CASE FIVE

Short case number: 3_1_5
Category: Cardiovascular
Discipline: General practice
Setting: Urban_Community
Topic: Nutrition & Obesity

Case

Hiliary Gung, aged 38 years, has poorly controlled type 2 diabetes, hypertension and hyperlipidaemia. She is morbidly obese with a body mass index of 42 (obese category 3). She has been reading a lot about diet and nutrition but is confused about what she should do, and asks you to explain it to her.

Questions

1. List the four main classes of dietary carbohydrates, their components and sources
2. Summarise how the body responds to over- and under-nutrition
3. What is the role of dietary fibre?
4. What are the current dietary recommendation for energy requirements in males and females at rest; at light work; and at heavy work?
5. List the complications of obesity and their outcomes.
6. What questions might you ask Hiliary to assess how obesogenic her home environment is?
7. List some potentially reversible causes of weight gain you may need to exclude in Hilary's case?
8. How is obesity quantified using body mass index?
9. How would you manage Hiliary in terms of lifestyle advice, weight loss diets and pharmacological and surgery therapies?

Suggested reading:

Hanlon P et al. Environmental and nutritional factors in disease. In: Davidson's Principles and Practice of Medicine 20th edition. Churchill Livingston, Philadelphia. Pages 97 - 132

ANSWERS# ANSWERS

1. List the four main classes of dietary carbohydrates, their components and sources.

DIETARY CARBOHYDRATES

Class	Components	Examples	Source
Free sugars	Monosaccharides Disaccharides	Glucose, fructose Sucrose, lactose, maltose	Intrinsic: fruits, milks, vegetables Extrinsic (extracted, refined): beet or cane sucrose
Short-chain carbohydrates	Oligosaccharides	Maltodextrins, fructo-oligosaccharides	
Starch polysaccharides	Rapidly digestible Slowly digestible Resistant		Cereals (wheat, rice), root vegetables (potato), legumes (lentils, beans, peas)
Non-starch polysaccharides (NSP, dietary fibre)	Fibrous	Cellulose Hemicellulose	Plants
	Viscous	Pectins Gums	

2. Summarise how the body responds to over- and under-nutrition

Responses to under- and over-nutrition

In response to starvation, reproductive function (menstrual cycles in women) is suppressed, BMR is reduced, and there are profound psychological effects including conserving energy through lethargy. These adjustments can 'defend' body weight within certain limits. However, in the low-insulin state of severe starvation, fuels are liberated from stores initially in glycogen (in liver and muscle), then in triglyceride (lipolysis in adipose tissue, with excess free fatty acid supply to the liver leading to ketosis) and finally in protein (proteolysis in muscle).

In response to over-nutrition, BMR is increased, and energy is consumed in the work of carrying increased fat stores. As a result, body weight is 'defended' within certain limits, and an increase in energy intake above this limit results in weight gain until a 'plateau' is reached at which energy expenditure is correspondingly increased. In the high-insulin state of over-nutrition, excess energy is invested in fatty acids and stored as triglycerides; these are deposited principally in the adipose tissue but they may also spill over and accumulate in liver (non-alcoholic fatty liver disease) and skeletal muscle. In the absence of hypothalamic function (e.g. in a patient with craniopharyngioma), or in rare patients with mutations in relevant genes (e.g. in leptin or melanocortin-4 receptors), loss of satiety signals, together with loss of the adaptive changes in energy expenditure, result in relentless weight gain without any plateau.

3. What is the role of dietary fibre?

Dietary fibre can be defined as those parts of food which are not digested by human enzymes. Most dietary fibre is made up of non-starch polysaccharides (NSP), the natural packing of plant foods. A small percentage of 'resistant' dietary starch may also escape digestion in the small intestine and pass unchanged into the large intestine. These carbohydrates may be fermented by the resident bacteria in the colon, contributing to flatus formation.

Some types of NSP, notably the hemicellulose of wheat, increase the water-holding capacity of colonic contents and the bulk of faeces. They relieve simple constipation, appear to prevent diverticulosis and may reduce the risk of cancer of the colon. Other viscous, indigestible polysaccharides like pectin and guar gum have greater effect in the upper gastrointestinal tract. They slow gastric emptying, contribute to satiety, and reduce bile salt absorption and hence plasma cholesterol concentration.

4. What are the current dietary recommendation for energy requirements in males and females at rest; at light work; and at heavy work?

