

CHAPTER 10: Diet and nutrition & effect on physical activity and performance

Practice questions - text book pages 144 - 145

- 1) Complex carbohydrates do not include:
- lipids.
 - triglycerides.
 - cholesterol.
 - haemoglobin.

Answer: d.

Explanation:

- *This is because haemoglobin is a red blood cell protein that functions in gas transport.*

- 2) The human body needs vitamins and minerals because:
- they give the body energy.
 - they help carry metabolic reactions.
 - they insulate the body's organs.
 - they withdraw heat from the body.

Answer: b.

- 3) Citrus fruits are an excellent source of:
- calcium.
 - vitamin C.
 - vitamin B.
 - calories.

Answer: b.

- 4) Which one of the following statements is false with respect to the functions of water within the human body?
- lubricates joints, keeping body surfaces from grinding against each other.
 - constitutes 70 percent of muscle weight.
 - fluid loss during exercise depends on the intensity and duration of the exercise, temperature and humidity, body size and fitness levels.
 - the major water loss during moderate exercise is as vapour via the respiratory system.

Answer: d.

Explanation:

- *Answer d. is false because the major water loss during moderate exercise is through sweating.*
- *Water does lubricate joints, is a major constituent of muscle weight and is dependent on duration and intensity of exercise - choices a. b. and c. respectively.*

- 5) For endurance trained athletes, the best carbohydrate strategy for a competition in a marathon or endurance triathlon appears to be:
- to consume carbohydrate 3-4 hours prior to the event.
 - to consume carbohydrate within an hour of the event.
 - to consume carbohydrate during the event.
 - all of the above.

Answer: d.

Explanation:

- *Carbohydrate is the main energy supplier in the form of glucose and is available for immediate energy use, needed prior to and during the event.*

- 6) An expected side effect of creatine supplementation is:
- cramping and gain in body mass.
 - reduction in power output.
 - muscle weakness.
 - all of these.

Answer: a.

Explanation:

- *The role of creatine is to enhance the ATP/PC system and hence power output and so b. and c. are invalid.*
- *Creatine supplementation is often responsible for gain in body mass as more water is needed to store creatine which can cause imbalances in hydration and electrolytes, resulting in cramping.*

7) Identify some of the benefits of taking commercially prepared liquid meals.

3 marks

Answer:

- Offer well-balanced nutritive value.
- Contribute to fluid needs.
- Are rapidly absorbed.
- Leave little residue in the digestive tract.

8) Table 10.3 provides information on exercise intensity and duration. Information on the appropriate fuel foods for action has been omitted.

Table 10.3 – fuel and exercise

exercise intensity	exercise duration	fuel used
maximal sprint	short	carbohydrate
low to moderate	moderate - up to 2 hours, e.g. jogging	carbohydrate and fat equally
severe	prolonged - e.g. cycling	less carbohydrate and more fat

a) Complete the third column to show which fuel foods supply the glycogen needed as exercise intensity and duration change.

3 marks

Answer:

See table 10.3 above.

b) Why is carbohydrate a much faster fuel (energy) source when compared with fat utilisation?

2 marks

Answer:

2 marks for 2 of:

- Carbohydrates are **absorbed** as glucose in the small intestine.
- And transported around the body to provide an **immediate** energy source.
- Although **fat provides twice** the energy yield of carbohydrates, fats are absorbed as fatty acid and glycerol, stored as triglycerides in adipose tissue.
- And then converted to glucose in the liver.
- And so there is a **delay** in fat conversion of 20 minutes minimum before fat becomes a usable energy fuel food.

c) Although fat reserves have value as a source of energy, in other ways they can be detrimental to sport performance. Discuss.

6 marks

Answer:

6 marks for 6 of:

- Eating a **low-carbohydrate**, a **high-fat** diet increases fat reserves and can force the body to adapt to burn **fat more efficiently**.
- Body fat reserves represent a relatively abundant fuel substrate even in the leanest of athletes even with low body fat percentages of 10%.
- Yielding twice the energy yield of carbohydrates.
- And so **fat** becomes a valued **secondary fuel food** as the exercise duration increases.
- Endurance athletes can exercise at a higher submaximal exercise level from improved fat oxidation.
- Thereby conserving glycogen stores, a physiological adaptation called '**glycogen sparing**'.
- Excess fat reserves are detrimental to most sport performance due to increased body mass.
- Which can have a negative effect on sport performance.
- For optimal competition performance, the athlete needs a combination of adequate fuel stores from CHO and fats in relation to the demands of his or her event.

9) What are the benefits of adding a small amount of sodium to a rehydration beverage?

