledge scores. Improvements in dietary behaviour were statistically significant in four out of five studies, representing healthier food choices, improvements in eating habits, reductions in added sugar and saturated fat intake, and increases in dietary knowledge. Three studies found significant mean reductions for haemoglobin A1c (−0.3%–0.8%), and/or weight (−2.3–12.7 kg), fasting blood glucose (−1 mmol/L), waist circumference (−1 cm), and triglycerides (−60.1 mg/dL). Web-based interventions support dietary behaviour change in adults with T2D, although changes in clinical outcomes are inconsistent.

### 2.77. Interleukin-6 Partially Mediates the Association between Docosahexaenoic Acid and Diabetes in Overweight and Obese Females

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An inverse association exists between docosahexaenoic acid (DHA) levels and diabetes in overweight and obese women. This study aimed to determine whether this relationship is mediated through inflammatory pathways. Overweight and obese women (body mass index (BMI)  $\geq 25.0$  kg/m<sup>2</sup>, aged 55–85 years) were included. C-reactive protein (CRP), interleukin-6 (IL-6), fibrinogen and neutrophil-to-leukocyte ratio (NLR) were examined as potential mediators, with age, BMI, and lifestyle factors included as covariates. In total,  $n = 768$  women were included (diabetes:  $n = 92$ ; BMI:  $30.9 \pm 5.0$  kg/m<sup>2</sup>; age  $65.9 \pm 7.1$  years). IL-6, CRP and fibrinogen were inversely associated with DHA in adjusted and unadjusted models ( $p < 0.05$ ), and IL-6 was inversely associated with diabetes ( $p < 0.05$ ). IL-6, but no other inflammatory marker, partially mediated the association between DHA and diabetes (natural indirect effect: odds ratio (OR) 0.98, 95% confidence interval (CI): 0.95, 1.00;  $p = 0.049$ ), accounting for ~10% of the inverse association between DHA and diabetes in the fully adjusted model. DHA remained independently associated with reduced odds of diabetes (controlled direct effect OR 0.82, 95% CI: 0.64, 0.99), suggesting additional pathways are also involved. IL-6 partially mediates the association between erythrocyte DHA levels and diabetes in overweight and obese females. Further research is required to identify additional pathways and determine whether a causal pathway exists.

### 2.78. Screening and Identification of Disordered Eating and Eating Disorders in Type 1 Paediatric Diabetes Clinics: Clinician Perspectives

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Youths with type 1 diabetes (T1D) are at significantly increased risk of disordered eating behaviours. Guidelines recommend routine screening for disordered eating to permit early detection and intervention; however, it is unknown if these are being utilised in paediatric diabetes clinics. The aim was to investigate current screening practices for disordered eating in youths attending tertiary paediatric diabetes clinics across Australia and NZ. A 35-item online cross-sectional survey of dietitians working in diabetes clinics with  $\geq 150$  children and adolescents in Australasia was conducted. The survey evaluated demographics, screening tools, treatment pathways, and staff awareness and training. Response rate was 77% ( $n = 10$ ). Clinics managed a range of 150–1400 paediatric patients. Anorexia nervosa was identified as the most common eating disorder. Only one clinic reported using a screening tool; however, it stated that it was not routinely used. Half (50%) of participants reported receiving training regarding disordered eating management. All respondents agreed additional procedures are needed to screen for disordered eating. Almost all (90%) agreed if barriers were addressed, their clinics would routinely screen. Early detection of an eating disorder in T1D is needed to facilitate effective treatment and minimise potential diabetes complications. Findings of this study have the potential to inform future screening guidelines.

### 2.79. GlucoTRIG™: A Novel Standardised Tool to Rank Composite Meals and Foods for Health

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The aim of the current study was to develop a novel physiological criteria, GlucoTRIG™, that considers both postprandial glycaemic and lipaemic responses, to rank meals/foods for health. A standardised reference meal was also developed to evaluate test meals with different macronutrient composition. In a randomised cross-over trial, healthy volunteers (both males and females;  $n = 10$  for each meal) consumed a reference meal (41% carbohydrates, 40% fat and 16% protein of the total energy intake) and three iso-caloric test (2000 kJ) meals (M1, M2, M3) of varying macronutrient composition. Venous blood samples were collected at 0 and 180 min post meal consumption for insulin and triglycerides determination to assess the GlucoTRIG™ value. The standard value obtained from mean GlucoTRIG™ values of the reference meal on three visits was found to be  $17 \pm 4.4$  (% coefficient of variation: -1.4). Test meal with high fibre, low total fat content and less refined foods exhibited a significant ( $p = 0.0024$ ) low GlucoTRIG™ value ( $10 \pm 7.7$ ) compared to the other two meals M1 ( $77 \pm 19.8$ ) and M2 ( $38 \pm 12.1$ ) with processed, relatively high-fat and low-fibre meals. GlucoTRIG™ may be a useful tool to rank meals for reducing the risk of metabolic diseases.

### 2.80. The Effect of Walnut Consumption on Blood Glucose Control in Adults: A Systematic Review and Meta-Analysis

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Habitual consumption of nuts, including walnuts, is associated with reduced risk of cardiovascular disease, however, evidence regarding the impact of walnut consumption on blood glucose is inconsistent. The aim of this study was to assess the evidence on the effect of walnut consumption on markers of blood glucose control. A systematic search of Medline, PubMed, CINAHL and Cochrane databases (to 2 March 2019) was conducted. Inclusion criteria were randomised controlled trials in adults; studies assessing the effect of walnut consumption on: fasting blood glucose and insulin, haemoglobin A1c, and homeostatic model assessment of insulin resistance. Random effects meta-analyses were conducted to assess the weighted mean differences (WMD) for each outcome. A risk of bias assessment was conducted using the Cochrane Risk of Bias tool 2.0. Sixteen studies were reviewed. Consumption of walnuts did not result in significant changes in fasting blood glucose levels (WMD: 0.331[-0.817, 1.479]) or other outcomes. Studies demonstrated 'some concerns' or 'high' risk of bias. The current evidence base does not demonstrate a beneficial effect of walnut consumption on markers of blood glucose control, however, the substantial risk of bias suggests a need for further high-quality trials on this topic.

### 2.81. An Evaluation of the European Union (EU)-Schoolfruit Program and the Taste Lessons Program in the Netherlands

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A healthy diet is important for optimal child growth and development. Opportunities to encourage and support children to adopt healthy eating behaviour should be explored. Dutch nutrition education programs such as European Union (EU)-Schoolfruit (EUS) and Taste Lessons (TL) provide school children with fruits and vegetables (FV) (EUS) and classroom-based nutrition

education (TL). However, the effectiveness of specific program components has not yet been evaluated. This research examines the effectiveness of individual components of current Dutch nutrition education programs targeting primary school children ( $n = 1441$ , schools  $n = 38$ ) aged 9–11 years. Child nutrition knowledge, food literacy and FV consumption were measured by a questionnaire. A quasi-experimental design with three arms compared: (1) schools that implement EUS ( $n = 11$ ), (2) schools that implement EUS and TL ( $n = 17$ ) and (3) schools that do not implement nutrition education ( $n = 10$ ). Outcomes were assessed pre-intervention (T0), during the intervention (T1), and 6 months post-intervention (T2). Preliminary results from T0 and T1 indicate significant increase in nutrition knowledge only for children of schools that participated in both programs (EUS and TL), compared to the control group ( $p = 0.00$ ), but no significant increase in FV intake (fruits  $p = 0.19$  and vegetables  $p = 0.20$ ). Results will contribute to improving future nutrition education programs.

### 2.82. Food Sensations® Effectively Using Food Literacy to Improve Nutrition

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Food literacy programs aim to improve planning, selection, preparation and eating of healthy foods. Governments are investing in these programs to improve nutrition at a population level. One such program is Food Sensations® for Adults (FSA), a free four-week nutrition and cooking program funded by the Western Australian Department of Health, targeting low- to middle-income adults. A validated food literacy behaviours checklist was developed to assess how effective FSA is in changing food literacy and selected dietary behaviours. Evaluation of participant outcomes attending 223 FSA programs run between May 2016 and June 2018 was conducted via voluntary pre- and post-program questionnaires ( $n = 1092$ ). Statistical analysis identified a significant increase ( $p < 0.0001$ ) in post-program scores for healthier food selection (25.1%), preparation (11.8%) and planning and management of meals (9.7%). Self-reported fast food meal intake and sugar sweetened drinks consumption significantly decreased post-program ( $p < 0.0001$ ). There was also a significant increase in self-reported fruit and vegetable serve intake, equating to an average increase of  $\frac{1}{4}$  serve/day of fruit and  $\frac{1}{2}$  serve/day of vegetables. FSA is effective in improving food literacy and dietary behaviours. Results indicate the potential benefits that investment in this type of program could bring to improve population health.

### 2.83. Playing a Nutritionally Focused Educational Game: Can It Improve Children's Nutrition Knowledge?

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Insufficient nutrition knowledge has been linked to poor dietary patterns. School children are an important population for early nutrition education. The use of computer games for the intention of nutrition education has previously been successful in teaching nutrition concepts to children. This study investigates the development and effects of a tablet-based educational game for improvement of nutrition knowledge. 'VitaVillage' is a farming-style game, where the user converts a virtual village to a health-promoting village by completing quests posed by villagers in need of healthy foods. The user then grows the foods by correctly answering questions about the healthy food and its nutritional value. Seventy-two year 5/6 primary school students completed a nutrition knowledge survey, then played the game for 20 min. One week later, they played again for 20 min and immediately completed the same nutrition knowledge survey. Preliminary results indicated there was a significant increase in nutrition knowledge compared to baseline scores. With regard to feasibility, children reported that they liked the game, with a mean score of 77 (standard deviation

(SD) 24.6), on a scale of 0–100. Preliminary VitaVillage results are promising. Further development and testing will inform utility within school-based nutrition education for children in the future.

#### *2.84. Using Segmentation for Behaviour Change: Living and Eating for Health Segments (LEHS) in Young Adults*

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Psycho-behavioural segmentation may be more effective to foster change than grouping by demographic characteristics. The aim was to determine whether Living and Eating for Health Segments (LEHS) were applicable in a nationally representative sample (18–24 yrs). Young adults selected one of six LEHS, Lifestyle Mavens (LM), Health Conscious (HC), Aspirational Healthy Eaters (AHE), Balanced All-Rounders (BAR), Contemplating Another Day (CAD), Blissfully Unconcerned (BU), and answered demographic and social media usage questions. Mean age was 21 yrs (standard deviation (SD) ± 2), mostly healthy-weight (54.6%), females (51.8%). All LEHS were selected: LM = 15.4% were primarily males (62%); HC = 21.1% slightly more males 54%; AHE = 27.5%, predominately females (61%); BAR = 21.4% more females (62%); CAD = 11.2% slightly more females (51.8%); BU=3.4% slightly more males 56.5%. For all, the internet was ‘helpful to see other people’s health-related experiences’ (61.1%–91.8%). Social media platform usage varied by LEHS: highest users were AHE, with extensive use of Facebook (40.8%), YouTube (45.9%) Instagram (43.2%) Snapchat (34%) and Spotify (35.3%) on Apple devices (48.1%). CAD (48.7%) reported using YouTube extensively and the highest (17.7%) to report not using Instagram. BAR were most likely to use laptops (44.2%) with extensive use of Facebook (39.2%) but did not use Twitter (56.0%). BU were more likely to report not using Snapchat (29.4%), Spotify (35.3%) and Apple devices (40.6%), but the most extensive users were of Android Smartphones (37.7%). Enabling YA to self-nominate into segments forces researchers to challenge existing stereotypes and assumptions about perceptions and behaviours.

#### *2.85. Learnings from a Five-Year Food Industry Initiative to Positively Impact Public Health*

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The food industry has an important role in influencing the food supply and ultimately, improving population diets. Dietitians and nutritionists within the food industry are uniquely placed to have an impact. In 2014 Lion Dairy and Drinks launched ‘Our Goodness Promise’ (OGP). The goal was to enable consumers to make more nutritious choices. The project aimed to deliver upon consumer demand for healthier products, enhance trust of consumers, customers and stakeholders, and build employee engagement and pride. This was a five-year initiative with clear and measurable targets encompassing reformulation and innovation, to labelling and communication initiatives. As ‘Our Goodness Promise’ concludes, we reflect on achievements and key learnings. The Deakin University Business Impact Assessment on Obesity report recognised the organisation as an industry leader. The project faced significant challenges: requiring top-down business support, integration into company-wide strategy, a robust evidence-based framework and criteria involving external peer review and validation. Key to success included linking to employees’ goals and establishing a monitoring and evaluation system. When implemented effectively, such initiatives have a positive impact on the food environment. More collaborative relationships across all sectors of industry, nutrition and public health are needed to continue to improve Australia’s health.

### 2.86. Salt-Related Knowledge, Attitudes and Behaviours (KABs) among Victorian Adults Following 22 Months of a State-Wide Salt-Reduction Initiative

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In 2016, VicHealth launched a state-wide salt-reduction initiative. This study examines if salt-related knowledge, attitudes and behaviours (KABs) of Victorian adults changed following the first 22-months of implementation. Adults (18–65 years) recruited from research panels completed an online survey in 2015 and 2018. Participants provided a complete survey in 2015 ( $n = 1584$  (43 (standard deviation (SD) 13) yrs; 47% female) and 2018 ( $n = 2141$  (42 (SD 13) yrs; 50% female), including  $n = 554$  and  $n = 799$  parents/caregivers at each time point. Most KABs remained unchanged. Small improvements were seen in the proportion of participants who correctly identified processed foods as the main source of dietary salt; 72% 2015 vs. 77% 2018 ( $p = 0.001$ ). The proportion who agreed it was difficult to understand sodium information on food labels decreased from 46% to 40% ( $p < 0.001$ ). Among parents/caregivers the proportion who agreed limiting salt in their child's diet was important increased from 64% to 73% ( $p = 0.002$ ); whereas the proportion who reported placing a salt shaker on the table decreased from 49% to 37% ( $p < 0.001$ ). The proportion who reported their child added table salt also decreased 35% to 26% ( $p < 0.001$ ). During the first 22 months of a state-wide salt-reduction initiative some positive changes in salt-related KABs were found, particularly for attitudes and behaviours reported by parents/caregivers regarding their children.

### 2.87. Evaluation of an Adapted Existing Evidence-Based School Canteen Intervention to Increase Compliance with a New State-Wide Canteen Policy

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All New South Wales Primary Schools are required to comply with the NSW Healthy School Canteen Strategy which requires menus to comprise of at least 75% 'Everyday' and 25% 'Occasional' menu items, and no sugar-sweetened beverages. A previous study assessed the effectiveness of a multi-component implementation intervention consisting of eight core intervention components to address the known barriers to adopting state-wide canteen policies in schools. The multi-component intervention was effective in increasing compliance with the state-wide policy (Fresh Taste @ School) from 17% at baseline to 35% at follow up. No studies have been conducted to assess the effectiveness of this intervention with the revised NSW Healthy School Canteen Strategy. A pre-post study was conducted to examine the effectiveness of an adapted version of an existing multi-component intervention for the NSW Healthy School Canteen Strategy. All primary schools with a canteen were eligible ( $n = 341$ ). The intervention included professional development workshops, menu feedback, menu action planning, resources, post workshop support and incentives. Compliance across eligible schools was 4% at baseline and 47% at follow up. The results support the ongoing implementation of the adapted multi-component implementation intervention in increasing school compliance with the NSW Health School Canteen Strategy.

### 2.88. Socio-Economic Differences in the Association between Frequency of Cooking Dinner and Diet Quality in the United States

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Home cooking is recommended to improve diet quality, which remains low overall and lower among low-income populations compared to higher-income groups. The objective of this study is to examine how cooking frequency is associated with diet quality, overall and stratified by socio-economic status (SES) in the United States (US). Data come from the 2007–2010 National Health and Nutrition Examination Survey ( $n = 9504$  adults). Linear regression models adjusted for fast food, ready to eat food, and frozen food intake, and socio-demographic and socio-economic measures were estimated overall and stratified by income to examine differences in the association between cooking and diet quality, based on SES. Models used survey weights to provide nationally representative estimates. Cooking frequency shows a clear, positive, linear relationship with higher Healthy Eating Index (HEI) score overall and among low- and high-income adults. However, among low-income adults, cooking 7+ times per week was associated with smaller increases in diet quality than among high-income adults (low-income: 1.37 ( $p < 0.05$ ) HEI increase; high-income: 3.55 ( $p < 0.01$ ) increase). Cooking dinner at home more frequently is associated with better diet quality overall, and among low- and high-income adults in the US, although the strength of that relationship is stronger among high-income adults.

### 2.89. Docosahexaenoic Acid (DHA)-Rich Fish-Oil Supplementation May Enhance Cognitive Function in Overweight/Obese Older Adults by Improving Cardiovascular and Cerebrovascular Function

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Obesity is associated with cognitive impairment, mediated by poor cerebrovascular function and chronic low-grade inflammation. Fish-oil supplementation may help to counteract accelerated cognitive decline by improving vascular function and reducing systemic inflammation. We randomised 152 participants in a placebo controlled factorial design trial to take fish oil (2000 mg docosahexaenoic acid (DHA) + 400 mg eicosapentaenoic acid (EPA)/day) alone or in combination with curcumin (160 mg/day) for 16 weeks. Transcranial Doppler ultrasound was used to measure basal cerebral hemodynamics and cerebrovascular responsiveness (CVR) to hypercapnic or cognitive stimuli (battery of 13 cognitive tests). Blood samples were taken to measure cardiometabolic and inflammatory biomarkers. Fish-oil supplementation improved cardiovascular function (heart rate ↓3%, triglycerides ↓24%, HDL cholesterol ↑8%; all  $p < 0.05$ ) and enhanced cerebrovascular function (cerebral artery stiffness ↓9%, CVR to selected cognitive tasks ↑28%; all  $p < 0.05$ ) in the whole cohort and improved processing speed in males ( $p = 0.027$ ). Improved cognitive performance was associated with increased CVR to cognition ( $R = 0.185$ ,  $p = 0.062$ ) and decreased inflammation (C-reactive protein;  $R = -0.202$ ,  $p = 0.027$ ). Adding curcumin did not alter these outcomes. Fish-oil supplementation offers a potential approach to counteract cognitive decline by improving circulatory function in our increasingly overweight/obese older population.



### 2.90. Maternal Resistant Starch Dietary Intakes during Pregnancy and Infant Allergic Disease

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The maternal diet during pregnancy plays a likely role in infant immune development, through direct nutrient immunomodulation and by modulating the maternal gut microbiome composition. Dietary fibres, as major substrates for microbial fermentation, are of interest in this context. This is the first study examining the relationship between maternal intakes of dietary fibre sub-types during pregnancy and subsequent infant allergic disease. In an observational study of 639 mother-infant pairs, we examined the associations between maternal intake of total dietary fibre (soluble, insoluble, resistant starch and prebiotic fibre), with infant allergic disease outcomes. In late pregnancy women completed a semi-quantitative food-frequency questionnaire. Parents completed allergy symptom questionnaires during infancy and attended a clinical assessment and skin prick testing at 12 months of age. Higher maternal dietary intakes of resistant starch were associated with reduced doctor-diagnosed infant wheeze, adjusted odds ratio (aOR 0.68 [95% CI 0.49–0.95];  $p = 0.02$ ) and in contrast associated with a higher risk of doctor-diagnosed eczema (aOR 1.19 [95% CI 1.01–1.41];  $p = 0.04$ ). The association of maternal resistant starch intake with infant phenotypes, highlights the need for randomised controlled trials with dietary fibre interventions in pregnancy, in tandem with microbiome analysis and immune function studies to elucidate mechanistic pathways.