DAILY ENERGY REQUIREMENTS

Circumstances	Requirements	
	Healthy adult females	Healthy adult males
At rest	6.7 MJ (1600 kcal)	8.4 MJ (2000 kcal)
Light work	8.4 MJ (2000 kcal)	11.3 MJ (2700 kcal)
Heavy work	9.4 MJ (2250 kcal)	14.6 MJ (3500 kcal)

5. List the complications of obesity and their outcomes.

COMPLICATIONS OF OBESITY

Risk factors	Outcomes
'Metabolic syndrome'	
Type 2 diabetes Hypertension Hyperlipidaemia	Coronary heart disease Stroke Diabetes complications
Liver fat accumulation	Non-alcoholic steatohepatitis Cirrhosis
Restricted ventilation	Exertional dyspnoea Sleep apnoea Respiratory failure (Pickwickian syndrome)
Mechanical effects of weight	Urinary incontinence Osteoarthritis Varicose veins
Increased peripheral steroid interconversion in adipose tissue	Hormone-dependent cancers (breast, uterus) Polycystic ovary syndrome (infertility, hirsutism)
Others	Psychological morbidity (low self-esteem, depression) Socioeconomic disadvantage (lower income, less likely to be promoted) Gallstones Colorectal cancer Skin infections (groin and submammary candidiasis; hidradenitis)

6. What questions might you ask Hilary to assess how obesogenic her home environment is?
-   General questions about her eating habits, e.g. portion sizes, regular meals versus snacking and the types of food she generally eats (especially high fat foods)
-   Questions regarding income and lifestyle. Does she have a cleaner?
-   Does she own a car? Does she travel mostly by car to work and other activities?
-   Presence of central heating in her home.
-   Choice of leisure/ relaxation activity – sedentary Vs Active

SOME REASONS FOR THE INCREASING PREVALENCE OF OBESITY-THE 'OBESOGENIC' ENVIRONMENT
Increasing energy intake
↑ Portion sizes
↑ Snacking and loss of regular meals
↑ Energy-dense food (mainly fat)
↑ Affluence
Decreasing energy expenditure
↑ Car ownership
↓ Walking to school/work
↑ Automation; ↓ manual labour
↓ Sports in schools
↑ Time spent on video games and watching TV
↑ Central heating

7. **List some potentially reversible causes of weight gain you may need to exclude in Hilary's case?**
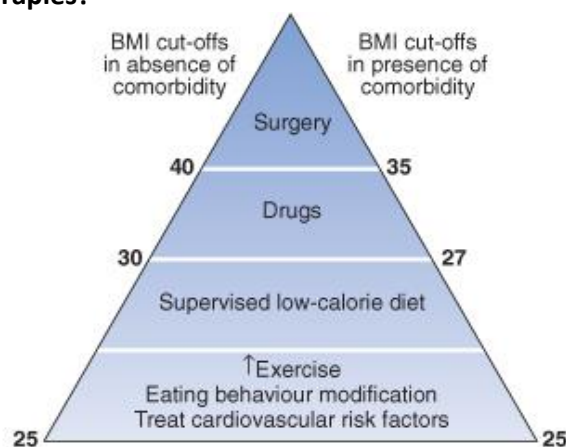
POTENTIALLY REVERSIBLE CAUSES OF WEIGHT GAIN

Endocrine factors

- Hypothyroidism
- Hypothalamic tumours or injury
- Cushing's syndrome
- Insulinoma

Drug treatments

- Tricyclic antidepressants
- Corticosteroids
- Sulphonylureas
- Sodium valproate
- Oestrogen-containing contraceptive pill
- β-blockers

8. **How is obesity quantified using body mass index?**

QUANTIFYING OBESITY WITH BODY MASS INDEX (WEIGHT/HEIGHT^2)

BMI (kg/m^2)	Classification*	Risk of obesity comorbidity
18.5-24.9	Normal range	Negligible
25.0-29.9	Overweight	Mildly increased
> 30.0	**Obese**	
30.0-34.9	Class I	Moderate
35.0-39.9	Class II	Severe
> 40.0	Class III	Very severe

9 **How would you manage Hilary in terms of lifestyle advice, weight loss diets and pharmacological and surgery therapies?**

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Based on the above diagram Hilary has a BMI of 42 with multiple co-morbidities, therefore you would be considering and discussing surgical options with her. This and given the fact that she is reluctant to see a dietician dietary therapies may be unsuccessful. However you would counsel her appropriately regarding increasing exercise within her limits of mobility and ability. Further detail available in text but students need to have a broad understanding of the when different therapies are used and should also understand that therapies need to be patient focussed as well. Risks and benefits of different therapies also need to be discussed with the patient and a management plan formulated.