of pricing discrepancies such as seasonal trends), to ultimately inform robust monitoring methods and pricing policies.

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Trends in discretionary foods and beverage sales in Australian grocery and convenience stores between 2011 and 2017

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Background: Discretionary foods and beverages are regularly consumed by Australian adults and children, and contribute to dietary risk – a leading contributor to the burden of disease. Analysing sales data allows for objective analysis of trends in discretionary foods and beverages, and can help corroborate findings from diet recall surveys. We aimed to quantify trends in sales of key discretionary foods and beverages over five years across all retail settings in Australia, and examine the proportion sold in grocery and convenience stores.

Methods: We estimated annual volume sales per-capita over five years (2012–2017 for foods and 2011–2016 for beverages) for thirteen discretionary food categories and two discretionary beverage categories using the Euromonitor Global Market Information Database and estimates of the Australian resident population. Linear regression models were used to estimate annual changes over five years. Additionally, we compared information from the Euromonitor GMID and the Nielsen Market Information Digest (MID) for grocery stores and convenience stores to estimate the proportion of discretionary foods and beverages sold in grocery and convenience stores.

Results: We observed annual increases in the sales per capita of frozen pizza, frozen processed potatoes, potato chips, tortilla chips, ice-cream, sugar confectionary, chocolate confectionary, pastries, and sports and energy drinks, no significant change in sales of sweet biscuits, chocolate spreads, and cakes, and decreases in sales of savoury biscuits, processed meat and soft drinks. The majority of discretionary food and beverage sales occurred in grocery stores (>40%). Convenience stores accounted for a smaller share of sales (<10%), with the exception of sports and energy drinks (23%).

Conclusions: While discretionary food and beverage sales remain high, from a public health perspective we observed encouraging trends for select food and beverage categories. Grocery stores may be an important avenue for public health action to reduce discretionary food and beverage purchases.

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Correlates of sugar-sweetened beverage consumption in Australian young adults

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Young adulthood represents an influential transitional period marked by poor dietary habits and excess weight gain. Sugar-sweetened beverages (SSBs) are a major source of excess caloric intake among young adults, yet little is known about the correlates of SSB consumption. This study examines the individual and situational correlates of SSB consumption, using real-time assessment of young adults' eating occasions (EO). Dietary, sociodemographic and health behaviour data were collected during the Measuring Eating in Everyday Life (MEALS) study ($n = 680$ adults, 18–30 y). Participants reported all foods and beverages consumed over 3–4 non-consecutive days using a Smartphone food diary app. For every EO, the situational characteristics such as eating location, purchase location, presence of others and activities while eating were recorded. Level of SSB consumption was determined using two approaches: frequency of SSBs per day, and amount (grams) of SSBs per day. Associations for individual level and EO level characteristics with level of SSB consumption (low/high) were analysed using multilevel logistic regression in M*plus*. Overall, 238 (35%) participants consumed SSBs of whom 48% consumed ≥98 g/d and 56% consumed ≥0.33 frequency per day. High SSB consumers (intakes ≥98 g/d) had a lower odds of being female (OR [95% CI]: 0.48 [0.29, 0.90]) and a higher odds of being overweight/obese (1.87 [1.03, 3.40]), consuming SSBs at work/university, compared to at home (2.14 [1.03, 4.45]), and purchasing SSBs from a convenience outlet, compared to a supermarket/grocery store (3.60 [1.53, 8.46]). High SSB consumption, based on frequency per day, was associated with overweight/obesity. In conclusion, over a third of young adults in this study consumed SSBs and high SSB consumption was associated with both individual and situational factors. Future research should explore how EOs containing SSBs differ from other beverage EOs, in relation to their accompanying foods and situational characteristics.

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Sex and menstrual cycle modulate cold- and meal-induced brown adipose tissue activity in humans

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Adaptive thermogenesis is the dissipation of energy via heat production and primarily occurs in brown adipose tissue (BAT). Earlier retrospective studies suggest that BAT activity is greater in women than men. Furthermore, sex and stress steroids regulate