2 marks

Answer:

1 mark for:

Benefits of adding a small amount of sodium:

- Sodium is an electrolyte, and it helps regulate the amount of water that's in and around your cells thus controlling body water balance.
- Sodium is needed for electrical nerve signal transmission, and therefore enables muscles and nerves to work properly.

10) Why is water considered an important nutrient to the human body, and why might a person who is exercising need extra amounts of it?

4 marks

Answer:

2 marks for 2 of:

Function of water within the human body:

- Water makes up 72% of muscle weight and 50% of adipose tissue.
- The human body uses water in all its cells, organs, and tissues to help regulate its temperature and maintain other bodily functions.

2 marks for 2 of:

Why might a person who is exercising need extra amounts of it?

- During exercise more water is produced during tissue respiration.
- And is transported to the skin where **sweating** occurs.
- More water must be consumed to replace the amount lost.
- Since excess loss of fluids impairs performance.

11) What are some of the effects of dehydration on the human body? How does this effect performance in sport? 4 marks

Answer:

- Fluid loss decreases **plasma volume**.
- This **decreases blood pressure**.
- Which in turn **reduces blood flow** to muscles and skin.
- In an effort to overcome this, heart rate increases and stroke volume decreases.
- To maintain a nearly constant cardiac output (known as the **cardiovascular drift**).
- Because less blood reaches the skin, **heat dissipation is hindered**.
- And the body **retains** more heat.
- And so **body temperature increases**.
- These physiological changes will **decrease** exercise **performance**.
- Dehydration promotes **renal retention** of water and sodium.
- Which makes the athlete thirsty.
- If the athlete does not rehydrate there will be continued **circulatory distress**.

12) a) Discuss how a balanced diet could be manipulated to increase an athlete's glucose reserves prior to a marathon race.

6 marks

Answer:

- **Carbo-loading** (or glycogen loading) before the event (modern method).
- This consists of tapering of training, whilst eating 50% CHO diet.
- Partially **depletes** glycogen stores.
- Therefore energy levels are not compromised.
- And **glycogen synthase** activity is increased (enzyme responsible for converting glucose to glycogen).
- Then, gradually increase CHO intake to 70% of diet, with light training.
- Day of rest and 70% CHO diet.
- **Repletes** glycogen stores on day of marathon.
- Taking in **isotonic** fluids during the event will top up blood glucose levels during the event.

- 12) b) Carbohydrates are used as an energy source during both aerobic and anaerobic conditions. It is therefore beneficial that an elite athlete's stores of carbohydrate are at a maximum before competition day. Discuss the advantages and disadvantages of glycogen loading. 4 marks

Answer:

Advantages:

- Enhanced **glycogen stores** in muscle and liver.
- Overall effect is for overall times in aerobic activities beyond 90 minutes to improve significantly.

Disadvantages:

- Increased body mass due to increased **water retention**.
- Needed for enhanced glycogen storage.
- During CHO depletion phase **decreased energy levels**.
- And **increased fatigue** (if using classic method of carbo-loading).

- c) How can an athlete's diet aid the recovery process? 2 marks

Answer:

2 marks for 2 of:

- Quick ingestion of **carbohydrates** after exercise (2 hour window of opportunity) will speed up recovery.
- Eating foods, such as rice and bananas, that have a **high glycemic index**.
- To raise blood glucose levels quickly and stimulate greater insulin release needed to convert glucose into glycogen.
- Water needed to **rehydrate** the body.
- **Electrolyte** replenishment needed to aid the metabolic process.
- **Protein** needed to aid tissue damage, repair and growth.

- 13) Give a brief outline and comment upon the following techniques, which may be employed in the belief that they will enhance sport performance: 9 marks

3 marks for each technique.

- a) Creatine supplementation

Answer:

Advantages:

- Increase in PC stores, thereby delaying alactic/lactic threshold.
- Which means that athlete can apply maximum power for longer.

Disadvantages:

- Associated muscle cramps.
- Weight gain.
- Heat-related symptoms such as dehydration.
- Renal stress.

- b) Bicarbonate loading.

Answer:

- Bicarbonate loading is a process whereby a performer ingests bicarbonate prior to competition.
- Used in anaerobic sports that generate high levels of lactic acid, such as a 400 metre race.
- The ingestion of bicarbonate provides a buffer, thus allowing higher concentrations of lactate in the blood.
- Thus delaying the **onset of fatigue** (OBLA).
- Bicarbonate loading can cause cramping, vomiting, bloating and diarrhoea.

- c) Caffeine.