### 2.91. Does Diet Quality Modify the Association between Vegetable Nitrate Consumption and Non-Fatal Cardiovascular Disease (CVD)?

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Dietary components, including vitamin C and polyphenols, are thought to favour the production of the vasodilator, nitric oxide (NO), via the nitrate-nitrite-NO pathway. Thus, the potential cardio-protective action of vegetable nitrate may be strongly reliant on other key beneficial components found in high-quality diets. The aim of the current investigation was to explore whether diet quality is an effect modifier for the association between vegetable nitrate consumption and non-fatal cardiovascular disease (CVD), within the 1946–1951 cohort of the Australian Longitudinal Study on Women's Health (ALSWH). In a sample of 5324 women, the prospective association between vegetable nitrate intake, stratified by diet quality ('high diet quality' (i.e. at or above the population median) vs. 'low diet quality' (i.e., below the population median)) and incidence of non-fatal CVD (including hypertension, stroke, heart disease and thrombosis) was analysed using generalised estimating equations. In multivariate models, higher vegetable nitrate intakes were associated with a significantly lower odds of non-fatal CVD in subjects reporting 'higher' diet-quality scores, but not in subjects reporting 'lower' diet-quality scores. Findings indicate that diet quality may modify the association between vegetable nitrate and non-fatal CVD and highlights the importance of addressing diet quality as a public health priority.

## 3. Posters

### 3.1. The Role of Nutrition Professionals in Microbiome Research: Investigating Cereal Fibre as a Case Study

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Obesity and its sequelae contribute to metabolic syndrome, a condition associated with increased non-communicable disease risk. Increasingly, the role of cereal fibres in modulating the gut microbiome and associated inflammatory processes is hypothesised as a mechanism for

reducing metabolic syndrome onset. A systematic literature review was conducted to evaluate the effect of cereal fibre on the gut microbiome, including changes to microbiota diversity or composition, in addition to markers of metabolic syndrome. The review protocol followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) format. Included studies were of randomised control design and provided cereal fibre-based intervention through dietary counselling or provision of foods or supplements. Initial searches identified 4947 papers after duplicate exclusion. Following screening and review, 49 primary and two secondary publications were included. Initial data extraction, indicated high variability in dietary data between studies with only 14 studies utilising a nutrition professional. Dietary data collection methods included food checklists and diet diaries with seven studies not capturing any dietary data. Inadequate reporting of dietary data related to baseline, intervention and background intake increases difficulties in ascertaining results related to the dietary intervention (in this case fibres) creating significant difficulties in extrapolating these findings to practice. Improved dietary data collection is essential for translation.

### *3.2. University Students Who Purchase Food On-Campus More Frequently Have Less Healthy Dietary Intake*

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University food environments typically offer an abundance of unhealthy food choices. There is a lack of research exploring how these unhealthy food environments impact students' dietary intake. This study explored the associations between on-campus food purchasing behaviours and dietary intake among a sample of Australian university students. An online cross-sectional survey with 362 students (mean age  $27.5 \pm 10.5$  years, 71.0% female) from the University of Newcastle, Australia, was conducted in 2017–2018. On-campus food purchasing behaviours (frequency of purchase and weekly expenditure for food/drinks), dietary intake (diet quality assessed by the Australian Recommended Food Score and percentage energy/day from energy-dense nutrient poor (EDNP) foods, assessed by the Australian Eating Survey Food-Frequency Questionnaire) and socio-demographics (e.g., age, sex) were captured. Associations between food purchasing behaviours and dietary intake were explored using linear regression. Mean diet quality score was  $32.6 \pm 10.2/70$ . Mean percentage energy/day from EDNP foods was  $31.7 \pm 14.4$ . Lower diet-quality score was associated with more frequent purchase ( $p = 0.047$ ) of food/drinks. Higher percentage energy/day from EDNP foods was associated with higher weekly expenditure ( $\beta = 0.22$ ,  $p < 0.001$ ) and more frequent purchase ( $p < 0.001$ ) of food/drinks. The findings support the need to improve university food environments, as a strategy to improve the unhealthy diets of university students.

### *3.3. Bitter Taste and Oral Health Outcomes in Older Australian Adults*

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Variance in bitter taste sensitivity is linked with increased dental caries; however, similar relationships with other oral diseases and their impact on oral health in old-age are not well-studied. Therefore, a secondary analysis was conducted using a cross-sectional study of elderly Australians ( $n = 649$ ). Participants were genotyped for TAS2R38 (rs713598) and completed surveys on diet and oral health. Statistical analyses were conducted using multivariable regression (JMP v14; adjusted for age and sex). Those with the AA genotype (non-tasters) were more likely to have missing teeth

than those with PP genotype (supertasters; 94% vs. 85%;  $\chi^2 = 6.72$ ,  $p = 0.0095$ ). However, PP individuals were more likely to have low diet quality score (66% vs. 46% in AA genotype;  $\chi^2 = 3.27$ ,  $p = 0.011$ ) and no significant association was found between genotype and reported sugar consumption. This suggests that recently identified non-gustatory functions of taste receptors, including the modulation of inflammation, may alter the risk for oral diseases. Future longitudinal studies are needed to identify associations between taste genotypes and oral diseases with a temporal element. Such research may contribute to improving oral health and the development of future therapeutic aids.

### *3.4. Transcriptomic Changes during Weight Loss: A Systematic Literature Review with Primary Data Synthesis*

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Weight loss is accompanied by a range of physiological changes. A combination of genes and environment influence weight loss success and, therefore, a more personalised approach is necessary. Transcriptomics of peripheral blood mononuclear cells (PBMCs) offers a unique picture of global physiological changes during weight loss. A systematic search was conducted for studies that reported global transcription changes in PBMCs during weight loss. Five studies met the inclusion criteria and two studies provided individual-level data. Intervention responders were defined as those who lost  $\geq 5\%$  body weight. Differentially expressed genes between responders and non-responders were identified through re-analysis of raw data ( $\pm 1.2$ -fold,  $\text{adj-}p < 0.05$ ) or via reported differentially expressed gene lists, which were analysed in PathVisio software to decipher affected pathways ( $Z\text{-score} > 1.96$ ). Studies reported between 0 and 1366 differentially expressed genes and there were no commonly affected genes or pathways between studies. This suggests that the physiological processes underpinning successful weight loss are individual and that weight loss per se does not result in similar systemic changes. Further work is needed to fully understand how these differences affect intervention outcomes and supports further research into personalised approaches to weight management using -omics approaches.

### *3.5. Expert Interviews about Scientific Disagreement*

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Expert disputes are common within many scientific domains, particularly in the area of health and nutrition. Although some consumers do attribute these scientific disagreements to the complexity of research, many use a narrower set of explanations. Having a better understanding of the epistemic and social practices of science may improve laypeople's views on scientific disagreements. This research develops a taxonomy of disagreements based on semi-structured interviews with experts from a variety of fields about their experiences with, and views on, scientific disagreements and is informed by a literature review and a conceptual analysis of disagreements in a set of nutrition topics. Experts' views and annotations to the proposed taxonomy are collected and used to validate the model. A description of experts' experiences with scientific disagreement is provided. The proposed taxonomy and its use as a framework to navigate health and nutrition-related disagreements are presented. We also explore its role as a framework to support and plan future research, to facilitate communication, and to guide practice, particularly in health and nutrition education.

### 3.6. Effects of Processed High-Sugar Diets on Pregnancy and Fetal Weight

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Maternal exposure to malnutrition has widespread effects on offspring development and growth as well as increasing risk of obesity and other non-communicable diseases later in life. The glycaemic index (GI) is a measure of carbohydrate quality, and low-GI diets are associated with improved metabolic health outcomes in mothers and their offspring in both humans and rodents. Four refined high-sugar diets (glucose, sucrose, isomaltulose and fructose) were designed to alter GI whilst controlling fibre content. Mice were fed one of these diets or unprocessed chow and time-mated after 6-weeks on the diet (13-weeks of age). Fetuses were harvested at term. At conception and during the first trimester glucose-fed mice were heavier than all other mice. Despite this, all sugar-diets gained less gestational weight than chow, and weight at conception correlated with pregnancy weight gain ( $r = 0.55$ ,  $p < 0.0001$ ). Glucose-fed (high-GI) mice were fatter than chow- and isomaltulose-fed (low-GI) mice at conception, and fatter than all other diets during pregnancy. Female fetuses from glucose and isomaltulose-fed mothers weighed less, and had smaller livers, than those from chow-fed mothers. Glucose-based diets were more adipogenic than all other sugars, but both glucose and isomaltulose diets constrained fetal growth.

### 3.7. The Physiological Effects of L-Theanine Incorporated in a Functional Food Product (Mango Sorbet) in Males: A Pilot Randomised Controlled Trial

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The consumption of green tea has been associated with numerous health benefits attributable to its bioactive constituents. Of these, L-theanine (L-THE), represents one of the most potential mediators of health-promoting effects. L-THE is a non-proteinogenic amino acid associated with the sensation of relaxation and decreased physiological stress response. However, the effect of L-THE when consumed as part of a complex nutrient mixture remain to be elucidated. Thus, the aim of this double blind, placebo-controlled cross-over trial was to determine the acute physiological responses elicited by a single intake of a potential functional food product (whey protein-based mango-sorbet) containing L-THE (ms-L-THE; 200 mg w/w) vs. flavour and colour-matched placebo (ms) vs. fasting measurements. Eleven male participants (age  $27.7 \pm 10$  yrs) were recruited and asked to consume both ms and ms-L-THE. Blood pressure, heart rate and heart rate variability (HRV) were monitored continuously over 90 min following ingestion of either products. The consumption of ms-L-THE produced a change in HRV, indicated by a reduction in LF/HF ratio ( $p = 0.043$ ), compared to baseline but not against ms ( $p > 0.05$ ). This response returned to baseline beyond 50 min post-ingestion. This result reflected an acute ms-L-THE mediated effect on the sympathetic nervous system with potential health benefits.

### 3.8. The Use of Honey as a Potential Therapeutic Agent in the Treatment of Oral Conditions—A Systematic Literature Review

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Tissues in the oral cavity are capable of rapid regeneration and repair. However, impaired wound healing throughout concurrent illness or injury, such as following radiotherapy, commonly leads to poor wound outcomes. Honey is a reported therapeutic agent for wound healing, due to its antioxidant, antibacterial and anti-inflammatory properties. This systematic review assesses safety and efficacy of honey as a therapeutic in the oral cavity. Four electronic databases were searched (PubMed, Cochrane, Scopus, Web of Science) following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses, 2015) guidelines, for randomised controlled trials examining the effect of honey on oral cavity conditions. In total, 2832 records were identified, and after applying exclusion criteria, 13 studies were included. Honey was applied topically throughout; chemotherapy- or radiotherapy-induced oral mucositis ( $n = 10$ ), dental wounds ( $n = 2$ ), and recurrent aphthous stomatitis ( $n = 1$ ). In the majority of studies (12/13), honey reduced severity and/or duration of the condition compared with control groups ( $p < 0.05$ ). Where reported, treatment groups also experienced increased quality of life. However, a Manuka honey group ( $n = 1$ ) experienced adverse effects and considerable withdrawals. In summary, honey as a therapeutic for oral conditions appears effective, however honey composition control, specifically bioactives, should be considered for future investigations to quantify properties of honey for optimal wound healing.

### 3.9. *Inflaming Public Interest: Public Perceptions on Nutrition and Inflammation*

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The internet is a major source of dietary advice, and the public are turning away from traditional nutrition experts such as dietitians. To ensure the voice of the nutrition expert is not ignored, there is a need to consider innovative dietary strategies that garner greater public support. Inflammation and nutrition is an emerging area of interest for researchers and consumers alike. This research aims to explore public perceptions and experiences with this novel nutrition topic. Comments from discussion forums of a nutrition-based massive open online course were qualitatively analysed using the framework method. Two of six themes identified during coding are presented by this research: 'I need guidance but who do I trust?' and 'What I need from health professionals'. Overall, nutrition experts were seen to ignore or rebuff public enthusiasm towards emerging nutrition topics. They also underestimated public health literacy, by failing to provide detailed dietary advice and complex scientific explanations that satisfied public curiosity. To match the public's growing nutrition interest and understanding, experts need to look beyond national dietary guidelines. Inflammation and nutrition is an emerging area of research that could be utilised by dietitians and nutritionists to better engage the public in expert-driven nutrition content.

### 3.10. *Carbohydrate Intake and Metabolic Flexibility: An Exploratory Study of Free-Living Humans*

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The aim of this study was to investigate the effect of carbohydrate (CHO) intake on maximal fat oxidation (MFO) during exercise. One hundred and seventeen healthy individuals participated in a maximal aerobic test with indirect calorimetry measures, anthropometry measures, 24-h food recalls and resting bloods to determine CVD risk factors and glucose homeostasis. A hierarchical multiple regression attributed 55.3% of variability to sex, age, fat-free mass (FFM), fat mass,  $VO_{2max}$  and age. Increased FFM,  $VO_{2max}$  and female sex were positively correlated with MFO. The addition of

protein, CHO and fat intake (g/day), explained a further 4.0% of variability, predominately due to a negative correlation of CHO intake. Participants with severe CHO restriction (<20% total energy intake (TEI) as CHO) exhibited higher MFO than participants consuming CHO meeting dietary guidelines (>45% TEI as CHO) ( $0.52 \pm 0.24$  g/min,  $0.38 \pm 0.13$  g/min, respectively,  $p = 0.020$ ). There was no change when stratifying the population into groups consuming <130 g and >130 g of CHO/day. This change in MFO in the extreme groups persisted when accounting for FFM, age, sex and aerobic fitness ( $p = 0.035$ ). Reduced dietary CHO intake resulted in higher MFO in a study recruiting the general population. This relationship was more evident with greater CHO restriction.

### 3.11. Selenium and Iodine Reduce Oxidative Stress in the Placenta

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A poor maternal diet during pregnancy may negatively impact placenta development and hence a baby's growth and development. Reactive oxygen species are essential for placental development but excessive levels result in oxidative stress (OS) which is associated with poor pregnancy outcomes. Key micronutrients are required for antioxidant action, including selenium and iodine. This study aimed to determine how selenium and iodine may impact OS in the placenta. HTR-8/SVneo cells were supplemented with mineral or organic selenium, iodine, or their combination for 24 h. Cells were treated with menadione or H<sub>2</sub>O<sub>2</sub> for 24 h to induce OS. Cell viability and lipid peroxidation as an OS marker were assessed. Similar experiments are being performed in first-trimester placenta explants. Selenium supplementation was associated with higher cell viability ( $p < 0.05$ ). Lipid peroxidation in cells supplemented with selenium or iodine, separately or together, was significantly lower than in those with no supplementation ( $p < 0.05$ ). Currently, further research is being undertaken on placental explants to find pathways involved in this effect. Laser ablation inductively coupled plasma mass spectrometry showed placenta explant uptake of selenium from the supplementation. Selenium and iodine may protect placental cells against oxidative stress which is important for healthy pregnancy.

### 3.12. Dietary Intakes of Older Australian Adults with Knee Osteoarthritis

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The aim of this study was to assess dietary intakes of a sample of older adults with knee osteoarthritis (OA) and compare these to national nutrient reference values. A subsample of participants ( $n = 57$ ; 32 females and 25 males) from a cross-sectional survey of community-dwelling adults completed food-frequency questionnaires (FFQs). The average age, weight and BMI of the sample was 68.3 years, 85.5 kg and 30.7 kg/m<sup>2</sup>, respectively, with majority of participants classed as overweight or obese (58%). Average energy (E) intake was 6989 kilojoules, with carbohydrate intake at 40% E, protein 21% E, total fat 39% E and saturated fat 15% E, compared to recommendations of 45%–65% E, 15%–25% E, 20%–35% E and ≤10% E, respectively. Average fibre intake for males and females was 22 and 19 grams, respectively, compared to recommendations of 30 and 25 grams. Likewise, intakes of other key nutrients including folate, retinol, vitamin E, calcium, magnesium and potassium were inadequate. These findings demonstrate that dietary intakes of older adults with

OA are high in fat but low in fibre and micronutrients and do not align with national recommendations. Given the health implications of poor dietary behaviours, there is a need for targeted nutrition interventions in this population.

### 3.13. Vitamin D Status and Systemic Inflammation in Obese Bariatric Surgery Patients

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Vitamin D is a major fat-soluble vitamin, which plays a significant role in immune system modulation and may provide protective effects in autoimmune conditions. Serum vitamin D is lower in obese people; the aim of this study was to investigate the relationship between serum 25-hydroxyvitamin D levels and systemic inflammation in the obese population. Data from 29 obese patients (body mass index (BMI) > 30 kg/m<sup>2</sup>) undergoing bariatric surgery was retrospectively examined. Blood samples were used to measure serum 25(OH) vitamin D, full blood count and lipid profile (Laverty Pathology, NSW, Australia). Associations between serum 25(OH) vitamin D levels, inflammatory cell counts and blood lipids were examined using Spearman's correlation coefficient. The mean (standard deviation, SD) serum level of 25(OH) vitamin D was 55 (21) nmol/L. There was a significant inverse correlation between 25(OH) vitamin D and blood neutrophils ( $r = -0.439$ ,  $p = 0.017$ ,  $n = 29$ ). There were also inverse correlations between 25(OH) vitamin D and white blood cells ( $r = -0.365$ ,  $p = 0.052$ ,  $n = 29$ ) and cholesterol ( $r = -0.341$ ,  $p = 0.071$ ,  $n = 29$ ) that approached significance. Our findings suggest a possible role for vitamin D, as a modifiable nutritional risk factor, in relation to the systemic inflammatory response in obese people. This highlights a potential nutritional target for reducing obesity-related inflammation.

### 3.14. A Systematic Review of Economic Evaluations of Antenatal Nutrition and Alcohol Interventions and Their Associated Implementation Interventions

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Antenatal health-promotion interventions improve maternal and infant outcomes and reduce the lifelong burden of disease, yet are underused. Greater understanding of the cost-effectiveness of antenatal health-promotion interventions and associated implementation-interventions is warranted to inform future research, policy and investment allocation. The aims of this systematic review were to (i) identify economic evaluations of interventions targeting antenatal nutrition and alcohol intake, (ii) identify economic evaluations of associated implementation-interventions, (iii) assess the quality of the economic evaluations and (iv) develop recommendations to promote their conduct. Two separate reviews were conducted to address aims (i) and (ii). Both reviews adhered to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Review (1) returned 9599 records, twelve were included, ten were nutrition interventions and two were alcohol interventions. Review (2) returned 136 records, zero were eligible for inclusion. Review (1) indicated interventions offer value for money. However, gaps in the evidence and methodological issues limit its value to decision makers; including identification of relevant outcomes and costs, extending beyond a within-trial time horizon to reflect lifelong benefits, methods of investigating uncertainty and a dominance of modelled evaluations. Review (2) identified no evidence of implementation costs. Assessment of the cost-effectiveness of interventions and their implementation strategies is warranted.

