BIOM30001 Course Summary

Table of Contents:

The Metabolic Syndrome	Page 2
Stem Cells and Tissue Engineering	Page 6
Chronic Airway Limitation	Page 8
Pain and Analgesia	Page 15

The Metabolic Syndrome (MetS)

Definition

- A cluster of associated (occur together more likely than chance) risk factor that and predispose a subset of diseases:
    - Cardiovascular disease
    - Stroke
    - Type II diabetes mellitus
    - Non-alcoholic fatty liver disease
- Together, these factors confer a risk that is greater than the sum of their parts

Diagnosis

- According to a joint interim study in 2009 publishing a consensus on clinical diagnosis, it is having an enlarged waist line (ethnicity and sex specific – **94cm** for white males, **80cm** for white women), and then at least 2 out of 4 of:
    - Elevated serum triglycerides (**≥150 mg/dL**)
    - Low high-density lipoprotein (HDL)-cholesterol (**≤40mg/dL** for men and **≤50mg/dL** for women)
    - Hypertension (blood pressure **≥130 mmHg** diastolic and/or **≥85 mmHg** systolic)
        - NB: this (and low HDL) combine to be "dyslipidaemia"
    - Elevated fasting plasma glucose (**≥100 mg/dL**) (hyperglycaemia)

CVD risk factors

- Established
    - Age (biggest risk factor – 80% in people over 65)
    - Sex (women significantly less likely before menopause, even slightly less after)
    - BMI
    - Blood pressure
    - Family history
- Modifier
    - Smoking
    - Alcohol (2 units (standards) per day is lowest risk factor (lower than zero))
    - Diabetes
- Non-established
    - LV hypertrophy

Population paradox – more people die in moderate risk category (so treatment/prevention aimed towards them)

- Due to higher absolute risk **(as more of them)** but lower relative risk (than high risk category)
    - Individual person:
        - Absolute risk = chance you will get a disease (generally in next 5yrs)
        - Relative risk = risk proportionate to the general population

Treatment

- Process/Benefits
    - Weight loss – to remove visceral fat
        - "Natural" techniques
            - Diet (low in fat, carbohydrates and proteins (only essential AAs/proteins), VLCD (very low calorie diet), vitamin/mineral substitutions)
            - Exercise (30 mins a day of moderate-high intensity exercise)
        - Medical intervention (excessively high diagnostics, or familial history (high risk category))

- **Bariatric** surgery (shrinks stomach to reduce appetite) – prevents diabetes
- Pharmacological intervention
  - Appetite suppressants
  - Anti-hypertensives (**ACE inhibitors** (or angiotensin receptor blockers) and **beta blockers, calcium channel blockers**)
  - Hyperglycaemia: oral hypoglycaemics (reduce hepatic glucose production; e.g. **metformin**, **sulfonylureas**) and insulin
  - **Statins** (used to treat dyslipidaemia) – 40% reduction in risk regardless of LDL levels

▪ Pathway
- Reduced visceral fat
  - ↓ FFA → ↓insulin resistance
  - ↓BP/dyslipidaemia/hyperglycaemia

○ Population health
▪ Education/health promotion (e.g. canteens at primary schools)
▪ Controlling composition of food/beverages found to be dangerous to health (e.g. reducing alcohol in beer/less pubs (Victorian Pure Foods Act 1905))
▪ Consumer behaviour modification via price (alcoholic drinks)
▪ Regulation of advertising (particularly to children)
▪ Economic policy to reduce the price of fresh food (competition from exports (no tariffs due to Free Trade Agreements))
- E.g. US – subsidise corn producers

- Challenges
  - Motivational/adherence
  - Economic/environmental/socio-economic causes
  - Hormonal
    - Homeostatic threshold – persists for more than a year post weight loss
      - Cause:
        - Short-term (satiety signals) – **ghrelin** release proportional to BMI
        - Long-term (adiposity signals) – **leptin**/insulin resistance
      - Effect – increased **stimulation** of **food intake** (even in fully satiated animals)
        - **Neuropeptide-Y** (NPY) and **agouti-related peptide** (AGRP) increased
        - POMC decreased (↓α-MSH released)
    - Adaptive thermogenesis (brain adapting energy expenditure to maintain body weight)
  - **Evolutionary bias** to protect against starvation – **reward pathway**
    - Greater desire for palatable food when losing weight (through associated increased ghrelin release)
  - Genetics (slight factor – approx. 3% of people)
    - Polygenic: >250 genes
    - Heritability (e.g. of energy-conserving phenotype)
    - Adopted twin studies – BMIs correlate more to biological parents than adoptive ones

Prevalence/socio-economic factors/causes (obesogenic environment)

- Food manufacturing (rising epidemic post-WW2 associated with industrial boom)
  - Automation of food processing – **more cost effective/cheaper**
    - Unhealthier
  - HFCS55 – fructose corn syrup used in frying, 1975 export deal
    - Keeps food fresher for longer, tastier, more convenient
- Lifestyle
  - More automation/technology