sive hepatic, but also with cardiometabolic diseases and NAFLD is thought to be involved in the pathogenesis of cardiometabolic diseases. Diagnosis of NAFLD by the gold standard method, liver biopsy, is invasive and, therefore, not feasible in routine practice. Consequently, there has been intense interest in blood markers that, alone or in combination with clinical parameters, would be able to identify patients with NAFLD. The most effective and safe treatment strategy to reduce liver fat content and improve hepatic inflammation and fibrosis in subjects with NAFLD is lifestyle intervention. However, a considerable amount of patients is not compliant with the respective recommendations or liver fat content and/or liver pathology does not improve, although weight loss can be achieved. In this respect novel studies have indicated that specific pharmacological treatment approaches may be effective and relatively safe to treat NAFLD.

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Glucose-sensing neurons of the mediobasal hypothalamus project to brown adipose tissue

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It is well established that neural input to BAT remains a critical feature of its functional recruitment. In the case of postprandial thermogenesis, activation of BAT sympathetic nerve activity following peripheral or central glucose infusion suggests a central nutrient-sensing mechanism in the regulation of BAT activity. It is hypothesised that BAT-directed neurons in discrete hypothalamic brain regions alter their electrophysiological properties in response to increased extracellular glucose concentration.

Injection of the GFP-tagged, transsynaptic retrograde virus, pseudorabies virus (PRV), into the interscapular BAT of Sprague-Dawley rats allowed for identification of neurons with a known polysynaptic projection to BAT. Whole-cell patch clamp recordings were performed on GFP+ neurons from coronal sections of the arcuate nucleus (ARC) and retrochiasmatic area (RCh). Increasing the extracellular glucose concentration from 1 mM (''fasted'') to 5 mM (''fed'') revealed both glucose-excited (6.00 ± 0.84 mV; 0.63 ± 0.18 Hz; $n = 14$ (29%)) and glucose-inhibited (-5.34 ± 0.75 mV; -0.34 ± 0.07 Hz; $n = 18$ (37%)) BAT-directed neurons in the ARC. Similarly, there were also substantial numbers of glucose-excited (7.32 ± 2.20 mV; 0.75 ± 0.22 Hz; $n = 5$ (45%)) and glucose-inhibited (-3.12 ± 2.24 mV; -0.80 ± 0.44 Hz; $n = 4$ (36%)) neurons in the RCh that projected polysynaptically to BAT. Retrospective immunohistochemical analyses of biocytin-filled cells revealed both POMC+ ($n = 9$) and POMC− ($n = 5$) glucose-sensitive neurons in both regions.

Furthermore, in attempt to delineate the heterogeneity of glucose-sensitive neurons through their monosynaptic projections, Retrobeads (Rb) were injected into the paraventricular nucleus, lateral hypothalamus and spinal cord of rats, and the glucose sensitivity of ARC/RCh double-labelled (Rb+/PRV+) neurons was tested.

These data provide a basis for the postprandial regulation of BAT thermogenesis through glucose-sensing mechanisms in hypothalamic neurons. They also provide additional insights into the axonal trajectory of identified hypothalamic glucose-sensors, which may form the basis of the observed heterogeneity within these populations of glucose-responsive, BAT-directed neurons.

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Effect of glucocorticoid on brown adipose tissue function in humans — A randomised double-blind placebo controlled cross-over study

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Background: Glucocorticoid (GC) excess causes obesity. In animals, GC inhibits brown adipose tissue (BAT) function, leading to weight gain. The involvement of BAT in the development of obesity induced by GCs in humans is not known.

Aim: To investigate the effect of GC on BAT function in humans.

Method: In a randomised double-blind cross-over design, 13 healthy adults (6 men, 7 women; age mean ± SEM, 28 ± 2 year; BMI 24 ± 1 kg/m^2) underwent 1 week each of oral prednisolone (15mg/day) and placebo treatment with an intervening 2-week wash-out period. At the end of each treatment, under standardised cooling (19 °C), BAT function was assessed by measuring (i) BAT activity on PET-CT scan after 75 MBq of FDG (ii) supraclavicular, (SCL) skin temperatures using infrared thermography, (iii) energy production after a standardised meal using indirect calorimetry.

Results: Compared to placebo, SCL BAT activity (SUV_{max} 6.1 ± 2.2 vs 3.7 ± 1.2, $P = 0.049$) was lower with prednisolone. During cooling, SCL skin temperature fell to a greater degree with prednisolone (−0.45 ± 0.1 vs −1.0 ± 0.1 °C, $P = 0.01$). Energy production was stimulated by the meal and the stimulation was significantly higher during prednisolone treatment (187 ± 16 vs 255 ± 25 kcal/day, $P < 0.01$). Postprandially, SCL skin temperature rose during placebo but fell during prednisolone treatment (+0.2 ± 0.1 vs −0.3 ± 0.1 °C, $P = 0.03$).

Summary: Prednisolone suppresses BAT activity on PET-CT, enhances meal induced energy production but reduces thermogenesis.

Conclusions: GC suppresses the function of human BAT. The enhancement of energy production in the face of a reduced thermogenic response suggests that GC reduces the dissipation of energy as heat, enhancing deposition as energy stores after nutrient intake. This is a likely mechanism by which GC induces obesity.

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Cost-effectiveness and equity impacts of a sugar sweetened beverage tax in Australia

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A sugar sweetened beverage (SSB) tax has been shown to be effective in reducing consumption of SSBs and increasing government revenue, but the fairness of such a policy should also be considered. We assess the cost-effectiveness of a SSB tax of 20% for Australia with explicit inclusion of equity through the distribution of health gains and the financial impacts by socioeconomic position (SEP) subgroup.

Cohort models were used for each Socio-Economic Indexes for Areas (SEIFA) quintile to estimate the impact of the tax on body mass index (BMI) for the 2010 Australian population. The health-adjusted life years (HALYs) and health care costs averted were estimated as a result of the changes in BMI resulting from the predicted decrease in SSB consumption, taking into account the diseases that have a demonstrated significant contribution to risk of excess weight. SEP specific inputs included baseline BMI and SSB intake, price elasticities, incidence and prevalence of disease and mortality. We also estimated quintile specific changes in expenditure on SSB, tax burden and tax revenue raised.

Application of a 20% SSB tax across the Australian population will lead to improvements in HALYs and considerable health care cost savings across the Australian population, with the greatest gains in the lowest SEP group. We estimate the increase in annual expenditure on SSBs to be around $4 higher in the lowest quintile compared to the highest (around $11 compared to $7). Total tax revenue resulting from this policy is estimated to be $610m.

A SSB tax can bring substantial health and health care cost savings, especially to those in the lowest SEP group. The tax revenue could potentially fund interventions that further reduce rates of obesity and or reduce the obesity disparities between SEP groups.

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