### 3.15. Supplementation with Docosahexaenoic Acid-Enriched Fish Oil Increases Circulating Testosterone in Overweight and Obese Men

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Pre-clinical studies suggest that docosahexaenoic acid (DHA) may influence testosterone synthesis. This is a secondary analysis of a randomised controlled trial which aims to determine whether DHA-enriched fish-oil supplementation affects circulating testosterone levels in men and women. Overweight and obese men and women without diabetes were recruited. They were randomly assigned to fish oil (DHA: 860 mg + eicosapentaenoic acid 120 mg/day) or placebo (corn oil) for 12 weeks. Total serum testosterone (nmol/L) was measured by a commercial pathology provider. Sixty-one participants (CO/FO:  $n = 29/32$ ) were included in this analysis (male:  $n = 22$ , 36.07%). Fish oil increased testosterone in men (+3.13 nmol/L,  $p = 0.025$ ), which remained significant in the fully adjusted model ( $p = 0.039$ ). There was no treatment effect in women ( $p > 0.05$ ). Changes to dihomo-gamma-linolenic acid in erythrocyte membranes significantly predicted changes in testosterone in men ( $\beta = -14.4$ , 95% confidence interval (CI): -17.7, -9.9,  $p < 0.001$ ). Changes to testosterone was associated with beneficial changes to fasting insulin ( $r = -0.43$ ,  $p = 0.044$ ) and Homeostatic Model Assessment of Insulin Resistance (HOMA-IR) ( $r = -0.43$ ,  $p = 0.045$ ) in men across the course of the study, with no associations in women. Dietary supplementation with DHA-enriched fish oil increases testosterone levels and improves metabolic function in overweight and obese men. Further research is warranted to substantiate findings before clinical recommendations can be made.

### 3.16. Reliability of a Nutrition Knowledge Survey Developed for Australian Children Aged 8–12 Years

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As nutrition knowledge has been found to be related to eating patterns, there is a pressing need to accurately report children's nutrition knowledge in Australia. However, few reliable and valid measurement tools exist, limiting the ability to measure the effectiveness of nutrition knowledge interventions. A team of nutrition and education experts developed a nutrition knowledge survey for Australian children aged 8–12 years, based on an existing validated Belgian survey. The questions were translated and adapted to align with Australian culture and national dietary recommendations. The new tool consists of seven nutrition-related topics (i.e., healthy choices, nutritional values, balanced meals, portion sizes, food safety, food groups and food sources). Year 5/6 students ( $n = 84$ , age = 10.9, SD 0.76) at a primary school in Newcastle, Australia were recruited and completed the nutrition knowledge survey twice, with one week in between. Teachers were asked not to teach any nutrition during the study. To test reliability, a Pearson correlation analysis was undertaken and high correlations between baseline and follow-up total scores ( $r = 0.736$ ,  $p < 0.001$ ) were found, confirming the reliability of the survey. In addition, preliminary analyses showed no significant differences between the nutrition topics. The present nutrition knowledge survey will be a reliable tool for assessing children's nutrition knowledge.



### 3.17. *The Effectiveness and Meaningfulness of Nutritional Intervention Programs amongst Indigenous Australians—A Scoping Review*

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Current literature suggests that there are many nutrition intervention programs available to Indigenous Australians, which aim to improve their overall health outcomes and ultimately bridge the life expectancy gap between non-Indigenous and Indigenous Australians. However, it is unclear as to whether these programs are effective and/or meaningful over time. The objectives of this scoping review were to identify both the effectiveness and meaningfulness of nutrition interventions among adult Indigenous Australians. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were followed to perform two separate searches of Australian literature from 2007–2019 across EMBASE, PubMed, CINAHL, and Australian Indigenous Health Informit databases. Papers were included if they studied adult Aboriginal Australian and Torres Strait Islanders who have participated in a nutrition intervention, which has had its success measured by effectiveness and/or meaningfulness. Experimental, qualitative and mixed methods were accepted. A total of 13 papers were identified, with five evaluating effectiveness and eight evaluating meaningfulness. Interventions included education/workshops, food and beverage subsidy, and cooking classes, with outcome measures varying greatly between studies. Overall, it was difficult to assess the long-term effectiveness and meaningfulness of nutrition interventions due to non-standardised outcome measures, combinations of nutrition interventions with other interventions, and the omission of Indigenous voice throughout their planning and execution.

### 3.18. *Nutrients, Foods, and Dietary Patterns: A Descriptive Analysis of the Systematic Reviews Used to Inform the Australian Dietary Guidelines*

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Dietary guidelines should reflect the best available evidence on the relationships between diet and health. The aim of this study was to examine the extent to which the systematic reviews used to inform the 2013 Australian Dietary Guidelines incorporated evidence from nutrient-based, food-based, and dietary patterns research. Documents describing the dietary guideline development process were identified. Evidence-synthesis methods, including the application of quality assessment approaches, were described qualitatively. Descriptive statistics were used to analyse systematic reviews by exposure, outcome, and design of included studies. Based on preliminary analysis of 143 systematic reviews, foods were the dominant exposure of interest (86% of systematic reviews), followed by nutrients (11%), and dietary patterns (3%). The majority of reviews focused on chronic disease outcomes rather than nutritional adequacy. Most reviews included evidence from cohort studies (91%). Quality assessment approaches tended to prioritise evidence from randomised controlled trials over cohort studies. In developing future iterations of the Australian Dietary Guidelines, there is an opportunity to draw on a growing body of evidence from dietary patterns research, which comes primarily from cohort studies. There may be a need to reconsider quality assessment approaches to ensure they are fit for purpose.

### 3.19. *'Nutrition Information Is Extremely Important for Our Patients'—a Qualitative Exploration among Physiotherapists to Provide Nutrition Care*

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Poor dietary behaviours contribute significantly to the prevalence of most chronic diseases, thus increasing the burden of disease and healthcare costs. The recent National Health Survey (2017–2018) reported most Australians to have poor dietary behaviours. Many Australians visit primary care health professionals on a regular basis but opportunities to get advice from a dietitian to improve dietary intake may be limited. There is interest in non-nutrition health professionals delivering ‘nutrition care’ during consultations. Physiotherapy has advocacy to include health promotion such as nutrition care in daily practice; within professional bodies both nationally and internationally. This study aimed to explore the perceptions of Australian physiotherapists towards providing nutrition care to their patients. Twenty physiotherapists practicing in Victoria were interviewed. Participants felt that the ideal role of a physiotherapist regarding nutrition care was to provide basic healthy-eating advice and knowing when to refer their patients to dietitians for specialist dietary advice. Although all participants were highly motivated to provide nutrition care to their patients, they identified a lack of training as the main barrier to providing such care. The findings of this study will be useful to inform the development of nutrition content for the Australian physiotherapy curricula and professional development.

### 3.20. *The Association of Micronutrient Intake on Sleep Quantity and Quality*

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There is growing interest in the possible effect of nutrition on sleep. However, whether there is an association of micronutrient intake and sleep has not been systematically investigated. This review explores the association of micronutrients among people who experience sleep difficulties. A database search included Medline, Embase, Web of Science, CINAHL and Google Scholar. Articles found were screened for inclusion and assessed for quality. Studies ( $n = 10$ ) with 12,170 participants included 5 observational, 3 randomised control trials (RCT) and 2 non-randomised trials. Two RCTs found Mg supplementation improved insomnia severity scores, subjective total sleep time, sleep efficiency (SE), sleep onset latency (SOL), early morning awakening, and decreased serum cortisol and increased melatonin. One RCT and one non-RCT reported vitamin D supplementation increased SE and reduced SOL. Serum vitamin D deficiency increased the risk of sleep disorders and unhealthy sleep. In a clinical trial, multi-vitamin and mineral supplementation reduced insomnia and depression symptoms, SOL and increased SE. No significant sleep improvements were found for vitamin B12, potassium and the mineral copper with several RCT, clinical trial and observational studies. Magnesium and vitamin D supplementation improved subjective and objective measures of insomnia although dose-response studies are needed.

### 3.21. *Postprandial Responses of One Carbon Metabolites to a Single Multivitamin Supplement Are Age-Dependent: An Acute Intervention Study*

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Folate and related vitamins are required for the complex regulation of metabolites involved in one carbon (1C) metabolism, which are implicated in common age-related diseases. Vitamin supplementation is widely promoted, yet there is limited evidence of either improved 1C status or health outcomes. This study aimed to investigate the impact of a multivitamin supplement on postprandial 1C metabolite fluctuations in 20 young (19–30 yrs) and 20 older (65–75 yrs) healthy adults to examine whether vitamin absorption and 1C metabolic pathway differed between age groups. Fasting plasma samples were collected, and following consumption of a single commercial multivitamin supplement and standardised breakfast, postprandial samples were collected hourly for 4 h. Plasma 1C metabolite concentrations were quantified using liquid chromatography coupled with mass spectrometry. Postprandial concentrations of homocysteine, choline, cystathionine, and S-adenosyl-homocysteine were higher, while serine, betaine, and methionine were lower in older adults across all time points. Glycine and carnitine concentrations were only responsive to ingestion in younger adults. This study established that following a multivitamin supplement ingestion, 1C metabolite response is affected by age. Further studies are needed to better understand the implications of these altered 1C metabolite dynamics on health outcomes in older adults.

### *3.22. A Novel Food Environment-Mapping Tool for Under-Resourced Low-Income Communities*

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Most food environment-mapping studies have been conducted in high- and middle-income countries with little focus directed to low-income countries. This is despite the latter communities facing significant challenges in regard to food insecurity, nutrition-related health disparities, and the nutrition transition that influence their food systems. These communities are significantly under-resourced, hence, traditional food environment-mapping tools (FEMT) cannot be applied. This study aims to develop a FEMT that can be used in under-resourced low-income (URLI) communities through applying novel photographic methods to analyse the food environment through a mixed-model approach. Photographic data were collected from a small Pacific Island, Niue as a case study. Findings from a systematic scoping review identified that the data could be rigorously analysed through inductive reasoning. Based on these findings, this process was applied to the data by organising the data in an MS Excel spreadsheet, collating the data into a food inventory, and generating themes to draw conclusions about the status of the food environment. Quantitative and qualitative analysis were applied which determined that the FEMT was successful in mapping the food environment in Niue, an URLI community demonstrating the potential for adaptation to other low-income countries in future research.

### *3.23. The Short-Term Impact of Consuming Higher Protein Snack Foods on Energy Intake in Social Drinkers: An Exploratory Study*

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Drinking alcoholic beverages is a risk factor for the development of chronic diseases, and may stimulate food intake, contributing to passive overconsumption of dietary energy. As protein is the most satiating of all the macronutrients, increased levels in foods may minimise excessive consumption. This exploratory study aimed to assess the short-term effects of consuming higher protein snack foods compared with standard protein snack foods on acute food energy intake, after a moderate intake of alcohol. A randomised single-blind crossover trial with 19 participants aged 19–31 years, was conducted. Participants attended two separate testing sessions, where they ingested white wine (30 g alcohol) and offered ad libitum access to either higher-protein snacks with a protein-fortified dip or standard protein snacks with a dip. Food intake and subjective appetite ratings were measured. There were no significant differences in mean food energy intake or subjective appetite ratings (all  $p > 0.05$ ) between the snacks. Mean protein intake was increased with

higher protein snacks compared with standard protein snacks ( $p < 0.001$ ). This exploratory study demonstrated a similar food-energy intake between higher protein snacks and standard protein snacks after a moderate alcohol dose, despite the difference in protein intake.

### 3.24. Which Meals Are Identified by Australians as Having Few or a Lot of Vegetables?

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Most Australians do not consume the recommended amounts of vegetables. Most vegetables are eaten in meals and, therefore, it is important to know which meals Australians identify as being rich or poor in vegetables. This is so that targeted education can be developed. A national online survey was conducted during 2012 in Australia among 1023 domestic food providers to examine their use of vegetables in evening meals. Respondents were asked to name three meals with few (less than two) and a lot (three or more) vegetables. Stir fry and meat/vegetables were the most popular meals identified that contained three or more different vegetables. Roast meat was the second most frequently cited meal followed by various pasta dishes, casserole/stew, steak, and soup. Similarly, various pasta and soup dishes and steak were the most highly cited meals with less than two vegetables. The meals identified with few vegetables offer an opportunity for intervention. Interventions may also target the addition of extra vegetables to nominated dishes with three vegetables or by increasing variety. Factors that prevent these additions should be investigated to help guide future public-health interventions aiming to improve vegetable intake.

### 3.25. Integrating Nutrition into the Mathematics Curriculum to Improve Primary School Children's Portion-Size Estimation Skills

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Healthy dietary patterns are essential for optimal growth and development during childhood. Schools are in theory an ideal setting to teach children about nutrition. However, studies report that crowded curricula mean teachers find it challenging to implement nutrition education as a sole subject. Therefore, integrating nutrition with core subjects across the curriculum might help address this barrier. This randomised controlled trial in 12 primary schools ( $n = 300$  children in Year 3 and/or 4) examines the impact of a teaching unit that integrates nutrition within mathematics on portion-size estimation skills, nutrition knowledge and attitudes towards mathematics. The intervention group receives a lesson plan to educate children about portion size, food groups, volume and capacity utilising experiential learning with mathematics cubes and food replicas. The control group continues usual lessons on volume and capacity. Outcome measures are being taken pre-intervention (baseline), immediately post-intervention (follow-up 1) and 4 weeks after intervention completion (follow-up 2). The intervention protocol and preliminary results will be presented. Results will inform future cross-curricular nutrition education interventions and strategies to enhance child nutrition knowledge and skills for in the school setting.

### 3.26. Determination of Molar Extinction Coefficients for Measuring Total Monomeric Anthocyanin Concentration in Foods Using Ultraviolet-Visible (UV-Vis) Spectroscopy

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Anthocyanins are bio-active compounds present in bright colored fruits and vegetables with increasing evidence for their health benefits. Despite various advanced methods to measure the total monomeric anthocyanin content in foods, the most simple and rapid way is the pH differential method using ultraviolet-visible (UV-Vis) spectroscopy. However, the literature for the molar

extinction coefficients which helps to measure the anthocyanin concentration is dated and has many discrepancies concerning the purity and stability of anthocyanin standards. In addition, the absorbance wavelength ( $\lambda$ ) for the molar extinction coefficient of anthocyanins is measured at wavelength 520 nm but the peak absorbance ( $\lambda_{\max}$ ) can differ among various anthocyanins depending on the structure of each anthocyanin. The molar extinction coefficients were compared at  $\lambda_{520}$  and  $\lambda_{\max}$  for six anthocyanin standards using UV–Vis spectroscopy. Determined molar extinction coefficients at  $\lambda_{520}$  and  $\lambda_{\max}$  were 6958 and 6969.4 for delphinidin-3-glucoside; 21,865 and 22,791 for cyanidin-3-glucoside; 10,373 and 13,347 for pelargonidin-3-glucoside; 11,185 and 11,198 for petunidin-3-glucoside; 13,611 and 14,131 for peonidin-3-glucoside; 6537.1 and 6538.3 for malvidin-3-glucoside. This study revealed that the absorbance wavelength greatly influences the molar extinction coefficients. The measured values for  $\lambda_{\max}$  can be utilized to quantify total monomeric anthocyanin for their respective anthocyanin equivalents in foods.

### 3.27. Pregnant Women's Adherence to the Dutch Food-Based Dietary Guidelines, Assessed Using the Dutch Healthy Diet (DHD15) Index

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Pregnant women often fail to meet dietary requirements, especially in low-socioeconomic status (SES) populations. We assessed how well low-SES pregnant women in The Netherlands adhere to the 2015 Dutch food-based dietary guidelines, compared to those with a higher SES. Intake assessed by a 185-item interviewer-administered, meal-based food frequency questionnaire was scored with the 2015 Dutch Healthy Diet index (DHD15-index). Scores ranged from 0 (no adherence) to 10 (full adherence) per component. Index scores for 12 components were compared between our current population of low-SES pregnant women ( $n = 37$ ), higher-SES pregnant women in the GLIMP2 study ( $n = 55$ ) and non-pregnant women of reproductive age in the NQplus study ( $n = 57$ ). Diet quality according to the mean DHD15-index scores was significantly lower in the low-SES population (mean  $4.2 \pm 1.1$  (standard deviation)) than in GLIMP2 ( $6.2 \pm 1.1$ ) and NQplus ( $6.5 \pm 1.2$ ) populations. Low-SES pregnant women scored significantly lower on six components: whole-grain products, dairy, fruit, nuts, tea and vegetables. Diet quality in low-SES pregnant women is lower than in higher-SES pregnant women and non-pregnant women of reproductive age. Interventions to improve diet quality should focus mainly on increasing intakes of whole-grain products, dairy and fruit.

### 3.28. Impact of Fruit and Vegetable Consumption Patterns of Pre-School Aged Australian Children (2–5 yo) on Whole Diet Intake of Fibre

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Fruits and vegetables are good sources of dietary fibre, however, food neophobia or socioeconomic factors may prevent varied diets in pre-school aged children, and the relative contribution of fruits and vegetables to fibre intake remains unclear. Therefore, we assessed fibre intake in 2- to 3-year-old ( $n = 464$ ) and 4- to 5-year-old ( $n = 358$ ) children from the Australian National Nutrition and Physical Activity Survey 2011–2012 by fruit and vegetable consumption patterns (none, fruit only, vegetable only, and both). Mean intakes were lowest in none increasing in vegetable only, fruit only and both in 2–3 years ( $8.5 \pm 5.4$  g,  $10.8 \pm 5.4$  g,  $15.1 \pm 6.4$  g and  $17.8 \pm 7.4$  g, respectively;  $p_{ANOVA} < 0.05$ ) and 4–5 years ( $10.8 \pm 5.2$  g,  $14.7 \pm 5.6$  g,  $17.2 \pm 6.4$  g,  $19.5 \pm 8.0$  g, respectively,  $p_{ANOVA} < 0.05$ ). Percentages meeting the adequate intake for fibre also followed the same

trend (2–3 years- none 13%, vegetable only 34%, fruit only 52%, both 70%; 4–5 years- none 9%, vegetable only 19%, fruit only 36%, both 54%;  $\chi^2 p < 0.001$ ). These findings demonstrate that while a varied diet of both fruits and vegetables is optimal for fibre intake, fruits alone may be superior to vegetables in pre-schoolers.

### 3.29. Influences of Acute Aerobic Exercise on Plasma Homocysteine Level

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Recently, the plasma homocysteine (Hcy) level has attracted attention as an indicator of bone quality. The plasma Hcy level is reported to change with exercise; however, in previous studies, there is no consensus on the type of exercise, aerobic or anoxic. We hypothesized that the plasma Hcy level increases after aerobic exercise. Ten male university students used a cycle ergometer, and exercise of 65% heart rate reserve (HR reserve) for 40 min was performed. Blood was collected from the brachial vein within 30 min after the end of exercise. Blood samples were stored at  $-80\text{ }^{\circ}\text{C}$  until analysis and plasma Hcy level were measured by high-performance liquid chromatography (HPLC). For statistical analysis, the paired *t*-test was performed with SPSS (ver. 25). Plasma Hcy level significantly increased 0.5 h after exercise in all subjects ( $8.10 \pm 2.76$  vs.  $8.79 \pm 3.16\text{ }\mu\text{mol/L}$ ,  $p < 0.05$ ). Since Hcy induces oxidative stress, when exercise was performed under this condition, 65% HR reserve, 40 min, it was suggested that the oxidative stress increases with the increase of plasma Hcy level. We conclude that the intake of coenzymes involved in Hcy metabolism maintains plasma Hcy level after exercise.

