1.7 Diet, cholesterol and CVD treatments

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS BMI • waist-to-hip ratio • antihypertensive • statin • anticoagulant

Objective

Practise statements 1.19–1.20: diet, energy balance and obesity measures, cholesterol, and the benefits and risks of CVD drug treatments.

1 Key knowledge and worked examples

Energy balance and its two measures

Energy in exceeds energy used → mass gain. Obesity is screened by **BMI** (kg m^{-2}: 18.5–24.9 healthy, 25–29.9 overweight, 30+) and **waist-to-hip ratio** (abdominal fat correlates more strongly with CVD risk than total mass).

Three drug families, three mechanisms

- **Antihypertensives**: beta blockers slow the heart, ACE inhibitors and diuretics lower blood volume and pressure.
- **Statins**: inhibit a liver enzyme in the cholesterol-synthesis pathway, so cells take up LDL from blood via LDL receptors.
- **Anticoagulants/antiplatelets**: warfarin reduces clotting factors; aspirin blocks platelet aggregation – both raise bleeding risk.

Worked example: BMI and WHR

Mass 74 kg, height 1.66 m: BMI = $74/1.66^2 = 74/2.756 = 26.9$ – overweight band. Waist 84 cm, hips 98 cm: WHR = 0.86. For a benefit–risk answer, always weigh the drug's effect against its side-effects AND against what lifestyle change could achieve.

2 Practice

2.1 Calculate the BMI of a person with mass 68 kg and height 1.60 m, and state their weight category. [2]

2.2 Statins lower blood cholesterol. Explain how, naming the organ and the molecule whose uptake increases. [3]

2.3 Give one benefit and one risk of anticoagulant treatment. [2]

3 Exam-style questions

3.1 A patient's energy intake is 11 500 kJ per day and expenditure is 9 800 kJ per day. A gram of body fat stores about 39 kJ. Calculate the theoretical weekly mass gain, and explain one reason why the real gain is usually smaller. [5]

3.2 Two 55-year-old men have the same blood pressure. Man A has LDL-cholesterol of 4.8 mmol dm^{-3} and refuses medication; Man B has 5.6 mmol dm^{-3} and takes a statin, which lowers his LDL by 35 %. Determine Man B's treated LDL, compare the two men's values, and discuss one benefit and one risk of Man B's choice that Man A has avoided. [6]

3.3 Atrial fibrillation makes clots form inside the heart. A patient with this condition is offered warfarin or daily aspirin. Compare the action of the two drugs, explain which is usually preferred for atrial fibrillation and why, and name the monitoring that warfarin requires. [6]

Solutions

Original-task marking: M1 method, A1 accuracy, B1 reasoning.

2.1 BMI $= 68/1.60^2 = 68/2.56 = 26.6$ – overweight.

2.2 Statins inhibit (competitive inhibition of) an enzyme in the liver's cholesterol-synthesis pathway; the liver responds by making more LDL receptors; LDL-cholesterol is removed from the blood into the liver.

2.3 Benefit: fewer clots, lower risk of stroke or heart attack. Risk: excessive bleeding after injury or internal bleeding, since clotting is impaired.

3.1 Daily surplus $= 11500 - 9800 = 1700$ kJ; weekly $= 11900$ kJ; mass $= 11900/39 \approx 305$ g. Real gains are smaller because the body adapts – metabolic rate rises with mass, and dietary-fat efficiency varies; people also compensate by moving less or under-reporting intake.

3.2 B's treated LDL $= 5.6 \times 0.65 = 3.64$ mmol dm^{-3}, below A's 4.8. Benefit: B's lower LDL means slower plaque growth and lower event risk despite the higher starting value. Risk: statins' side-effects – muscle pain or liver enzyme changes – need monitoring, which A avoids; A may also achieve benefit by diet change without drug risk.

3.3 Warfarin reduces the liver's production of clotting factors (vitamin-K dependent); aspirin blocks platelet aggregation, one step of clot formation. For clots forming inside the heart on stagnant blood, reducing the whole clotting cascade (warfarin) is usually preferred to attacking platelets alone. Warfarin requires regular blood tests (INR) to keep clotting within a safe window, because too much causes bleeding and too little does not protect.