thermogenesis in rodents. This study aimed to investigate cold- and meal-induced BAT thermogenesis in healthy men ($n = 14$; age 23.07 ± 0.7 years, BMI $23.22 \pm 0.7\,kg/m^2$) and women at 2 stages of the menstrual cycle (luteal, $n = 9$; age 25.22 ± 1.7 years, BMI $21.56 \pm 0.4\,kg/m^2$ and follicular, $n = 11$; age 24.64 ± 1.2 years, BMI $22.12 \pm 0.9\,kg/m^2$). Cutaneous temperature at the supraclavicular region (human BAT depot) and the manubrium (BAT negative control) were measured at 1 min intervals using infra-red thermography. Cold-induced thermogenesis involved the immersion of one hand into cool (15 °C) water for 5 mins. Once BAT temperature returned to baseline, a liquid meal (Ensure, 10 kcal/kg body weight) was consumed. Thermogenic responses to both diet and cold were greater in females ($P < 0.05$) than males, and this was effect was greater ($P < 0.05$) during the luteal phase of the menstrual cycle. During cold-exposure, the increase in BAT temperature was abrogated ($P < 0.05$) in females during the follicular phase compared to luteal phase of the menstrual cycle. Regression analyses revealed that serum estradiol concentration was correlated to cold- ($P < 0.05$, $R^2 = 0.13$) and meal-induced thermogenesis ($P = 0.07$, $R^2 = 0.10$), whereas meal-induced changes in BAT temperature were inversely correlated with serum testosterone concentration ($P < 0.05$, $R^2 = 0.13$). There was no correlation between BAT temperature and serum progesterone concentration. On the other hand, serum cortisol concentration was inversely related to baseline BAT temperature ($P < 0.05$, $R^2 = 0.17$). In summary, women exhibit greater thermogenic responses to both cold and meal stimuli than men. Furthermore, BAT activity in women is influenced by the stage of menstrual cycle, which relates to fluctuating levels of estradiol.

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Perilipin 5 deletion in hepatocytes remodels lipid metabolism and causes hepatic insulin resistance in mice

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Obesity is associated with dysfunctions in lipid and glucose metabolism, which is linked to the development of insulin resistance and type 2 diabetes. The perilipin (PLIN) family of proteins localize to cellular lipid droplets and control lipid flux within cells by coordinating protein-protein interactions. PLIN5 is expressed in highly oxidative tissues and, in skeletal muscle, controls triglyceride lipolysis and β-oxidation of fatty acids, which in turn helps to maintain insulin sensitivity in this tissue.

The aim of this study was to investigate the role of PLIN5 in regulating hepatic lipid and glucose metabolism in lean and obese mice. To address this aim, we generated PLIN5 liver-specific knockout mice ($Plin5^{LKO}$) by crossing *Plin5* floxed mice with albumin-Cre mice. Hepatocytes isolated from $Plin5^{LKO}$ mice exhibited marked changes in lipid metabolism characterized by decreased fatty acid uptake and storage, decreased fatty acid oxidation that was associated with reduced contact between lipid droplets and mitochondria, and reduced triglyceride secretion.

With consumption of a high-fat diet, $Plin5^{LKO}$ mice accumulated intrahepatic triglyceride, without significant changes in inflammation, ceramide or diacylglycerol contents, endoplasmic reticulum stress or autophagy. Instead, livers of $Plin5^{LKO}$ mice exhibited activation of c-Jun N-terminal kinase, impaired insulin signal transduction and insulin resistance, which impaired systemic insulin action and glycemic control. Re-expression of *Plin5* in the livers of $Plin5^{LKO}$ mice reversed these effects. Together, we show that *Plin5* is an important modulator of intrahepatic lipid metabolism and suggest that the increased *Plin5* expression that occurs with over nutrition may play an important role in preventing hepatic insulin resistance.

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Hunger-sensing AgRP neurons engage the hypothalamic-pituitary-adrenal axis to mediate adaptive responses to stress

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Hunger-sensing Agouti-related peptide (AgRP) neurons in the hypothalamic arcuate nucleus are fundamental to survival. They increase food intake during energy deficit and also facilitate adaptive behaviors to cope with hunger by reducing anxiety and increasing motivation, therefore enabling appropriate food seeking behavior. A fundamental question remains; what are the physiological mechanisms through which AgRP neurons regulate adaptive behaviors. We examined the hypothesis that activation of AgRP neurons in the absence of food engages the Hypothalamic Pituitary Adrenal (HPA) axis to mitigate anxiety associated with acute emotional stress. Using hM3Dq DREADDS, prior activation of AgRP neurons 3-hours before acute restraint stress significantly increased plasma corticosterone 15, 30 and 60 min and ACTH 30 min after stress onset. Anterograde tracing of AgRP neurons using the cre-dependent herpes simplex virus H129 ΔTK-TT confirmed that AgRP neurons target ~30% of CRH neurons in the PVN. In behavioural experiments, prior activation of AgRP neurons reduced anxiety-like behaviour, increased memory recall and promoted food intake after acute stress. Prior activation of AgRP neurons also promoted food-seeking and food consumption in a food-baited novel environment used to evoke acute stress. To determine whether the behaviours were a result of increased circulating corticosterone we pre-treated mice with metyrapone, an inhibitor of corticosterone synthesis and repeated these behavioural experiments. Unexpectedly, inhibiting corticosterone did not influence AgRP-induced behavioural adaptation to stress. Activation of selective AgRP to PVN and AgRP to medial amygdala circuits using retrograde transport of DREADDs from terminal regions induced a significant feeding response. However activation of these circuits in isolation did not influence adaptive behaviour in response to acute stress. Our results suggest AgRP neurons promote an adaptive response to stress independent from increases in plasma corticosterone, however the specific circuits responsible remain to be determined and may require multiple AgRP circuits acting in unison.

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