### 3.30. Short-Chain Fatty Acids Reduce Lipopolysaccharide (LPS)-Induced Inflammation in Immune Cells of Obese Humans

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Chronic low-grade systemic inflammation, a hallmark feature of obesity, leads to a number of non-communicable diseases such as type 2 diabetes mellitus (T2DM), cardiovascular disease (CVD) and liver disease. Short-chain fatty acids (SCFAs) have been proposed to inhibit lipopolysaccharide (LPS)-induced inflammation, a primary trigger of systemic inflammation in obesity. Peripheral blood monocytes ( $n = 18$ ) were isolated from blood of obese bariatric patients immediately prior to gastric sleeve surgery. Isolated monocytes were stimulated with 1 ng/mL of LPS alone (control) or simultaneously treated with varying concentrations of butyrate or propionate (0.3, 3 or 30 mM) or acetate (100, 200 or 300 mM). Supernatant was harvested after 15 hrs incubation and tumour necrosis factor (TNF)- $\alpha$  analysed via enzyme-linked immunosorbent assay (ELISA). TNF- $\alpha$  (pg/mL) production was higher in untreated LPS-stimulated monocytes (740.75 [365.4, 1044.2]), compared to monocytes treated with 3 mM butyrate (468.0 [220.1, 627.1];  $p = 0.0316$ ), 30 mM butyrate (312.9 [120.6, 390.8];  $p < 0.001$ ) and 30 mM propionate (404.3 [231.2, 649.2];  $p = 0.0022$ ). Additionally, TNF- $\alpha$  response in untreated LPS-stimulated monocytes (665.0 [432.5, 816.7]) was higher than monocytes treated with 300 mM acetate ( $n = 6$ ) (0.3 [0.1, 1.0];  $p = 0.005$ ). Our findings demonstrate that butyrate, propionate and acetate are effective in attenuating LPS-induced inflammation in obesity, highlighting their novel potential for reducing systemic inflammation in obese individuals.

### 3.31. Is Weight Status Associated with Peripheral Levels of Oxytocin? A Pilot Study in Healthy Women

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The physiological regulation of food intake is based on an intricate feedback system controlled by short-term 'hunger' and 'satiety' signals and long-term signals from fat stores. This pilot study aimed to (1) measure fasting basal appetite hormones (leptin, ghrelin, cholecystokinin and cortisol) with a focus on oxytocin; (2) determine whether healthy vs. hyperpalatable food cues differentially alter plasma oxytocin; and (3) assess whether hormonal responses to healthy vs. hyperpalatable food images depended on weight or food-addiction status. Eighteen healthy women attended a one-off experimental session. Blood was collected before and after viewing two sets of food (healthy and hyperpalatable) images. A positive correlation between body mass index (BMI) and plasma oxytocin was found ( $r^2 = 0.32$ ,  $p = 0.021$ ) at baseline. Basal oxytocin levels were higher ( $p = 0.015$ ), and cholecystokinin levels lower ( $p < 0.001$ ), in self-reported food-addicted ( $n = 6$ ) vs. non-food addicted women. In response to food images, a non-significant ( $p > 0.05$ ) trend of increased oxytocin levels were observed in obese and food-addicted women. The opposite trend was observed in healthy weight and non-food addicted women. A combination of oxytocin resistance and lower levels of cholecystokinin may interact to promote overeating in some individuals. This may be an important factor in the pathogenesis of obesity and food addiction.

### 3.32. *The Effect of Advanced Glycation End-Products on Bone-Quality Deterioration and Possible Prevention with Epigallocatechin Gallate (EGCG)*

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Not only reduction of bone mineral density but also degradation of bone quality are causes of osteoporosis. Bone quality is defined by enzymatic crosslink and non-enzymatic cross-link. Enzymatic crosslink is formed by lysyloxidase (LOX) and makes bone flexible. Recently, it has been suggested that advanced glycation end-products (AGEs) which are non-enzymatic cross-link, decreases LOX expression, but this mechanism is not clear. Meanwhile, epigallocatechin gallate (EGCG) from green tea has pharmacological activity partly due to inhibition against DNA methyltransferase (DNMT). Thus, in this study, we investigated the influence of AGEs on LOX level and the preventive effect of EGCG in vitro. First, MG63 cells (a human osteosarcoma cell line) were cultured with 0–100 µg/mL AGEs and assayed mRNA expression by pRT-PCR. Next, the cell was treated with 500 or 1000 nM EGCG with 100 µg/mL AGEs. The result showed that LOX mRNA expression was inhibited after treatment of 100 µg/mL AGEs. The EGCG/AGEs treatment group significantly increased compared with that of AGEs group via the inhibition of DNMT. It is suggested that AGEs influence bone quality by suppressing the LOX level, and EGCG can be expected as a functional food component that prevents deterioration in bone quality by recovering the AGEs-influenced LOX level.

### 3.33. *The Relationship between Adherence to Australian Dietary Guidelines and Brain Health in Older People with and without Type 2 Diabetes*

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Cognitive dysfunction is common among older adults, particularly in those with type 2 diabetes (T2D). Higher adherence to the Dietary Guidelines for Americans is associated with better brain health. However, it is unclear if adherence to the Australian Dietary Guidelines (ADG) is associated with brain health in older adults. We aimed to examine the relationship between

adherence to 2013 ADG and both cognition and brain magnetic resonance imaging (MRI) and determine whether T2D modifies any associations. A sample of 689 people ( $n = 343$  T2D) aged 55–90 years were enrolled. The 80-item Cancer Council food-frequency questionnaire was used to assess dietary intake. Cognitive function was assessed with a battery of neuropsychological tests. Brain structure was measured by MRI. Multivariable linear models were used to assess the associations between ADG and brain health. The mean age of the sample was 70.0 years (standard deviation (SD) 7.4) with 42.8% males. The mean ADG was 55.5 (SD 10.6, range 24.1 to 84.6). No associations were observed between ADG and brain health. T2D did not modify any associations ( $p > 0.05$ ). This is the first study to investigate associations between adherence to ADG and brain health. Future prospective studies are required to clarify long-term associations.

### 3.34. Plasma Phospholipid Omega-3 Polyunsaturated Fatty Acids as a Determinant of Omega-3 Status

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Erythrocyte (RBC) long-chain omega-3 polyunsaturated fatty acid (LCn-3PUFA) content is regarded as the gold standard biomarker for determining LCn-3PUFA status. This study aims to validate plasma phospholipid (PP) LCn-3PUFA composition as a marker of LCn-3PUFA status, using RBC LCn-3PUFA composition as a reference. Fasting blood samples were collected and stored at  $-80$  °C. PP and RBC LCn-3PUFA composition were determined using gas chromatography (%w/w). Sex, age, and body mass index (BMI) were adjusted in the regression to explore RBC and PP LCn-3PUFA correlations. Forty-four participants were included (female:  $n = 29$ , 65.9%; age:  $39.5 \pm 16.0$  years, BMI:  $30.7 \pm 6.4$  kg/m<sup>2</sup>) in the study. There were strong correlations for both RBC and PP eicosapentaenoic acid (EPA;  $r = 0.801$ ,  $p < 0.001$ ) and docosahexaenoic acid (DHA;  $r = 0.885$ ,  $p < 0.001$ ). These correlations were highly significant in both men (EPA:  $r = 0.857$ ,  $p < 0.001$ ; DHA:  $r = 0.841$ ,  $p < 0.001$ ) and women (EPA:  $r = 0.778$ ,  $p < 0.001$ ; DHA:  $r = 0.891$ ,  $p < 0.001$ ), with no significant differences between sexes ( $p > 0.400$ ). PP EPA and DHA were significant predictors of RBC EPA ( $\beta = 0.72$ , 95% confidence interval (CI): 0.55, 0.90,  $p < 0.001$ ) and DHA ( $\beta = 1.19$ , 95% CI: 0.98, 1.39,  $p < 0.001$ ) respectively in the fully adjusted model. EPA and DHA content in PP are strongly correlated with those in erythrocytes. PP fatty acid composition provides a valid marker of LCn-3PUFA status.

### 3.35. Secondary-School Healthy-Eating Policy Implementation: Canteen Manager Attitudes

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Despite the existence of healthy-school canteen policies across Australia, research indicates that implementation of such policies is limited. Several barriers to schools' implementation of these policies have been identified, however, there is limited knowledge of such in the secondary-school setting. The aim of this study is to describe secondary-school canteen manager perceptions and acceptability of healthy-school canteen policy implementation support. A cross-sectional telephone survey of eligible government and Catholic secondary school canteen managers was undertaken in New South Wales, Australia during May 2017 to August 2018. A total of 80 canteen managers completed the telephone survey (66%,  $n = 122$ ). Less than a third (29%) of canteen managers reported they were implementing the healthy canteen policy. Canteen managers reported the main challenge to implementing healthy canteen policies was perceived as child food preferences (40%). The majority of canteen managers reported printed resource materials (90%) and menu feedback support (89%) as the most acceptable methods of policy implementation support. These results suggest healthy-canteen policy implementation is limited in secondary schools. Canteen managers do,



however, appear to accept policy implementation support, which should endeavour to address canteen managers' perceived barriers.

### 3.36. Long Chain Omega-3 Polyunsaturated Fatty Acid Intake in Older Australians: Associations with Increasing Age, Cardiovascular Risk and Cognitive Function

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Long-chain omega-3 polyunsaturated fatty acid (LCn-3 PUFA) consumption may promote healthy ageing. Therefore, we examined associations between age and LCn-3 intake, and between LCn-3 PUFA, cardiovascular risk and cognitive function in older Australians. Cross-sectional data were collected from 90 adults aged 50 to 80 years. LCn-3 PUFA intake was assessed using a food-frequency questionnaire and red blood cell (RBC) fatty acid profiles. Cardiovascular outcomes included blood pressure, cholesterol and glucose. Cognitive outcomes included Addenbrooke's Cognitive Examination and the Cambridge Neuropsychological Test Automated Battery. Positive associations were observed between age and total RBC LCn-3 PUFA ( $b = 0.06$ ; 95% confidence interval (CI) :0.01, 0.10 %;  $p = 0.01$ ), and age and LCn-3 intake from fish oil capsules ( $b = 17.44$ ; 95% CI 2.39, 32.49 mg/day;  $p = 0.02$ ). A negative association was observed between total RBC LCn-3 PUFA (%) and glucose ( $b = -0.16$ ; 95% CI:  $-0.28, -0.04$  mmol/L;  $p = 0.01$ ), while a positive association was observed between total RBC LCn-3 PUFA (%) and total cholesterol ( $b = 0.17$ ; 95% CI: 0.01, 0.33 mmol/L;  $p = 0.01$ ). No associations were observed for cognitive function. LCn-3 PUFA and fish-oil consumption increased with age in this sample of older Australians. However, associations with markers of cardiovascular risk were inconsistent, suggesting bi-directional relationships between LCn-3 intake and health.

### 3.37. Encapsulated Tuna Oil Results in Higher Absorption of Docosahexaenoic Acid (DHA) in Toddlers

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The omega-3 docosahexaenoic acid (DHA) is an essential component for brain and visual acuity development during fetal and early postnatal life. The European Food Safety Authority has proposed DHA supplementation as mandatory for infant formulas. The challenge for infant formula manufacturers is to provide DHA in the most stable and bioavailable form that most closely resembles the DHA format found within human breast milk. The aim of this study was to investigate the bioavailability of different omega 3 DHA formulations in healthy toddlers compared with high DHA tuna oil for one month. Sixty toddlers were randomly allocated to four groups: 1. unfortified toddler formula, 2. unfortified toddler formula +high DHA tuna oil, 3. milk drink fortified with high DHA tuna oil powder formulation 1, 4. milk drink fortified with high DHA tuna oil powder formulation 2. The bioavailability was checked through analysis of blood and faeces fatty acid levels. Results showed that the DHA bioavailability was enhanced through microencapsulation of the high DHA tuna oil. Microencapsulation of high DHA tuna oil into a stable powder format is a common delivery method for incorporating DHA into infant and toddler's formula to ensure the active DHA fatty acid is protected and bioavailable.

### 3.38. Assessment of the Cooking and Food Provisioning Action Scale (CAFPAS): Food Agency, Diet Quality and Cooking Behaviours in a Nationally Representative Sample of Adults in the United States

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Evidence regarding how to measure the ability to cook healthy meals at home, a key behaviour for healthy eating, is mixed. Some measures focus on individual cooking skills or knowledge domains. But this may be problematic due to the diversity of approaches to food preparation. In this study, we examine how a new scale to measure food agency is related to cooking attitudes, confidence, behaviour, and dietary intake. We conducted a web-based, national survey of adults in the USA ( $n = 1457$ ) using Amazon Mechanical Turk. Participants answered validated questions about their cooking and food skills, cooking confidence, attitudes, perceptions and behaviour. Food agency was measured using the Cooking and Food Provisioning Action Scale (CAFPAS) a 28-question scale that captures food-related attitudes, self-efficacy and structural barriers to food preparation. In adjusted models, greater Food agency was associated with higher confidence in ability to cook from scratch ( $p < 0.001$ ), cook a healthy meal ( $p < 0.001$ ), and prepare a meal with vegetables never used before ( $p < 0.001$ ). Higher food agency was associated with greater intake of fruit ( $p = 0.007$ ), vegetables ( $p < 0.001$ ), and lower intake of soda ( $p = 0.038$ ). The CAFPAS, and the construct of food agency, will be useful for the development and evaluation of cooking skill interventions.

### 3.39. A Novel Content Analysis Approach to Gain Insight into Adolescents' Exposure to Food Marketing via Social Media

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Food marketing has the effect of enhancing attitudes, preferences and increased intake of marketed foods in children and adolescents. While the use of social media applications in adolescence has proliferated, little is known about the content of food marketing within these applications. In this study we present a novel approach to explore food-marketing content on Dutch and Australian adolescents' (13–16 yrs;  $n = 20$ ) social media accounts, specifically Instagram, Snapchat and YouTube. Adolescent participants will be invited to the university to meet with a researcher and to login to their account(s) on the aforementioned social media applications. They will be asked to scroll through their social media feeds accompanied by a researcher who will instruct them on how to identify and then extract food-marketing content with screenshots (text, images) or recordings (videos, games) using a screen recorder application. Sponsored content, advergames (i.e., games promoting products) and social influencer advertising (e.g., video blogs promoting products) will be extracted and coded. Preliminary results of a quantitative analysis of the extracted food advertisements will be presented, and methodological strengths and limitations as well as ethical considerations will be discussed.

### 3.40. Fruit and Vegetable Consumption and Psychological Distress in Australian Pregnant and Breastfeeding Women

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This cross-sectional study was the first to determine the association between fruit and vegetable intake and psychological distress in an Australian sample of pregnant and breastfeeding women. Data were collected from the Australian Bureau of Statistics in the 2014–2015 Australian National Health Survey. Participants included 166 pregnant and 207 breastfeeding women >18 years old. Participants were asked to report the number of serves of fruit and vegetables they usually consumed each day. The Kessler Psychological Distress Scale (K10) was used to measure levels of global non-specific psychological distress. The association between fruit and vegetable intake and psychological distress were investigated using linear regression adjusted for relevant covariates. Mean  $\pm$  standard deviation (SD) fruit intake was greater in the pregnant compared to breastfeeding women ( $2.0 \pm 1.0$  versus  $1.7 \pm 1.0$ ,  $p < 0.05$ ). The mean K10 score for both pregnant and breastfeeding women was in the 10–15 ‘little or no psychological distress’ range. In pregnant women, combined fruit and vegetable intake was inversely associated with psychological distress in the fully adjusted model ( $\beta = -0.37$ , 95% confidence interval (CI):  $-0.72, -0.02$ ). There was no association between fruit and vegetable intake and psychological distress in breastfeeding women. A higher intake of combined fruit and vegetables may help reduce psychological distress in pregnant women.

### 3.41. Palmitic Acid and Its Potential Role in the Pro-Inflammatory Obesogenic Environment

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Systemic inflammation contributes to the development of co-morbidities in obesity. This study examined responses of peripheral blood monocytes to the pro-inflammatory stimuli, lipopolysaccharide (LPS) and palmitic acid (PA), which are increased in the circulation of obese people. Peripheral blood monocytes were isolated from lean ( $n = 6$ ; body mass index (BMI)  $< 30$  kg/m<sup>2</sup>) and obese individuals ( $n = 7$ ; BMI  $\geq 30$  kg/m<sup>2</sup>) and were cultured with media alone (control), PA (500  $\mu$ M), LPS (1 ng/mL) or combined PA and LPS (PA-LPS) for 15 h. Cell culture supernatants were assayed for tumour necrosis factor (TNF)- $\alpha$  and interleukin (IL)-1 $\beta$ , using enzyme-linked immunosorbent assay (ELISA). PA alone increased monocyte production of IL-1 $\beta$  ( $176.5 \pm 46.9$  pg/mL (PA) versus  $91.4 \pm 37.0$  pg/mL (control);  $p < 0.05$ ). Monocytes stimulated with PA-LPS ( $277.5 \pm 39.8$ ) had higher IL-1 $\beta$  production than monocytes treated with control  $91.4 \pm 37.0$  pg/mL;  $p < 0.01$ ), PA alone ( $176.5 \pm 46.9$  pg/mL;  $p < 0.05$ ), or LPS alone ( $171.5 \pm 39.8$  pg/mL;  $p < 0.05$ ). Monocytes isolated from obese individuals had increased production of both TNF- $\alpha$  ( $271$  (125, 968) versus  $0.8$  (0.3, 18.1);  $p < 0.05$ ) and IL-1 $\beta$  ( $326$  (279, 389) versus  $0.7$  (0.4, 10.5);  $p < 0.01$ ) compared to lean individuals in response to PA. Palmitic acid may contribute to the pro-inflammatory environment observed in obesity.

### 3.42. The Influence of Cooking on D Vitamins in Dried Button Mushrooms Exposed to Pulsed Ultraviolet (UV)-Radiation

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Dried mushrooms briefly exposed to ultraviolet (UV) radiation are an excellent non-animal dietary source of vitamin D; however, the effect of cooking on the vitamin D content of UV-enhanced dried mushrooms is unknown. We assessed the influence of cooking on the concentration of three D vitamins (vitamins D<sub>2</sub>, D<sub>4</sub> and 25-hydroxyvitamin D<sub>2</sub>) in dried, UV-exposed common button mushrooms (*Agaricus bisporus*). We randomly selected 12 × 250 g samples from a single growing room, and these were air-dried at 60 °C for 22 h, exposed to 1–4 s of pulsed UV-radiation, rehydrated by soaking in warm water, and cooked in three ways (oil fry, dry fry, boil). Samples were analysed in triplicate for D vitamins by liquid chromatography triple quadrupole mass spectrometry. All three cooking methods increased the concentration of vitamins D<sub>2</sub> and D<sub>4</sub> between three and seven-fold compared to dried, UV-exposed uncooked samples. Boiling resulted in the greatest increase in D vitamins (from 3 to 22).