Answer:

- Caffeine **stimulates** the central nervous system, thereby reducing reaction time.
- Caffeine is used as a substance to promote fat metabolism.
- Thus sparing glycogen reserves during prolonged exercise.
- And **reduces adipose tissue** in elite performers.
- Benefits are likely to occur across a range of sports, including endurance events, stop-and-go events (e.g. team and racquet sports), and sports involving sustained high-intensity activity.

14) The dietary requirements of a power athlete and an endurance-based athlete have similarities and differences. Discuss.

8 marks

Answer:

4 marks for 4 of differences:

- A **balanced diet** for both groups of athletes is essential for optimal performance.
- Consisting of between 10-15% proteins, 20-25% fats and 60-75% carbohydrates.
- And nutritionally **complete** to meet the demands of the individual's training and competition programme.
- As well as providing **nutrients** for tissue growth and repair.
- A tailor-made diet will include the **additional** nutrient and fluid demands that will enable an athlete to train hard, recover between sessions and maintain ideal body weight.
- The energy requirements between a power and endurance-based athlete will be different because of the differences in the **intensity** and **duration** of the training or competition programmes.
- As reflected by the daily energy intake of around 8500 kJ for a female swimmer and around 6000 kJ for a female gymnast.
- **Glycogen** is the most important fuel reserve and the major fuel that supports any type of exercise.
- Hence a **high carbohydrate (CHO)** diet significantly improves performance for both power athlete and endurance-based athlete.
- However, an endurance-based athlete, such as a marathon runner, would need to consume at least 6-10 grams of CHO per kg of body mass.
- The additional stored carbohydrate provides the critical energy for improved endurance performance.
- Furthermore, **carboloading**, used by many endurance-based athletes, is a very effective technique for increasing both muscle and liver glycogen stores.
- **CHO requirement** for a power athlete would be around 4-6 grams of CHO per kg of body mass.
- Thus reflecting a reduced intake as discussed above.
- **Protein requirements** would differ between these two groups of athletes.
- For an endurance-based athlete the recommended protein intake is 1.2-1.4 grams per kg of body mass.
- In contrast, for a power athlete the recommended protein intake is 1.4-1.8 grams per kg of body mass.
- This need for a difference in protein intake is because after heavy resistance training the rate of protein breakdown and resynthesis is greater for the power athlete.

4 marks for 4 of similarities:

- **Fat intake** should be restricted for both endurance and power athletes, since muscle mass is more powerful than fat.
- **Water intake** before, during and after training or competitions is vital to all sports performers.
- Since excessive fluid loss can lead to dehydration and reduced performance.
- **Sports drinks** also reduce the risk of dehydration.
- And provide an important source of energy.
- And so improve the performance of both endurance-based and power athletes.
- Elite power and endurance-based athletes **supplement** their diets with **nutritional ergogenic aids**.
- Such as **glucosamine**, a herbal supplement that is known to reduce joint inflammation and stiffness.
- And protein supplements such as **glutamine**, which is known to reinforce the immune system.
- Thus reducing the risk of infection.

15) Discuss possible reasons why consuming high-glycaemic carbohydrates following intense aerobic physical activity enhances endurance performance.

4 marks

Answer:

- The **glycaemic index** rates CHOs according to how **quickly** they raise blood glucose levels.
- For **rapid** carbohydrate **replenishment** after exercise, high GI foods such as bananas, brown rice, pasta, raisins or wholemeal bread should be eaten within two hours of completing the physical activity.
- This is because eating these foods will be **more efficient** in increasing **blood glucose** concentrations.
- Hence stimulating the greater **insulin** release needed to convert glucose to glycogen.

16) Describe two positive and two negative effects of creatine supplementation.

4 marks

Answer:

Advantages:

- Increase in PC stores, thereby delaying alactic/lactic threshold.
- Which means that athlete can apply maximum power for longer.

Disadvantages:

- Associated muscle cramps.
- Weight gain.
- Heat-related symptoms such as dehydration.
- Renal stress.

17) For endurance athletes, describe the potential negative effects of consuming a concentrated sugar drink 30 minutes before competition and the ideal composition of a sports drink.

4 marks

Answer:

- *Hypertonic* sports drinks contain *high levels of glucose* - up to 20%, which if consumed 30 min before a competition will *increase* blood glucose concentrations.
- This will cause a rapid increase in *insulin* released to mop up this glucose (converting it into glycogen).
- The impact of this is to reduce blood glucose levels to below levels required for the competition, thereby causing *energy and performance levels to fall*.

- The ideal composition of a sports drink is around *4% glucose* (known as a *hypotonic* drink).
- These drinks designed to quickly replace fluids lost through sweating without pushing the glucose levels above that which would kick-in the insulin effect above.