### 3.43. Cruciferous Vegetable Intake Is Inversely Associated with Abdominal Aortic Calcification in Older Australian Women

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Our previous work has identified the benefit of cruciferous vegetables on lower carotid artery intima-media thickness in older Australian women. We now hypothesise that the intake of cruciferous vegetables may also be associated with a lower odds of severe abdominal aortic calcification (AAC), a stable marker of vascular disease that predicts cardiovascular disease (CVD) outcomes. Dietary intake was assessed using a validated food frequency questionnaire. Cruciferous vegetables included cabbage, Brussels sprouts, cauliflower and broccoli. AAC was scored using the Kaupilla AAC 24 scale on bone density lateral spine images, and were categorised as “not severe” (0–5) and “severe” (≥6). Data were analysed using logistic regression adjusting for lifestyle and CVD risk factors. Mean (standard deviation, SD) age and cruciferous vegetable intake was 74.9 (2.6) yrs and 32.2 (21.7) g/d, respectively; 161/904 (17.8%) women had severe AAC scores. Cruciferous vegetable intake (per SD, 21.7 g/d) was associated with a lower odds of having severe AAC (fully-adjusted odds ratio (OR) = 0.79, 95% confidence interval (CI): 0.64, 0.98, *p* = 0.035). This relationship remained after further adjustment for non-cruciferous vegetables (*p* = 0.028). In conclusion, higher consumption of cruciferous vegetables was associated with a lower odds of having severe AAC. This study provides further evidence of the potential benefits of cruciferous vegetables for improved cardiovascular health.

### 3.44. Which Behaviour-Change Techniques within Weight-Management Interventions Improve Adiposity Outcomes in Young Adults? A Systematic Review and Meta-Analysis of Randomised Controlled Trials (RCTs)

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Young adulthood is associated with the highest rate of weight gain compared to any other age group. This review evaluates the effectiveness of interventions with adiposity outcomes among young adults and, identifies which behaviour-change techniques (BCTs) are most effective. A search of six electronic databases for RCTs assessing change in adiposity in young adults (17–35 years) until October 2018 identified 18,779 articles. From this, 44 studies were included. The meta-analyses for weight ( $n = 15$  studies), body mass index (BMI,  $n = 18$  studies) and waist circumference ( $n = 9$  studies) demonstrated no significant differences between intervention and control groups at either  $\leq 3$  months and  $>3$  months. Also, there were no differences between interventions focusing on either weight loss or weight-gain prevention. The narrative synthesis demonstrated similar findings with many studies failing to identify significant intervention effects. Four BCT's demonstrated a percentage effectiveness ratio  $>50\%$ ; these were: goal setting (outcome), habit formation, self-monitoring of outcome(s) of behaviour and social reward. More studies are required before these BCTs could be confirmed as having greater effectiveness than others. This review highlights the challenges facing efforts to positively change adiposity measures in young adults. Increasing the personalisation of programs by tailoring these to young adults may be an alternative approach for this group.

### 3.45. Consumers' Behaviour Towards Functional Food and Health Claims

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The purpose of the study is to investigate the impact of functional food and health claims on consumers' behaviour. A cross-sectional study was conducted with a self-administered survey; 407 adult consumers from southern Brazil responded to an online questionnaire which was available from January to March 2015. The results demonstrate that 73.7% of the respondents have the habit of purchasing functional and health claim-food, although 56% of them indicated that their understanding of the claims is superficial. Regarding consumption frequency, 2/3 consume this type of food daily or weekly. Healthy lifestyle, healthy gut microbiota, disease prevention, especially cardiovascular, cholesterol control, physical appearance and wellbeing are their main purchase motivation. Although many people tend to buy functional and health claim-food, the majority of them do not comprehend their alleged meaning. Besides that, there is a significant movement towards a healthier lifestyle. In conclusion, it is evident that there is a need for investment in claim improvements and in how they are displayed on food labels to better communicate with consumers.

### 3.46. Assessment of Satiety and Satiation Properties of Fruits and Vegetables Consumed as Snacks

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One strategy to reduce obesity risk is to control appetite via increasing the daily consumption of fruits, vegetables, nuts and cereals. The aims of the present work were to investigate the effects of food structure on satiation and satiety, and test whether resting energy expenditure (REE) could be a driver for individual response of energy intake using a trained human panel. Twenty-one panelists were recruited and body anthropometric, volume of oxygen ( $VO_2$ ) intake and resting energy

expenditure (REE) measured. They each rated their fullness after 20 min of ad libitum snacking on cut apple (CA), cut carrot (CC), blended apple (BA) or blended carrot (BC); and every 30 min for 180 min thereafter. Immediately after snacking, there was no significant difference in fullness between samples but the panelists consumed 53% more calories from apple than carrot ( $p < 0.001$ ); while 24% more calories were consumed from BC than CC ( $p = 0.013$ ). Over time, there were significant differences in fullness between gender, snack type and structure ( $p < 0.001$ ), respectively. There was no significant differences in fullness with  $VO_2$  or REE. Food structure affects satiation. Subsequent satiety is driven by food composition and structure. REE should be further investigated with a larger group of panelists.

### 3.47. Using Novel Technologies to Integrate Nutrition and Mathematics Education into Primary Schools

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One in four Australian children are overweight. Poor eating patterns and larger portion sizes contribute to increased energy intake. Children and adults have difficulties in estimating (food) volumes, food-portion sizes, understanding food labels, and kilojoule content, all of which require basic mathematical skills. Worldwide interest and achievement in mathematics has declined in school-age children due, in part, to the perceived irrelevance of the school curriculum. Technology, gamification and real-life contexts can help make volume-learning relevant to children. Schools play a key role in promoting healthy lifestyles and healthy eating for children. Embedding aspects of the personal development, health and physical education syllabus within mathematics can promote aspects of quality teaching and enhance learning experiences. Within our interdisciplinary team of computer scientists, nutrition and mathematics education experts, we have developed and pre-tested an evidence-based tool for integrated mathematics and nutrition education based on augmented reality technology. SnackAR is an app that displays a variety of virtual foods and teaches children to estimate accurate portions using different measurement units, e.g., weight in grams, volume in millilitres, volume in  $cm^3$ , and energy in kilojoules. The prototype technology, acceptance and usability data and potential integration into the primary school curriculum will be presented.

### 3.48. Understanding Processes and Pathways in the Development of Eating Behaviours and Weight in Childhood: Implications for Research and Intervention

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Interventions to promote the development of healthy-eating behaviours and weight in childhood should be based on knowledge about the mechanisms that explain their development and disruption. We conducted three reviews on the mechanisms underlying the development of eating (appetitive traits, appetite self-regulation) and weight that draw on insights from developmental theory and research. Using the key themes, constructs, models and research designs that arose from searches of developmental science literature, we assessed parallels with the development of eating. Findings indicated that research and theory about eating and weight in childhood could be advanced through systematic application of a biopsychosocial process model, which is a strong feature of developmental science scholarship. A possible biopsychosocial model in relation to the development and disruption of children's eating (including appetite self-regulation) and weight is outlined. It proposes that eating and weight develop through bidirectional and transactional processes that link child biology (e.g., genes, temperament) and behaviour (e.g., appetitive traits) with psychosocial processes (e.g., parental feeding practices) and the social and food environment. Research and interventions on eating and weight in childhood would benefit from systematic

application and testing of such a model to clarify mechanisms in the development of eating and weight.

### 3.49. *The Influences of Dietary Colonisation on Gut Microbiome in Indigenous Populations: A Rapid Literature Review*

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Diet is the number one risk factor in global burden of disease. Indigenous populations world-wide did not generally suffer from lifestyle-related diseases prior to introduction of energy-dense, nutrient-poor food with colonisation. Diet plays a central role in modulating gut microbiota, and microbes subsequently influence food-related metabolic activities, which potentially influence chronic disease prevention and management. A literature review of seven databases (Medline, Embase, Cochrane, CINAHL, Proquest, Informit, Lowitja) was conducted in January 2019 to investigate relationships between diet and gut microbiome of indigenous populations. Thirteen included studies (from Africa, India, South America and Australia) reported that the gut microbiota of hunter-gatherer populations were diverse and dominated by *Prevotella*, Proteobacteria, Spirochaetes, Clostridiales, with strong Prevotellaceae-Ruminococcaceae gradients, which are associated with diets rich in plants and fibre. Conversely, urban population microbial communities are enriched in *Bacteroides*, Bifidobacterium and Firmicutes, which are associated with unhealthy diets. Authors of included studies propose that the current health of Indigenous populations may have suffered from disrupted microbial ecosystems, as a result of interruption to the established relationships between environment, indigenous lifestyles and the gut microbiota. They propose gut microbiome research in vulnerable populations, using culturally appropriate research methodologies and geographically, culturally-tailored community-scale approaches to microbiome engineering.

### 3.50. *Effects of Interrupting Prolonged Sitting on Postprandial Glucose Responses According to Dietary Variables from Two Laboratory-Based Studies in Type 2 Diabetes*

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Frequent interruptions in sitting attenuates postprandial glycaemia relative to uninterrupted sitting. Whether such effects are dependent on meal characteristics remains unknown. Data was pooled from two randomised crossover laboratory-based trials ( $n = 46$ ) comparing the effects of prolonged sitting with sitting interrupted with simple resistance activities (SRAs) in overweight/obese adults with type 2 diabetes (T2D). Meals (breakfast/lunch) were replicated across conditions and prepared according to estimated energy requirements (33% of total) and individual food preferences. Log-linear mixed-effects models explored the interactive effects of dietary variables (energy, carbohydrate and glycaemic load) and SRAs on glucose incremental area-under-the-curve (iAUC) adjusting for age, sex, body mass index (BMI), and pre-prandial values. Overall, no interactive effects of SRAs and dietary variables were observed ( $p_{\text{interaction}} > 0.05$  for all). However, in the highest tertiles of glycaemic load and carbohydrate intake, interrupting sitting lowered postprandial glucose responses by 16% (exponentiated coefficient ( $[IEC] = 0.84$ ; 95%

confidence interval (CI): 0.74–0.95;  $p = 0.008$ ) and 22% (EC = 0.78; 95% CI: 0.66–0.94;  $p = 0.012$ ) relative to sitting, respectively. No effect of SRAs was seen according to tertiles of energy intake. In the context of controlled, eucaloric test meals, interrupting prolonged sitting with SRAs improved glucose control among individuals with T2D in the highest tertiles of glycaemic load and carbohydrate intake.

### 3.51. Starch Intake During Pregnancy Is Associated with Child Cognition at 4 Years

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Maternal nutrition during pregnancy can influence offspring brain development as well as future disease susceptibility. This study aimed to investigate the association between maternal macronutrient intake during pregnancy and child cognitive and behavioural outcomes at age 4 years. Data were from mother-child dyads ( $n = 64$ ) enrolled in the Women and Their Children's Health cohort in NSW, Australia. Pregnancy macronutrient intake over the previous 3 months was assessed using the validated 74-item food-frequency questionnaire, the Dietary Questionnaire for Epidemiological studies version 2, at 18–24 weeks' and 36–40 weeks' gestation. Child cognition and behaviour were measured at 4 years using the validated Wechsler Preschool and Primary Scale of Intelligence, 3rd version (WPPSI-III) and Child Behaviour Checklist (CBC). Using linear regression analyses adjusted for maternal age, education, pre-pregnancy body mass index (BMI), breastfeeding duration and birthweight, child performance IQ was inversely associated with maternal starch intake ( $b = -11.02$ ,  $p = 0.03$ ). No associations were found between maternal macronutrient intake and child cognitive and behavioural outcomes ( $p \geq 0.05$ ). Maternal starch intake may impact on child cognitive function, further research is warranted to understand how different types of starch may influence brain development and function.

### 3.52. Process Evaluation of a Telehealth Nutrition Intervention for Child Weight Management

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Families with children aged four to 11 years in New South Wales, Australia, participated in a 12-week telehealth nutrition intervention for child weight management with complementary components: website, Facebook group, and text messages. This study aimed to summarise the fidelity and participants' acceptability and satisfaction with the intervention. Intervention fidelity was reported consistent with the National Institutes of Health Treatment Fidelity Framework. Intervention delivery was measured using a dietitian-reported session evaluation survey. Intervention usage was objectively tracked using web analytics. Participants' acceptability and satisfaction were measured using 5-point Likert scale and open-ended questions in a process evaluation survey. Telehealth consultations were delivered with good adherence to the structured topics ( $\geq 83\%$ ). Parents ( $n = 30$ ; mean age 41 years, body mass index 30 kg/m<sup>2</sup>, 97% were female) reported that the intervention was easy to use (87%–100%), had improved their family/child eating habits (93%), and they would continue using telehealth and the website, as well as recommend it to



other parents (90%–91%). A 12-week nutrition intervention for child weight management using telehealth, website, Facebook and text messages can be delivered by trained dietitians with good fidelity and attain high acceptability and satisfaction among families with primary school-aged children.

### *3.53. Does Following a Ketogenic Diet as an Adjuvant Treatment to Radiation Therapy or Chemotherapy Improve Cancer Outcomes? A Systematic Review*

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The aim of this review is to synthesise available evidence on the association between ketogenic diet therapy and cancer outcomes in oncology patients undergoing chemotherapy or radiotherapy. An online search of five databases for studies published in English up to May 2019 was conducted. Inclusion criteria were randomised controlled trial (RCT), case report and/or cohort study design; adult and/or child population; patients with a cancer diagnosis undergoing radiotherapy and/or chemotherapy; prescribed ketogenic diet therapy as the primary intervention and reported cancer outcomes following intervention. Studies were assessed for methodological quality using the American Dietetic Association's (ADA) Evidence Analysis Manual: Quality Criteria Checklist for primary research. From 3104 studies identified, five studies were included. Studies included 81 participants diagnosed with varying cancer types at early to advanced disease stages. Studies administered ketogenic diets of varying macronutrient profiles alongside varying chemotherapy and radiotherapy treatment protocols. While promising results were reported in patient compliance and tolerability of the ketogenic diet as well as some plasma variables, evidence was inconclusive for cancer outcomes. There is a need for more rigorous trials to evaluate whether ketogenic diets are able to contribute to improved cancer outcomes when used in conjunction with current treatment modalities.

### *3.54. Breastfeeding and Infant Respiratory Health Outcomes in High-Risk Offspring: A Systematic Review and Meta-Analysis*

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Wheeze is highly prevalent in infancy, yet prevention strategies are lacking. We aimed to conduct a systematic review and meta-analysis examining the association between breastfeeding and wheeze in infants with a family history of asthma and/or allergic disease. Articles were identified through systematic electronic searches and reference checking. Observational studies and randomised controlled trials (RCTs) were eligible if they assessed breastfeeding and respiratory outcomes in infants (0–12 months) with a family history of asthma/ allergic disease. Quality was assessed using Newcastle Ottawa Scale and Cochrane Risk of Bias Tool. Meta-analyses were conducted using RevMan. (PROSPERO registration: CRD42019118631). Of 1781 papers, 10 met inclusion criteria (1 RCT; 9 Observational). Most (90%) were of acceptable quality and bias risk. Breastfeeding was associated with a 45% reduced odds of wheeze during the first year of life (ever vs. never: odds ratio (OR) 0.55 95% confidence interval (CI): 0.44–0.70,  $I^2 = 43%$ ,  $n = 4$  studies); no association was detected for 0–6 months (ever vs. never: OR 0.46, 95% CI: 0.17–1.25,  $I^2 = 88%$ ,  $n = 2$  studies). Compared to never breastfeeding, any breastfeeding reduces the odds of wheeze in high-risk infants. A paucity of studies precluded examination of other respiratory outcomes, including wheeze severity, and the impact of breastfeeding intensity in high-risk infants, highlighting the need for further research.

### 3.55. *Anti-Proliferative Effect of Krill Oil Extract on Human Colorectal Cancer Cells Is Associated with the Suppression of Epidermal Growth Factor Receptor (EGFR)-Mediated Signalling Pathway and Expression of Programmed Death Ligand-1 (PDL-1)*

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Over-expression of the epidermal growth factor receptor (EGFR) is associated with a range of cancers while interruption of EGFR signalling can prevent cancer growth and improve the patient's condition. Our previous study showed that the free fatty acid extract (FFAE) of krill oil (KO) has anti-proliferative properties. This study investigates the potential role of FFAE of KO in modulating EGFR signalling pathway. Human colorectal cancer (CRC) cell lines DLD-1, HT-29 and LIM-2405 were treated with the FFAE of KO (0.12 µL/100 µL) for 24 h. Cell migration and apoptosis were determined by Boyden chamber migration assay and flow cytometry respectively. The expression of EGFR, protein kinase B (Akt), extracellular signal regulated kinase (ERK) and programmed death ligand-1 (PDL-1) was determined via Western blotting and immunohistochemistry. Mixed-model analysis of variance (ANOVA) was performed using SPSS. The FFAE of KO significantly inhibited cell migration and induced apoptosis compared with ethanol-treated cells ( $p < 0.01$  to  $p < 0.001$ ). In addition, it reduced the expression of EGFR and the activation of its associated downstream signalling pathways of Akt and ERK, along with reduced PDL-1 expression. Krill oil may be a novel therapeutic agent for CRC due to its important role in the inhibition of the EGFR signalling pathway.

### 3.56. *The Effects of Commercially Available Energy Drinks Containing Caffeine on Athletic Performance, and Their Safety: A Systematic Review of Randomised Controlled Trials*

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Energy drinks (ED) are frequently consumed by athletes to provide a quick surge of energy, potentially increase concentration, and may act as an ergogenic aid. The perceived benefits of energy drinks are often conflicting, as the short- and long-term effects on overall health are still relatively unknown. The consumption of energy drinks in this population sample is relatively high, with the potential of causing negative health effects and interfering with the performance. Following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, this systematic review aimed to explore the adverse effects of commercially-available energy drinks consumed by athletes and to examine the effects on athletic performance and physiology. Twenty-four studies met the inclusion criteria as blinded, placebo-controlled studies measuring athletic performance. The results indicated that 9 studies reported adverse effects in 443 athletes, with the most common symptoms being assigned to insomnia ( $n = 52$ ; 11.7%), gastrointestinal related symptoms ( $n = 49$ ; 11%), and muscle soreness ( $n = 45$ ; 10%). Nevertheless, the consumption of energy drinks improved athletic performance and sports performance in 21 out of 24 studies ( $n = 14$ ) and ( $n = 7$ ). Changes in biochemical levels such as lower secretion of  $\beta$ -endorphin ( $n = 1$ ), epinephrine and norepinephrine ( $n = 1$ ) were observed. While popular, risks associated with chronic ED consumption should be considered carefully by athletes.

### 3.57. Fast Food Continues to Impact Negatively on Young Adults' Diets

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Young adults are the highest consumers of food prepared outside home, including fast foods. Australian research has documented the high sodium density of fast foods and while reformulation has occurred the decreases are small. A diverse sample of 18- to 30-year-olds was recruited across NSW and recorded their dietary intakes for three days using a validated app with a database designed specifically for inclusion of fast foods. Mean dietary sodium density and contribution of fast foods to overall proportion of energy and sodium intakes were calculated, with comparisons by gender. One thousand and one young adults participated. Mean dietary sodium density was 318 mg (standard deviation (SD) 109 mg) per 1000 kJ, with no significant gender difference. Fast food contributed 12% (SD 20%) of total energy but 16% (SD 15%) of total sodium to the diet. Males consumed greater proportions of energy and sodium from fast foods; 15% (SD 17%) kJ and 19% (SD 22%) of sodium for males versus 10% (SD 13%) kJ and 13% (SD 18%) of sodium for females ( $p < 0.001$ ). The contribution of sodium from fast foods is disproportionate to energy. Young males in particular would benefit from further intervention to decrease the sodium content of fast foods.

### 3.58. Targeting Parental Barriers of Child Preference, Time and Cost May Result in Healthier Lunchboxes for Children

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Parents are the primary lunchbox packers for school children. This study aimed to assess the association between parental barriers to packing healthy lunchboxes and the nutritional quality of school lunchboxes. A cross-sectional study was conducted in 12 Catholic primary schools in the Hunter region of New South Wales. Parents were asked to select the influences on their lunchbox packing from a list of identified barriers, via a computer-assisted telephone interview (CATI). Following parental consent, child school lunchbox photographs were analysed using a valid and reliable lunchbox audit tool to determine the mean number of serves of discretionary foods packed. Parents who completed the CATI ( $n = 848$ ; 89.4%) and had a child/children with a lunchbox photo ( $n = 1118$ ; 63.2%) were included in the analysis. Parents reporting *knowledge* as most influential in packing lunchboxes (15.8%) packed the least discretionary foods (1.88 serves) compared to parents selecting other barriers. Parents reporting child preference (57.5%), time (10%) or cost (2.4%) as most influential were more likely to pack a higher number of discretionary foods (2.67 serves,  $p < 0.001$ ; 2.98 serves,  $p < 0.001$ ; 3.19 serves,  $p = 0.01$ ). Interventions seeking to improve lunchbox packing behaviour may benefit from addressing parental barriers of child preference, time and cost to improve nutrition in school lunchboxes.

### 3.59. Pregnant Women Have Poor Carbohydrate Knowledge and Do Not Receive Adequate Nutrition Education

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In order to manage blood glucose levels in pregnancy, women need to know what and how much to eat, particularly for foods containing carbohydrate. The aim was to assess pregnant women's carbohydrate and standard serve size knowledge and examine whether health professionals provided nutrition education. Between July 2017 and April 2018 Australian pregnant women were recruited to complete an online survey, including a modified PedCarbQuiz carbohydrate knowledge questionnaire and an online buffet, where they selected images equivalent to one Australian Guide to Healthy Eating (AGHE) standard serving size. One hundred and eighty six pregnant women (mean age: 30.9 years, standard deviation (SD) = 4.7 years) at 12–22 weeks gestation completed the survey. Participants achieved a median score of 27/36 for identification of carbohydrate-containing foods and a median score of 1/12 (range: 0–11) for identification of grams of carbohydrate in specific portions. Participants achieved a median score of 14/22 (range: 4–19) for identification of one AGHE standard serve of 11 carbohydrate-containing foods. Less than half ( $n = 92$ , 49.5%) received nutrition education from health professionals. Pregnant women had sub-optimal carbohydrate knowledge. This could contribute to impaired blood glucose concentrations and risk of adverse health outcomes in pregnancy. Opportunities for pregnant women to access nutrition advice from health professionals should be explored.

### 3.60. Development of the Home-Cooking Environment and Resource Inventory (Home-CookERI™)

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Cooking skill proficiency is associated with higher diet quality and better health. Home-cooking environment characteristics are hypothesized to moderate the association between cooking skills, diet quality and health. To address the lack of valid and reliable tools that quantify characteristics of home-cooking environments, the aim was to develop a home-cooking environment and resource inventory (Home-CookERI™). Home-CookERI™ is accessible via an online survey using qualtrics<sup>SM</sup>. Items include spaces and resources within domestic settings that are used for storage, preparation and cooking of food or non-alcoholic beverages. Home-CookERI™ is being iteratively developed by pre-testing the tool with a panel of 15 international nutrition and cooking experts and 15 adults from the general population who provide feedback on face and content validity and usability. Inter-rater reliability of Home-CookERI™ will be assessed by comparing data collected by dietitian researcher dyads who both complete Home-CookERI™ in the same domestic cooking environments. This study will produce a gold standard Home-CookERI™. Further studies will test validity and reliability of Home-CookERI™ when completed by a general population sample. Home-CookERI™ has potential applications in nutrition epidemiology, health promotion and nutrition interventions.

### 3.61. Image-Based and Image-Assisted Dietary Assessment Methods: A Systematic Review of Current Evidence

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Progress in camera technology has increased the application of image-based and image-assisted methodologies to dietary intake assessment. This systematic review summarised the accuracy of image-based and image-assisted methods for dietary intake assessment. A systematic search of seven databases was conducted in April 2019 to identify studies that reported on an image-based or image-assisted dietary assessment method, and compared dietary intake calculated from the image method with a reference dietary assessment method. Fifty-one studies were included, of which 38 employed active capture for predominantly image-based assessment, and 13 involved passive-capture technologies for image-assisted assessment. Active-capture methods underestimated energy intake by 0%–30% ( $n = 9$ ) against total energy expenditure (using doubly-labelled water) and 0%–11% ( $n = 19$ ) for relative validation methods. Nutrient intakes calculated from image-based methods were comparable to reference methods ( $n = 15$ ). In all studies that employed image-assisted methods, significant overestimates were reported for energy intake ( $n = 4$ ) and nutrient intake ( $n = 2$ ) relative to the reference method. Image-based methods achieve comparable accuracy to traditional dietary assessment methods for both energy and nutrient intake, with lower participant burden. Ongoing advancements in technologies for image capture will result in continued improvements and expanded applications of image-based and image-assisted methods in the context of dietary assessment.

### 3.62. Intergenerational Cycle of Disease: Maternal Anthropometry and Newborn Cardiometabolic Health

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Children born to mothers with obesity are reported to be at an increased risk of cardiovascular disease and obesity in adulthood, although this may be partly due to a shared environment. We sought to determine whether maternal adiposity is directly associated with offspring cardiometabolic health, independent of the postnatal environment. Mother-infant pairs ( $n = 209$ ) were recruited from the Royal Prince Alfred Hospital, Sydney. Maternal height and weight were obtained from medical records. Neonatal weight, body fatness (%), aortic intima-media thickness (aIMT) and autonomic activity (heart-rate variability) were assessed at birth by our research personnel. Maternal height and weight were associated with offspring birth weight (height:  $r = 0.279$ ,  $p < 0.0001$ ; weight:  $r = 0.171$ ,  $p = 0.01$ ), although individually they only accounted for a small proportion of the overall variance ( $R^2 = 0.078$  and  $R^2 = 0.029$ ). Similarly, maternal height and weight were associated with offspring body fatness ( $r = 0.188$ ,  $p = 0.003$ ,  $R^2 = 0.036$  and  $r = 0.131$ ,  $p = 0.03$ ,  $R^2 = 0.017$ ). None of the maternal anthropometric measures were associated with offspring aIMT ( $p > 0.05$ ), although maternal body mass index (BMI) was associated with poorer infant autonomic activity ( $r = -0.191$ ,  $p = 0.01$ ). Maternal height is a stronger predictor of offspring body size than maternal weight. Maternal BMI is directly associated with a poorer autonomic activity, which may increase the risk of hypertension and cardiovascular disease in adulthood.

### 3.63. Design and Development of a Smartphone App for the Collection of Individual Dietary Intake Data in Settings Where Shared Plate Eating Is Common

Megan Rollo, Marc Adam, Josh Crompton, Connor Dodd, Janelle Windus, Kerith Duncanson, Tracy Burrows, Clare Collins, Shamus Smith

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Ensuring a dietary-assessment method accounts for eating behaviours of the intended population is paramount to minimise measurement error. An iterative approach was used to design and develop an image-voice food record smartphone app for assessing individual dietary intake of adults and children aged  $\leq 5$  years in Cambodia. The first phase involved exploring the context and defining the app technical requirements, user types, features and use cases. This process was informed by an interdisciplinary steering group consisting of experts in dietary assessment, user design and software engineering and staff from an in-country non-government organisation. Contextual information was gathered through consultation and review of literature and publicly available videos. This facilitated understanding of primary user characteristics, typical dietary patterns, food preparation and eating environments, and behaviours during eating including consumption from discrete (individual) servings and shared servings. Next, the design of the app was conceptualised and a prototype generated and continuously refined using an iterative process. The final app collects intake data for multiple individuals from both discrete and shared servings, recipes, and breastfeeding occasions. Consideration of user literacy levels is addressed in the app interface through inclusion of auditory and visual elements. App features, output and learnings will be presented.

### 3.64. Diet Quality and Headache in Australian Female Adults: A Pilot Study

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Headaches are a debilitating chronic condition that affects quality of life. Strategies for managing headaches have focused on the avoidance of triggers, including food triggers. Rather than individual foods, recent research has begun to explore relationships between headaches and total diet. This study aimed to explore differences in diet quality between female headache (HA,  $n = 9$ ) and non-headache sufferers (CON,  $n = 11$ ). Diet quality, measured by the Dietary Guideline Index, was determined using a food-frequency questionnaire and food-behaviour survey. Occurrence of headache and exposure to triggers was recorded daily for one month. During the month, the HA group experienced more frequent ( $13.3 \pm 9.1$  vs.  $2.4 \pm 1.6$ ;  $p = 0.01$ ) and longer ( $791 \pm 485$  vs.  $112 \pm 68$  min;  $p = 0.005$ ), but not severe (visual analogue scale,  $50.2 \pm 19.4$  vs.  $41.6 \pm 17.3$  mm;  $p = 0.193$ ) headaches compared to CON. Diet-quality scores were lower in HA versus CON ( $80.3 \pm 13.3$  vs.  $93.9 \pm 17.9$ ;  $p = 0.076$ ). Although limited by sample size, this study suggests that diet quality differs in women according to headache status. Larger observational studies are required and may provide support for intervention studies evaluating the effect of improved diet quality on headache frequency, duration and severity.

### 3.65. The Influence of Food Waste on the Nutritional Composition of Black Soldier Fly Larvae: A Systematic Literature Review

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With the global population predicted to reach 8.6 billion by 2030, increases in food production will add pressure to an already strained food system. Black Soldier Fly (BSF) larvae can be found worldwide and offer an edible and viable alternative to traditional protein food sources, with reduced environmental impact. Studies have examined the nutrient composition of BSF larvae fed

decomposing organic materials, including consumer waste. This literature review aims to determine which food waste-rearing substrate influences the most favourable nutritional composition of BSF larvae. Scopus, Web of Science, PubMed, Scifinder and ScienceDirect databases were searched for eligible articles published in English from January 2000 to January 2019. Of 658 articles identified, 82 full-text articles were assessed for eligibility, resulting in 33 studies for inclusion. Seventeen articles reported on mixed organic waste, seven on fruit and vegetables, four on consumer waste, three on non-edible plant waste, and two on meat, poultry or fish. There were numerous differences in the source of waste fed to BSF larvae and the methodologies used to quantitate their ultimate nutritional composition. The results of this review will contribute to the knowledge of sustainable food sources of high nutritional quality, for subsequent application in product development.

### *3.66. Impact of Life-Time Exposure to Trauma on Body Awareness in People with Obesity: Baseline Results from a Nutrition Intervention Comparing Intermittent Fasting to Calorie Restriction*

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Exposure to trauma during development can influence health and health behaviours later in life. Disturbed body awareness and autonomic reactivity have been implicated in disordered eating and may develop as a result of experienced trauma. Whether life-time exposure and adaptation to traumatic events predicts subjective awareness of autonomic state in people with obesity remains unclear. We implemented the Traumatic Antecedents Questionnaire (TAQ) and Body Perception Questionnaire-Very Short Form (BPQ-VSF) at baseline in a weight-loss intervention to assess trauma exposure and body awareness, respectively. The TAQ assesses 10 domains: competence, safety, neglect, separation, interpersonal abuse (emotional, physical, sexual), witnessing trauma, other traumas (e.g., traumatic loss), and exposure to drugs at four developmental periods: early childhood, latency, adolescence, and adulthood. The BPQ-VSF measures subjective awareness of autonomic reactivity. Adults with overweight/obesity ( $n = 71$ , age  $40.5 \pm 9.6$ , body mass index (BMI)  $33.3 \pm 4.0$ , 76% female) were included in the analysis. Mean BPQ  $t$ -score was on average .54 standard deviations higher than normative values ( $55.4 \pm 11.4$ ; one-sample  $t$ -test,  $p < 0.001$ ). Traumatic separation during ages 7–12 predicted BPQ scores (linear model,  $\beta = 1.89$ ;  $p = 0.047$ ). Adults with obesity may experience greater disturbed body awareness than the general population. Autonomic dysfunction may be partially explained by traumatic separation during latency.

### *3.67. Obesity and Symptom Management in Fibromyalgia*

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This study aimed to systematically review the effect of weight loss in obese adults with fibromyalgia (FM) and FM-related symptoms. A systematic search was undertaken of six databases (Medline, Cochrane, CINAHL, EMBASE, AMED and Scopus) using keywords regarding weight loss studies in obese adults with FM and FM-related symptoms including tender-point counts and tender-point pain ratings. Reference lists of retrieved articles were manually searched for additional studies. Each study was assessed for its relevance and validity using the quality criteria checklist for primary research. Four studies met the inclusion criteria. Three of the four studies were assessed as positive using the quality checklist and one study was rated neutral. Most participants were females. Weight-loss strategies included obesity surgery, dietary energy restriction and lifestyle changes. All

studies reported varying degrees of weight loss with significant improvements in FM-related symptom severity and quality of life. This study provides preliminary evidence to support weight loss as an intervention for obese adults with FM to alleviate symptoms and improve quality of life. Further research is needed to improve understanding of the role of obesity in FM and to determine optimal and sustainable programs for weight loss and symptom management.

### *3.68. Feasibility of the AusMed Diet Program: Translating the Mediterranean Diet for Older Australians*

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Mediterranean diet patterns (MEDI) are associated with health benefits relevant to older populations. Adherence research comes mostly from Mediterranean countries with high cultural acceptability. This study examines the feasibility of the AusMed diet program, in older Australians. The study had two phases. Firstly, a process evaluation was conducted with a group of older Australians ( $n = 17$ , mean age 71.2 yrs). Consumer research groups were presented the AusMed materials in three sections: 1. Education; 2. Program support; 3. Food. Quantitative feedback showed all participants (100%) agreed that their knowledge of the MEDI had improved and they were confident they could adhere to AusMed; support materials were acceptable with preferences of a booklet format (70%) and group setting delivery (58%). Themes emerging from semi-structured interviews ( $n = 6$ ) were; 1. Barriers, 2. Behavioural support and 3. Individualisation. Phase 2 was a 2-week feasibility trial. Modified program materials were delivered by a dietitian ( $n = 15$ ). Adherence was measured using the 14-point Mediterranean diet score. All participants increased adherence (mean increase  $4.2 \pm 2.2$ ) from a mean score of  $5.4 \pm 2.4$  (low adherence), to a mean score of  $9.6 \pm 2.0$  (moderate–high adherence). All reported confidence in continued dietary change.

### *3.69. A Model for the Planning, Implementation and Evaluation of Domestic Cooking Education Programs*

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Domestic cooking education programs are implemented in nutrition practice, health and educational settings to improve individuals' food skills, cooking skills, diet quality and ultimately health and well-being. No comprehensive models exist to guide the development, implementation and evaluation of cooking education programs. This study aimed to address this gap through the development of the Cooking-Education (Cook-Ed™)-model. The PRECEDE–PROCEED model provided the underlying framework for the Cook-Ed™ model and its content was informed by peer-reviewed literature on food and cooking skill education, and the opinion of our international team ( $n = 11$ ) including dietitians, cooking educators, qualified chefs, a home economist, and an occupational therapist. A matrix was developed, and embedded within the model, to help identify priority food and cooking skills needed to support adherence to dietary recommendations. An electronic Delphi process was used successfully to reach team consensus on the content and format of both the Cook-Ed™ model and the matrix. A case study will be presented to illustrate potential application of the Cook-Ed™ model and matrix for a children's after-school cooking program. Further research is needed to evaluate the Cook-Ed™ model's feasibility in practice and impact on cooking program outcomes.



### 3.70. Kid's Menus at Non-Fast Food Venues: A Survey of Parents

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On average Australians spend a third of their food budget eating out. A greater understanding of child-specific (kid's) menus is required to guide appropriate regulatory initiatives given excessive discretionary food and sub-optimal core food intakes in Australian children. This study aimed to describe parents' reports of their children's frequency of consuming foods from non-fast food venues and their perceptions of kids' menus at these venues. Results were available from 95 parents, of children aged six months to 12 years, who completed a cross-sectional child-health survey. Food from non-fast food venues was consumed by 18% of children at least weekly and a further 36% at least monthly. At these venues parents reported seeing a kids' menu often/sometimes (54%), with 78% of children ordering from these menus often/always (36%) or sometimes (42%). Parents viewed the portion size of kids' menu items as just right (38%) or too large (34%). On average, parents perceived 45% of kids' menu items to be healthy, although they preferred 69% to be healthy items. Most parents (86%) wanted to see changes to kids' menus. Parents' views support the implementation of regulatory initiatives to increase the availability of healthy options on kids' menus at non-fast food venues.

### 3.71. Do Images of Unhealthy Foods and Beverages Elicit Disgust or Fear; A Comparison of General Public and Nutrition Expert Responses

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Promoting regular consumption of healthy foods and discouraging energy-dense, nutrient-poor (EDNP) foods is key to managing diet-related chronic disease. However images of EDNP can elicit a desire to consume. Our aim was to evaluate whether levels of fear and disgust towards unhealthy foods differed between the public and nutrition experts. An online survey of 266 nutrition or dietetic experts, recruited through health professional networks, and 336 lay participants via Qualtrics, was undertaken. Responses to images of EDNP foods (burger, pizza, ice cream, chocolate) measured levels of fear and disgust (1 = nil, 5 = most) using standard questionnaires. Mean levels of fear and disgust perceptions towards all items were low among experts and lay people (rated <2.2 for all items; maximum 5). Nutrition experts had significantly lower levels, albeit small, in ratings of fear in response to images of burgers, pizza, ice cream, chocolate ( $p < 0.001$ ), and perceived lesser disgust towards images of burgers, ice cream and chocolate ( $p < 0.001$ ), but not pizza ( $p > 0.05$ ). Levels of fear and disgust were low for all food types. Further studies should explore whether images or messages that evoke emotion have the potential to influence dietary intake of both healthy and unhealthy foods and/or can inform campaigns aimed at improving dietary patterns.

### 3.72. *Designing and Implementing Healthy-Eating Campaigns on Social Media by Health-Promotion Professionals*

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Social media (SM) platforms have disrupted the way health professionals (HP) engage and reach communities to encourage healthy behaviours. This study explored experiences of HP delivering healthy-eating campaigns via SM platforms. Semi-structured interviews were conducted in a sample of nine Australian nutrition-focused HP who developed and implemented SM campaigns. Experiences explored included campaign planning, delivery and evaluation. Inductive content analysis identified the main themes. Participants, mainly from health organisations, had backgrounds in nutrition and communication or marketing. Three themes emerged: (i) lack of capacity to remain competitive with ‘influencers’ and food industry on SM. Day-to-day SM management and evaluation activities were limited by dedicated time for SM and budgetary constraints. To overcome these obstacles, HP cross-promoted messages from other organisations and collaborated on SM campaign creation. (ii) SM messaging strategy was fundamental to campaign success. Effective messages were short, relatable, and positively toned. HP also identified that content should include a mixture of formats (e.g., videos and photos) and not sound overtly health-related or didactic. Co-creation and sharing content from the community boosted engagement. (iii) All described needing to understand the target audience. Those with a greater understanding of marketing strategies identified the need to segment the population using behavioural characteristics.

### 3.73. *Methods for Automated Food Image and Aroma Recognition*

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To advance dietary assessment methods, we have developed an approach based on deep learning which recognizes foods and drinks directly from photographs taken by a smartphone. As some details cannot be recognized from images, this method requires an upgrade which would take aromas into consideration as well. For food image recognition, we developed a novel deep-learning architecture called NutriNet and trained it on a dataset of 225,953 photographs. Additionally, we used a deep learning approach to recognize each individual pixel in a photograph, and trained it on a dataset of fake-food photographs. We are upgrading NutriNet with an approach for recognizing food aromas collected by a mobile device, such as a molecular sensing system or an electronic nose (e-nose). NutriNet achieved a classification accuracy of 86.72%, whereas the fake-food solution achieved an accuracy of 92.18%, and is able to recognize any number of foods and drinks in a photograph. Our results show that recognition of foods and drinks from photographs is a viable approach to dietary assessment, and represents a step towards its automation. In addition, our current work is focused on combining the developed methodology with food aroma recognition approaches which could lead to even better results.

### 3.74. C-Reactive Protein Levels among Non-Obese and Obese Adolescents in Yogyakarta, Indonesia

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The rate of childhood obesity is increasing in Indonesia. If unmanaged, it can continue into adolescence and adulthood, increasing the chance for early development of cardiovascular disease (CVD) risk factors. Inflammation has been thought to be the underlying mechanism of obesity-associated CVD. This study aims to investigate the association between c-reactive protein (CRP) and CVD risk factors in adolescence in Yogyakarta, Indonesia. This is a cross-sectional study involving students in 10 high schools in Yogyakarta, Indonesia, in 2016. CVD risk factors including obesity, blood pressure, lipid profiles and fasting plasma glucose (FPG) and insulin (FPI) were measured. High-sensitivity CRP (hsCRP) levels were quantified using plasma enzyme-linked immunosorbent assay (ELISA). An independent *t*-test and linear regression were used for statistical analyses. The study involved 112 obese and 97 non-obese adolescents. hsCRP levels were almost double in obese compared to non-obese adolescents (74.5 vs. 44.0 mg/L,  $p = 0.057$ ). hsCRP levels were significantly associated with z-score BMI ( $p < 0.001$ ). They were not significantly associated with blood pressure, lipid profiles, and FPG ( $p > 0.05$ ), but they were significantly associated with FPI ( $p = 0.003$ ). This study showed that hsCRP levels were significantly associated with z-score body mass index (BMI) and FPI indicating a potential role of inflammation in CVD risk factor development in adolescents.

### 3.75. Risk of Ketonemia and Ketonuria in Women with Gestational Diabetes: The MAMI2 Study

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Elevated ketone concentrations during pregnancy are undesirable and often indicate poor control of gestational diabetes (GDM). We conducted a pilot cross-sectional study at Royal Prince Alfred and Campbelltown Hospitals, Australia, to determine the proportion of women with GDM experiencing ketonuria and ketonemia. Maternal anthropometry, 12-h dietary recall and blood and urine samples were collected at enrolment. Pregnancy outcomes were obtained from medical records. One hundred and sixty women (aged  $32.9 \pm 0.4$  y and prepregnancy body mass index (BMI)  $26.3 \pm 0.5$ , mean  $\pm$  standard error of the mean (SEM)) took part in the MAMI2 study at  $30.9 \pm 0.2$  weeks gestation. Ketonuria was evident in 14% of the population, and the average random blood ketone concentration was  $0.1 \pm 0.0$  mM. There was a strong positive correlation between urinary and blood ketone levels ( $n = 19$ ,  $r_s = 0.717$ ,  $p < 0.001$ ). Women in the lowest carbohydrate intake tertile (4–33% energy) had 2-fold increased odds of higher ( $>0.1$  mM) blood ketone concentrations (odds ratio (OR) = 2.14, 95% confidence interval (CI): 0.98–4.64). Approximately two-thirds of women did not meet pregnancy weight-gain guidelines. While lowering carbohydrate intake suggested an increase in ketogenesis, the blood ketone concentrations attained were not of clinical significance.

### 3.76. Dietary Changes and Characteristics of Women with and without Gestational Diabetes: The MAMI3 Study

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Since lower carbohydrate intake is now acceptable to improve glucose control in people with type 2 diabetes, we assessed whether women with gestational diabetes (GDM) were also aiming to reduce carbohydrate intake. We surveyed a sample of pregnant women with ( $n = 50$ ) and without GDM ( $n = 43$ ) attending antenatal clinics at a tertiary hospital, to determine changes in their dietary habits since pregnancy. We also captured their anthropometry, social and medical history. Although the two groups of women were comparable for age, parity, pre-pregnancy weight and body mass index (BMI), a higher proportion of women with GDM had a higher proportion family history of type 2 diabetes mellitus (52% vs. 19%), were more likely to be of Asian ethnicity (74% vs. 21%) and less likely to consume alcohol at any time point in pregnancy (8% vs. 30%), than their counterparts who did not have GDM ( $p < 0.05$ ). More women with GDM reported following a moderately lower carbohydrate diet (64% vs. 7%) while lower proportion of them reported not following any particular diet (18% vs. 58%) when compared with their non-GDM counterparts (both  $p < 0.001$ ). Our present survey suggests that women with GDM are more likely to restrict carbohydrate intake, such that there is potential for nutrient deficiency.

### 3.77. Red Cell Folate (RCF) Overestimated in Australian Health Measures Survey (AHMS): Neural Tube Defect (NTD) Risk Possibly Underestimated

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In 2009, the Australian government mandated the addition of folic acid to bread flour to reduce the risk of neural tube defects (NTDs). In the 2011–2012 Australian Health Measures Survey (AHMS) mean red cell folate (RCF) in women 16–44 y was 1647 nmol/L. Over 99% of women had an RCF >906 nmol/L, consistent with a very low risk of NTDs. However, RCF was measured using an immunoassay which is not recommended due to questionable accuracy. The microbiological method is the preferred method for RCF measurement. To determine whether the method used to measure RCF in AHMS led to spurious conclusions about the folate status of Australian women we collected a fasting blood sample from 74 healthy women (18–44 y). RCF was measured using the immunoassay and the microbiological method. Mean RCF (95% confidence interval (CI)) concentration measured with the AHMS immunoassay method was 1707 (1641, 1773) compared with 890 (831, 942) nmol/L using the microbiological method. No women had an RCF <906 using the immunoassay, whereas 57% of women had erythrocyte RCF <906 nmol/L using the microbiological

method. Data from the AHMS probably underestimates the number of women at risk of NTDs. Women planning a pregnancy should continue to take folic acid supplements.

### 3.78. *The Supporting Mums (SMS) Study: A Pilot Randomised Controlled Trial (RCT) of a Text-Message Delivered Intervention for Weight Loss and Maintenance of Weight Loss in the Postpartum Period*

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Postpartum weight management is challenging. Text messaging could offer a low-intensity, flexible approach to behaviour change during this time and is a potentially low-cost and scalable intervention. This study examined the feasibility and acceptability of a text message-delivered intervention supporting weight loss and maintenance of weight loss in women with overweight and obesity in the postpartum period. One hundred women (body mass index (BMI) > 25 kg/m<sup>2</sup>), within two years of giving birth, were randomised to receive text messages about weight management (intervention,  $n = 51$ ) or text messages about child health and development (active control,  $n = 49$ ) for one year. Two-way messages were used to assess engagement. Fifteen women became pregnant during the study and had to stop for this reason. Retention rates were high at 12 months (intervention = 85.7%; control = 90.7%). At 12 months, women in the intervention group lost  $-1.75$  kg (standard deviation (SD) 6.7 kg) and women in the control group gained 0.19 kg (SD 7.5 kg). Within the intervention group, high engagers lost, on average, 1.89 kg more weight than low engagers at 12 months. Women rated the intervention highly (92% were satisfied/very satisfied with the messages at 12 months). A text message-based intervention to support weight management was acceptable to women and this approach should be tested in a full randomised controlled trial (RCT).

### 3.79. *Infant Birth Outcomes Are Correlated with Plasma Micronutrient Status*

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Dietary nutrients such as vitamin B<sub>12</sub>, folate, magnesium, zinc and iron are required in synthesis, repair, and methylation of DNA. Their deficiency at any stage of human development may induce DNA damage and epigenetic changes and accelerated telomere shortening. Hence a case cohort study was conducted to augment understanding of the association of plasma micronutrient with infant birth outcomes as assessed at birth and 3 and 6 months after birth. Peripheral blood was collected from a cohort of healthy Australian infants at birth (cord blood) ( $n = 82$ ), three ( $n = 64$ ) and six months ( $n = 53$ ) after birth. The blood was analysed for micronutrients: iron, copper, zinc, calcium, magnesium, sodium, potassium, phosphorous, sulphur, vitamin B<sub>12</sub> and folate. There was a decrease in iron ( $p = 0.007$ ), potassium ( $p < 0.0001$ ) and red cell folate ( $p < 0.001$ ) at six months compared with birth. Copper and vitamin B<sub>12</sub> associated positively while potassium associated negatively with gestational age. Calcium and sulphur associated negatively with head circumference and APGAR score respectively. Although conducted on a small sample of healthy

infants, the study demonstrated that micronutrient status varies significantly during the first six months of life and is significantly associated with birth outcomes.

### 3.80. *Digital Workbooks to Support Learning in Flipped Nutrition Classrooms: Student Perspectives*

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Blended learning, a combination of face-to-face and online content delivery, is often combined with a flipped classroom approach (FCA). In the FCA, students undertake activities (i.e., short online lectures/readings/assessment tasks) before and after attending class. This asynchronous approach gives students greater control over their learning and enables more time to apply knowledge in the classroom. PebblePad workbooks were integrated into three undergraduate nutrition courses to support learning by providing weekly worksheets covering all phases of the FCA (prepare, participate and recap). The aim of this project was to evaluate the overall satisfaction and usefulness of these workbooks to support and evidence learning from the student perspective. Thirty-nine students who successfully completed a FCA nutrition course with an integrated PebblePad workbook participated in an online survey. Most students found the workbook engaging (95%) and utilised it for learning (62%), application (65%) and consolidation of knowledge (51%) several times a week. Overall satisfaction with the student experience of using the workbook was high with 86% satisfied/very satisfied; however, concerns were raised regarding assessment and technical issues. The digital workbook has the potential to enhance self-directed learning in nutrition education and this study highlights a further need for evaluation of this pedagogical approach.

### 3.81. *Evaluation of Chemical Changes in Potato Chips, Chicken Nuggets and Broccoli after Deep Frying with Extra Virgin Olive Oil, Canola and Grapeseed Oils*

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The aim of this study was to assess the food nutritional profiles of potato chips, chicken nuggets and broccoli after deep-frying with different oils. The trials consisted in 4 cycles of deep frying at 180 °C for 4 min using extra virgin olive oil (EVOO), canola and grapeseed oils. Samples of food and oils were taken untreated and after the treatments for chemical analysis. Results showed that there is a transference between food and oils regarding fatty acid profile and antioxidant content as well as trans fatty acids (TFAs) and polar compounds (PCs). All food presented more antioxidants and monounsaturated fatty acids after cooking with EVOO than after cooking with canola and grapeseed oils. The highest PCs in food were found when using canola oil and grapeseed oils. EVOO was shown to decrease the PCs in chips and chicken nuggets. PCs were not detected in raw broccoli, however broccoli cooked in EVOO showed the lowest PCs content. Canola and grapeseed oils increased the TFAs in food whereas EVOO decreased the TFAs in the chips and maintained the initial TFAs levels in chicken nuggets and broccoli. This study shows that EVOO improves the food nutritional profile when compared with canola and grapeseed oils.

### 3.82. *Can Mushrooms Be Explored for Nutrition Intervention Potential for Gestational Diabetes?*

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The World Health Organization defines gestational diabetes (GDM) as “hyperglycemia that is first recognized during pregnancy that may lead to type II diabetes among one-third of women later in life”. While metformin is the current choice of a drug intervention, there is a paucity of data of any

specific food-based intervention to manage the inflammatory pathology of GDM. Twenty-five species of mushrooms belonging to the phylum Basidiomycota have been accepted as food. Their potential role in reducing hyperglycemia is currently of research interest. Hence, a systematic search was conducted on online databases (PubMed, Medline, CINHALL, EBSCO) using key terms 'mushroom, diabetes, hyperglycemia, gestation diabetes'. The narrative review observed that in vivo studies demonstrate mushrooms and their extracts being a source of bioactive compounds (polysaccharides, lectins, lactones, alkaloids, terpenoids, and phenolic compounds) which may downregulate inflammatory pathways that are also observed in the pathology of GDM. Mushroom glucans may reduce serum glucose, enhance serum insulin, improve liver peroxisome proliferator-activated receptor alpha (PPAR- $\alpha$ ) expression and mRNA expression of protein; and provide structural support to pancreatic  $\beta$ -cells. However, human intervention studies are required to confirm the anti-diabetic potential of mushrooms to form the basis of economical, food-based intervention for the management of GDM.

### 3.83. Overview of an Evidence-Based Nutrigenomics Approach to Weight Management

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Genetics contributes to 40%–70% of obesity. Several meta-analyses link rs9939609 and rs1558902 single nucleotide polymorphisms (SNPs) in the *FTO* gene to higher body mass index (BMI), increased fat mass and increased cravings. Physical activity reduces obesity risk in SNP carriers, according to a meta-analysis. Two randomised controlled trials (RCTs) from the POUNDS LOST study show that SNP carriers lose more weight than non-carriers on a high-protein, calorie-restricted diet over two years. The rs1801282 SNP in the peroxisome proliferator-activated receptor gamma (*PPARG*), causing decreased conversion of excess calories into body fat, is also linked to obesity. RCT suggests that less than 25% of total daily calories from fat and 30 min of moderate-intensity aerobic activity are beneficial for weight loss in obese SNP carriers. Based on this, a calorie-restricted 25% protein diet and regular physical activity can reduce the genetic effect on their weight in *FTO* SNP carriers. Depending on the *PPARG* SNP status, a low-fat diet may also be recommended. In conclusion, dietary and exercise interventions can modulate the effect of genetic variants on obesity, suggesting that lifestyle treatments for weight management may be specifically tailored to individuals' genetics. Further prospective RCTs are needed to study the effect of a gene-based diet for weight management.

### 3.84. Advanced Glycation Endproduct-Induced Albuminuria and Changes in Gut Microbiota and Metabolome Are Attenuated by Resistant Starch in a Mouse Model of Type 2 Diabetes

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Excess intake of dietary advanced glycation endproducts (AGEs) contributes to chronic renal injury. This study investigated whether excess consumption of dietary AGEs promotes gut dysbiosis and exacerbates renal injury in diabetic mice, and if this could be ameliorated with resistant starch (RS) supplementation. Six-week-old diabetic mice (db/db) and non-diabetic mice (db/m) were randomised to receive a low AGE (LAGE, unbaked rodent chow) or a high AGE diet (HAGE, baked at 160 °C for 1 h)  $\pm$  12.5% RS for 10 weeks; 24-h urine was collected for the assessment of albuminuria. Cecal digesta were collected for an untargeted metabolomics screen and microbiota analysis. The HAGE diet exacerbated albuminuria in diabetic mice which was attenuated by RS. In db/db mice, a HAGE diet was associated with an increase in the Firmicutes/Bacteroidetes (F/B) ratio, which was ameliorated by supplementation with RS. High-AGE-fed db/db mice had a unique cecal metabolome with a marked increase in metabolites from the phenylalanine, tryptophan and tyrosine pathways. RS protected against HAGE-induced albuminuria and reversed changes observed in the

microbiome and cecal metabolome. This study supports the notion that dietary AGEs contribute to diabetic kidney disease via alterations in gut homeostasis and indicates a potential renoprotective role for RS.

### 3.85. *Fast-Tracking Nutrition*

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Malnutrition is highly prevalent in acute hospital settings with local, Australian and international studies reporting rates of approximately 40%. Malnutrition is associated with longer length of stay, higher treatment costs and increased mortality. Trauma patients at John Hunter Hospital accrue significant nutritional deficits as a result of multiple fasting episodes (for procedures) to manage complex injuries. These patients frequently miss meals due to the inflexibility of hospital food service systems. A pre- and post-interventional study on fasting experiences of 40 hospitalised patients in a trauma ward was assessed. Flexible meal items (snack bags and frozen meals) were provided for staff to access out of kitchen service hours. Nutritional intake was measured using a 24-h recall and requirements were estimated using the ratio method. Fasting duration data was collected from patient records and interviews. Implementing flexible food items increased patient energy and protein intake by 28%. Fasting duration was reduced by 9% for patients proceeding to theatre and 17% for cancellations. Nursing staff and patients provided positive feedback on the implementation. This is an effective and low-cost intervention that improves nutritional intake, reduces fasting time, is well received by patients, and readily implemented by nursing staff.

### 3.86. *Nutritional Quality and Cost of Food and Drinks Available in Vending Machines at an Australian University*

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Vending machines offer convenient access to food and drinks to staff and students across university campuses. Our aim was to determine the nutritional quality and cost of food and drinks available in vending machines at the University of Newcastle, Australia. An audit of vending machines at the three major campuses of the University of Newcastle was undertaken during August/September 2019. The audit involved visual inspection of vending machines with the number of slots and the name and weight or volume of the food or drink item in each slot recorded. The nutritional quality of the food and drinks were assessed according to the Health Star Rating (HSR) system (0.5 stars least healthy to 5 stars most healthy). Individual items were classified as healthy if the HSR  $\geq 3.5$ . The total number and proportion of “healthy” and “unhealthy” items available in vending machines, and the mean cost of “healthy” and “unhealthy” items, were calculated. Sixty-one vending machines were audited, containing 2158 slots of which 1787 or 82.8% contained “unhealthy” food or drinks. The mean (SD) cost of “healthy” items was \$3.15 (1.47) and “unhealthy” items \$3.57 (0.59). Strategies to improve the nutritional quality of food and drinks in vending machines are warranted.



### 3.87. *The 10 out of 10 for Nutrition Project—Embedding the Nutrition Care Policy at the John Hunter Hospital*

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Inadequate nutrition in hospitalized patients is associated with poor patient outcomes including increased risk of complications and health service cost. The 10 out of 10 for Nutrition project was conducted at the John Hunter Hospital (JHH) over a nine-month period across 2017/2018 to embed the NSW Health mandated Nutrition Care Policy. A nutrition care “bundle of care” comprising 10 key tasks was implemented on each ward over a 6-week period with the aim of identifying nutrition risk on admission, treating malnutrition and ongoing monitoring of patients to prevent hospital-acquired malnutrition. Audits of compliance were undertaken with a key performance indicator (KPI) of 80% compliance to be achieved. Significant improvements in compliance between baseline ( $73.29 \pm 14.37$ ) and week 5 ( $92.36 \pm 4.955$ ;  $t(13) = -4.793$ ,  $p < 0.001$ ) and baseline and four months post facility-wide completion ( $88.69 \pm 8.507$ ;  $t(15) = -3.869$ ,  $p = 0.002$ ) were observed. Unfortunately, in the 12–18 months post-implementation, compliance has not been sustained ( $\leq 59\%$ ). Embedding a multi-faceted policy across a large facility takes a strategic and multi-disciplinary approach supported not only by policy but development of key tasks and activities to support the implementation, ongoing executive level sponsorship and leadership, and a simple and regular audit/feedback system aligned with existing audit strategies.

### 3.88. *Extended Enteral Feeding after Oesophagectomy*

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Weight loss of approximately 10%–15% and associated malnutrition is common in patients with oesophageal cancer before and after oesophagectomy. Excess weight loss is associated with poorer prognosis and inversely associated with quality of life (QOL). Recent studies indicate that appetite remains poor at 3 months post-surgery, posing questions about optimal post-surgical enteral feeding duration. The aim of this study is to assess the nutritional and QOL impact of providing longer-term enteral feeding to patients with oesophageal cancer undergoing an oesophagectomy. This randomised controlled trial compares 12 weeks of post-operative enteral feeding to the current standard practice of six weeks post-operative enteral feeding. Data collection occurs pre-operatively (baseline) and at two, six, 12 and 26 weeks post-operatively. To date, there have been 13 participants recruited (eight controls: five intervention). Preliminary analysis of 12-week post-operative data shows there was a difference between control and intervention for both weight loss ( $-6.6$  kg vs.  $-1.4$  kg,  $p > 0.05$ ) and percentage of weight change ( $-8.0\%$  vs.  $-1.6\%$ ,  $p > 0.05$ ), however this was not significant. Results from this study will be utilised to guide clinical practice and maximise patient care to improve the nutritional status of patients undergoing oesophagectomy for curative treatment of oesophageal cancer.

### 3.89. *Developing Skills of Future Clinical Dietitians*

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Educators with the Bachelor of Nutrition and Dietetics (Hons) program at the University of Newcastle recognised the need to increase student exposure to the hospital environment in the 3rd year in order to improve preparedness for 4th-year placements. In 2018, the third-year “clinics” were significantly modified to provide a wider variety of inpatient and outpatient experiences and better scaffold their learning. The clinics were evaluated to gauge the level of preparedness and confidence and allow for further improvements. Students were surveyed at the end of the academic year via a web-based self-administered questionnaire. Twenty three students (41% of the cohort) responded. Students reported enhanced learning in: clinical dietetics and dietetic practice, a better understanding of the role of a dietitian ( $\geq 90\%$  agreed or strongly agreed), decreased anxiety and greater preparedness for their final-year placements ( $\geq 70\%$  agreed or strongly agreed). Students reported increased confidence with the highest confidence in: communicating with a patient, communicating with a dietitian/supervisor and undertaking a nutrition assessment ( $\geq 68\%$  reported being confident or very confident). Students were overall satisfied with the clinics. Sessions have been modified for 2019, and outcomes more clearly articulated. The clinics will be further evaluated at the end of 2019.

### 3.90. *Experiences of Feeding Post-Oesophagectomy*

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The best curative option for oesophageal cancer is the surgical re-sectioning of the oesophagus with an oesophagectomy. Patients undergoing oesophagectomy experience high rates of malnutrition due to a range of factors including swallowing difficulties chemoradiation and surgery side effects. Understanding experiences of and barriers to feeding post-oesophagectomy is imperative to the provision of adequate support. The aim of this study was to gain an understanding of the experiences of feeding post-oesophagectomy from the perspectives of patients, carers and dietitians. Semi-structured interviews were used to explore the experiences and perspectives of two patients undergoing oesophagectomy and their respective carers and dietitians. Interviews were conducted pre-surgery and six weeks post-surgery. Data analysis was carried out using thematic analysis. Four themes emerged from the data: ‘I just couldn’t eat’, ‘no reward in eating anymore’, ‘I didn’t realise how important the tube was’ and ‘adequate dietetic involvement’. Patients described having severe side effects that physically prevented them from eating and losing their joy on eating occasions. Patients and carers initially prioritised the oesophagectomy issues over nutrition but realised the importance of nutrition during the recovery period. It was also identified that adequate dietetic involvement was required to support this patient population nutritionally.

### 3.91. *Vulnerable, Single and Living in Poverty: Dietary Intake of Women Living in Australian Capital Territory and Western Australia*

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This study explored the dietary intake of vulnerable women living in the Australian Capital Territory (ACT) and Western Australia (WA). Women from ACT ( $n = 37$ ) and WA ( $n = 23$ ) who received food relief underwent a 24-h recall to estimate dietary intake. FoodWorks (Xyris Software,

QLD) was used to analyse dietary patterns and compare with national food group and nutrient intake recommendations. The average age was  $42.76 \pm 11.25$  years. Food groups and nutrient intake did not differ by state. One-third of women met the serve recommendation for vegetables, with the median (interquartile range, IQR) servings (1.65 (2.46)) lower than national intakes. No-one met fruit group recommendations. Grain servings were achieved by 57% of women and age influenced intake [2.87 (4.04); 5.31 (8.22)]. One third achieved meat serves [0.89(1.54); 0.99 (1.00)]; and 44% achieved dairy serves [1.09 (1.28); 1.80 (1.83)]. About 1/3 of women had significantly lower intakes than the estimated average requirement (EAR) for calcium ( $p < 0.001$ ), vitamin E ( $p = 0.008$ ) and potassium ( $p < 0.001$ ); 20% did not meet the EAR for iron ( $p = 0.028$ ). Food group intakes were below requirements and key food groups that are protective (fruit and vegetables) highlighted limited access. Key nutrients including iron and calcium are below respective EAR and likely to be associated with deficiencies and increased disease risk.

### 3.92. Testing the 'Super' in Foods

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With our increasing global population there is a pressing need for significantly increased plant production and more efficient utilisation as well as the development of novel nutritious food sources which contain high-quality proteins, fats and carbohydrates. Often the hidden benefits of these alternative food sources have not been thoroughly validated or tested and there is a high likelihood that they also contain valuable therapeutics to improve human health and prevent future disease. In addition, many foods are termed 'superfoods' with claims that they can reduce the risk of chronic diseases such as arthritis, asthma, heart disease and bowel disease and improve overall human health. Many of these claims are unfounded and the mechanisms by which these 'superfoods' may work is largely unknown. We have used IEC6 rat intestinal cells and human Caco2 colon cells to test the impact of sunflower, flax and chia seed extracts on cell viability. Cell viability increased with increasing concentrations of flax, chia and sunflower seed extract in both cell lines. Mineral analysis comparing the seed extract and the flour showed enrichment for beneficial minerals. Current studies are examining whether these seed extracts have antioxidant and anti-inflammatory properties.

### 3.93. Energy Substrate Use and Contribution of Protein Synthesis to Energy Metabolism in Cultured Juvenile Spiny Lobster *Sagmariasus Verreauxi* under Different Nutritional Conditions

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Investigations of energy substrate use and contribution of protein synthesis (PS) to energy metabolism (EM) are crucial for fully understanding nutritional physiology of aquaculture species. This study determined energy substrate use in cultured *Sagmariasus verreauxi* juveniles by stoichiometry through measuring oxygen consumption, carbon dioxide and nitrogenous excretion, and evaluated the contribution of PS to EM by calculating the difference of oxygen consumption before and after injection of a PS inhibitor cycloheximide. Juveniles that were 10-day starved, 2-day fasted, and fed with squid *Nototodarus sloanii* were examined. Lipid was the primary energy substrate for starved juveniles whereas the proportion was incalculable. Protein was the primary substrate for fasted juveniles (65% of oxygen consumption), with lipid accounting for the remainder (35%). Following feeding, protein contribution remained at over 50%, while lipid (0%–43%) and carbohydrate (0%–37%) provided considerable energy at different times, suggesting besides protein, non-protein ingredients are also essential to lobster aquaculture. The contribution of PS to EM in starved, fasted and fed lobsters were 13%, 29% and 96%, respectively, demonstrating PS represents minor components of EM in unfed decapods, while major in fed decapods. This work is essential for

illustrating relationships between nutritional status and diet quality, and for developing cost-effective aquafeeds.

### 3.94. Which Bugs Do Our Children Have? Challenges of Defining the Typical Child Gut Microbiome

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The consortium of trillions of microorganisms living inside the human gut are integral to health. During early life, the gut microbiome develops before stabilising and becoming adult-like. Little has been done to collate and characterise the microbiome of children. A systematic review was undertaken to address this gap (PROSPERO ID: CRD42018109599). MEDLINE and EMBASE were explored using keywords related to healthy preadolescent children and gut microbiome in journal articles published between 1/1/2000, and 31/8/2018. Of the 815 journal articles identified, 42 met the inclusion criteria (healthy children aged 2–12 years; used next-generation sequencing; cohort study or clinical trial). Results indicate the preadolescent gut microbiome is dominated at the phylum level by Firmicutes (weighted overall average relative abundance = 51.1%) and Bacteroidetes (36.0%); genus level by *Bacteroides* (16.0%), *Prevotella* (8.69%), *Faecalibacterium* (7.51%) and *Bifidobacterium* (5.47%). Geographic location and 16s rRNA sequencing region were associated with microbial proportions. Large variations in  $\alpha$ -diversity and short-chain fatty acids were reported; partially explained by diet, location or methods used, independent of age. As costs of analyses continue to fall, future longitudinal studies examining function capacity with more phenotypic data will allow improved understanding of the role of the gut microbiome in health.

### 3.95. Energy Substrate Use and Protein Metabolism in Cultured Juvenile Spiny Lobster *Sagmariasus Verreauxi* under Different Nutritional Conditions

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Investigating energy substrate use (ESU) and protein metabolism is crucial to understanding nutritional physiology and refining diets for aquaculture species. This study determined ESU by stoichiometry in cultured *Sagmariasus verreauxi* juveniles that were 10-day starved, 2-day fasted, or fed with squid *Nototodarus sloanii*. Additionally, the contribution of protein synthesis to energy metabolism was considered in two ways: oxygen consumption pre- and post-injection of a protein synthesis inhibitor cycloheximide; and measurement using a stochastic endpoint method in lobsters fed isoenergetic diets containing 40%, 50% and 60% protein. Stoichiometry and stochastic endpoint methods have been extensively used in human and terrestrial animal research, but not in aquatic ectotherms. During starvation, lipid was the primary energy substrate whereas during fasting, protein was the primary substrate (65% of oxygen consumption), with lipid accounting for the remainder (35%). Following feeding, protein contribution remained at over 50%, while lipid (0%–43%) and carbohydrate (0%–37%) provided considerable energy at different times. The contribution of protein synthesis to energy metabolism in starved, fasted and fed lobsters was 13%, 29% and 96%, respectively. Different dietary protein levels did not affect protein synthesis. Overall, this study illustrated the potential of a sophisticated nutritional physiological approach for developing cost-effective aquafeeds.

### 3.96. Post-Menopausal Women with High Visceral-Fat Levels Exhibit Impaired Bone Turnover and Altered Bone Resorption in Response to Acute Calcium Consumption

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Dietary calcium recommendations for postmenopausal woman does not take into account the effects of obesity. Obese women often present with higher bone mineral density (BMD) and yet report increased fracture risk. To assess the acute anti-resorptive effect of calcium in obese women, two forms of calcium were administered to 77 postmenopausal women with varying visceral adipose tissue (VAT) levels. Each week, fasting participants were randomised to receive a single oral dose of either milk (1000 mg Ca), calcium carbonate tablet (1000 mg Ca), and fruit juice (no calcium). At each session, blood samples were collected at baseline and hourly for 5 h. Serum cross-linked telopeptides (CTX) and parathyroid hormone levels were measured along with baseline vitamin D, osteocalcin and bone-specific alkaline phosphatase. The mean age of participants was  $65.6 \pm 4.5$  with body mass index (BMI) range 18.3–53.9 kg/m<sup>2</sup> and VAT range 91–3392 cm<sup>3</sup>. VAT levels correlated positively with BMD ( $p < 0.001$ ) and inversely with CTX ( $p = 0.002$ ) at baseline. While the maximum CTX reduction was similar in the high- and low-VAT groups, the absolute change in CTX levels was less in the highest quartile of VAT ( $p < 0.05$ ). Although obesity alters bone resorption at baseline, current dietary calcium recommendations remain effective in reducing bone resorption.

### 3.97. Long-Term Ad Libitum Modern Paleolithic Diet Associated with Increased Risk of Iodine and Calcium Deficiency in Healthy Individuals

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There is little literature available on micronutrient intake for those adhering to ad libitum Paleolithic diets over a long-term period, however, short-term interventions show low calcium and iodine intake. The aim of this study was, therefore, to examine micronutrient intake and status of healthy, long-term, Paleolithic diet followers ( $n = 44$ ) and compare intakes to controls ( $n = 47$ ) consuming a standard Australian diet, and to Australian Nutrient Reference Values. Participants completed a 3-day weighed diet record and provided 24-h urine for analysis of iodine. Dietary calcium and iodine intakes in the Paleolithic group were significantly lower than controls (631 mg/day vs 871 mg/day and 112 µg/day vs. 156 µg/day, respectively; both  $p < 0.001$ ). The proportion of individuals meeting the estimated adequate requirement (EAR) was significantly lower for calcium and iodine in the Paleolithic group, when compared to controls (20% vs. 53% and 61% vs. 87%, respectively, both  $p < 0.01$ ), with urinary iodine status currently under analysis. The proportion of those not meeting the calcium EAR in the control group reflects Australian Health Survey findings. Individuals following long-term low-carbohydrate diets, excluding major sources of calcium (dairy) and iodine (breads and fortified cereals), are at risk of clinical deficiency and require monitoring in the primary health care setting.

### 3.98. Dietary Intakes of Older Australian Adults with Knee Osteoarthritis

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The aim of this study was to assess dietary intakes of a sample of older adults with knee osteoarthritis (OA) and compare these to national nutrient reference values. A subsample of participants ( $n = 57$ ; 32 females and 25 males) from a cross sectional survey of community-dwelling

adults completed food-frequency questionnaires (FFQs). The average age, weight and body mass index (BMI) of the sample was 68.3 years, 85.5 kg and 30.7 kg/m<sup>2</sup>, respectively, with a majority of participants classed as overweight or obese (58%). Average energy (E) intake was 6989 kilojoules, with carbohydrate intake at 40% E, protein 21% E, total fat 39% E and saturated fat 15% E, compared to recommendations of 45%–65% E, 15%–25% E, 20%–35% E and ≤10% E, respectively. Average fibre intake for males and females was 22 and 19 grams, respectively, compared to recommendations of 30 and 25 grams. Likewise, intakes of other key nutrients including folate, retinol, vitamin E, calcium, magnesium and potassium were inadequate. These findings demonstrate that dietary intakes of older adults with OA are high in fat but low in fibre and micronutrients and do not align with national recommendations. Given the health implications of poor dietary behaviours, there is a need for targeted nutrition interventions in this population.

### 3.99. Association Between Weight Status, Omega 3 Fatty Acids (N-3PUFA) and Omega 3 Index in Healthy Young Women

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Obesity has been shown to negatively impact omega 3 index (O3I) in older adults and children. This relationship has not yet been shown in young women, a particularly vulnerable and understudied group. Data from the cross-sectional Food, Mood and Mind Study, which recruited healthy young women (18–35 y;  $n = 300$ ), was analysed including fasting blood samples (O3I, C-reactive protein (CRP), omega 3 fatty acids (n-3PUFA)), anthropometric parameters (body mass index (BMI), waist circumference (WC)) and fish-oil supplement and food intake data (food frequency questionnaire). Participants with high levels of inflammation (CRP > 10) were excluded. Data reported mean + standard deviation (SD). Included participants ( $n = 244$ ) had a mean age, BMI and WC of  $26 \pm 5.14$  y,  $27 \pm 7$  kg/m<sup>2</sup>,  $82.3 \pm 16.8$  cm, respectively. BMI and WC were significantly, negatively associated with O3I (BMI:  $p < 0.0005$ , WC:  $p < 0.0005$ ) and docosahexaenoic acid (DHA) (BMI:  $p < 0.0005$ , WC:  $p < 0.0005$ ). When stratified into quartiles, BMI had a significant, negative, linear relationship with n-3PUFA ( $p < 0.005$ ) which was independent of dietary n-3 PUFA intake. CRP was also significantly negatively correlated with n-3PUFA ( $p < 0.0002$ ). Taking fish-oil supplements resulted in significantly higher O3I ( $p = 0.024$ ). This study demonstrates a significant, negative association between O3I and n-3PUFA with BMI and WC in healthy young women, regardless of dietary n-3PUFA intake.

### 3.100. Nutrients, Foods, and Dietary Patterns: A Descriptive Analysis of the Systematic Reviews Used to Inform the Australian Dietary Guidelines

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Dietary guidelines should reflect the best available evidence on the relationships between diet and health. The aim of this study was to examine the extent to which the systematic reviews used to inform the 2013 Australian Dietary Guidelines incorporated evidence from nutrient-based, food-based, and dietary patterns research. Documents describing the dietary guideline development process were identified. Evidence synthesis methods, including the application of quality assessment approaches, were described qualitatively. Descriptive statistics were used to analyse systematic reviews by exposure, outcome, and design of included studies. Based on preliminary analysis of 143 systematic reviews, foods were the dominant exposure of interest (86% of systematic

reviews), followed by nutrients (11%), and dietary patterns (3%). The majority of reviews focused on chronic disease outcomes rather than nutritional adequacy. Most reviews included evidence from cohort studies (91%). Quality assessment approaches tended to prioritise evidence from randomised controlled trials over cohort studies. In developing future iterations of the Australian Dietary Guidelines, there is an opportunity to draw on a growing body of evidence from dietary patterns research, which comes primarily from cohort studies. There may be a need to reconsider quality assessment approaches to ensure they are fit for purpose.

### 3.101. Role of Zinc in Cardiovascular Disease

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Coronary artery disease (CHD) is a major public-health concern with approximately 1.4 million Australians affected. Reports in animal models showed that zinc supplementation significantly reduced aortic lesions, whereas zinc deficiency was linked to cardiovascular disease (CVD). Zinc is also critical for the integrity and function of both the vascular endothelium and the smooth muscle. In humans, an inverse relationship between dietary zinc intake and low-grade atherosclerosis was reported. However, the more detailed relationship between zinc deficiency and CVD has not been studied. We are exploring the role of zinc in CVD. Through in vitro experiments, we are investigating the potential effect of zinc on muscle cell phosphodiesterase-5 activity and the subsequent degradation of a vasodilatory molecule, namely cyclic guanosine monophosphate. Shortly, we will commence collecting dietary information from patients already enrolled in the Coronary Angiogram Database of South Australia study, using a food-frequency questionnaire (FFQ). We will compare FFQ zinc data of patients who, according to an angiogram, were diagnosed with CAD to patients who had no apparent atherosclerotic pathologies. Finally, we will link the dietary data with patients' plasma zinc levels. This study will reveal if zinc dietary guidelines need to be adjusted for CVD patients.

### 3.102. An eHealth Intervention for Promoting Healthy-Eating Behaviours amongst Disadvantaged Individuals with Type 2 Diabetes (T2D)

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People of low socio-economic position are disproportionately affected by diabetes, and by unhealthy eating patterns that contribute to poor disease self-management and prognosis. Electronic health (eHealth) technologies have the potential to address some of the barriers to healthy eating experienced by this group. This study aims to test the appeal and feasibility of EatSmart, a 12-week, web- and mobile phone-delivered, healthy-eating behaviour change intervention, to help disadvantaged patients with type 2 diabetes (T2D) to increase their vegetable, fruit and water consumption. EatSmart is a pilot study and uses a pre-post test design. Sixty people with T2D who are on a healthcare card/pension and aged 18–75 years will be recruited. Participants will complete baseline assessments on dietary intake, dietary self-efficacy, barriers, and demographic and clinical

data. Following intervention completion at three months, effects will be assessed via the same self-completion surveys with additional questions asking about their experience with and perceptions of the program, and also by using website login data. This study will provide data to address the currently limited evidence regarding how disadvantaged populations with diabetes may benefit from an eHealth-delivered behaviour-change program which aims to teach healthy eating on a budget in order to better self-manage their condition.



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