BMSN1601 – Tutorial #1

Name: Wong Kwok Yin **UID:3036070362** **Tutor: Ms Caroline Yang**

Tutorial Activities

- Please **complete** and **submit** your answers before the tutorial day via appropriate links on Moodle. The deadline for submission of your work is on **13 Sept 2022 (Tuesday) by 11:59 pm**. Late submission/ submission to the wrong link will NOT be entertained.
- During the tutorial students are expected to actively engage in the discussion and answering tutor's questions. Your tutor will randomly choose students to answer questions.
- Please refer the instructions and marking criteria posted on Moodle.
- **NO model answer** will be posted on Moodle.
- Please also note that the tutorial content may be assessed in mid-term test and/or the final examination.

Part 1: Lecture content review exercise

Instructions:

The aim of this session is to consolidate your understanding about the lectures through questions and answers exercise. For the MCQs, please choose the correct answer and explain why the other options are incorrect.

1. Which of the following reactions is a hydrolysis reaction?
   A. Reaction between hydrochloric acid and sodium bicarbonate
   B. Breakdown of glucose into carbon dioxide and water
   C. Breakdown of fatty acids to form acetyl-CoA
   D. Synthesis of protein from amino acids
   E. Breakdown of maltose into glucose

Ans: E, during breakdown of maltose into glucose, a water molecule is needed to break down the glycosidic bond between 2 glucose molecules in maltose molecule. Thus, Breakdown of maltose into glucose is one of hydrolysis reaction.

A is not correct, the reaction between aqueous HCl and $NaHCO_3$ is acid-base reaction which only hydrogen ion react with $NaHCO_3$ to give CO_2 , Na^+ and H_2O, in which case water is not involved in breaking bond in the reaction.

B is not correct, the breakdown of glucose into carbon dioxide and water can be simplified to consider a combustion process. Consider the final reaction, O_2 is needed to do the oxidation of glucose to form CO_2 and H_2O. Water is not need to break a large molecule, glucose, into any other smaller molecule. Thus, it is not a hydrolysis reaction.

C is not correct, during the breakdown of fatty acids to form acetyl-CoA, fatty acyl-CoA is formed first. Then, an oxidation (β − Oxidation) is occurred, and acetyl-CoA. Although H_2O is required during the reactions, but H_2O is not used as a chemical to break the bond in the large molecule into numbers of smaller molecule. Thus, the reaction is not a kind of hydrolysis reaction.

D is not correct, during the synthesis of protein from amino acids, a water is removed in order to form peptide bond, a necessary bond for protein, between the amino acids. In this case, water is removed in the reaction between amino acids to form protein. No large molecule is broken down to numbers of smaller molecule by water. Thus, this reaction condensation but not hydrolysis.

2. Carbohydrates are stored in the liver and muscles in the form of

A. glycogen.
B. monosaccharide.
C. protein.
D. starch.
E. triacyglycerol.

Ans: A, glycogen are stored in the liver and muscles. Glycogen is a polymer of glucose containing $\alpha -$ glycosidic bond and in an extensive branched structure. In this structure, glucose units can be easily hydrolyzed from the end of each branch of glycogen when glucose is needed for metabolism, such as muscle contraction.

B is incorrect, monosaccharide cannot be stored in the body because it can directly breakdown by the cell for metabolism.

C and E is incorrect, protein and triacyglycerol(triglyceride) are not carbohydrates even though they can be broken down to give energy. For most of case, protein would not be stored for broken down for energy, except serious energy deficit. Besides, triglycerides doesn't stored in the muscles cells.

D is incorrect, after intaking the starch, starch is broken down into glucoses molecules for absorption in our body. Comparing to starch, only glycogen is stored by condensation of glucoses molecules for better efficiency of hydrolysis to release glucose for metabolism because glycogen has an extensive branched structure but starch doesn't have it.

3. Cardiac output refers to the

A. volume of blood pumped out by **each** ventricle (心室) per minute.
B. volume of blood pumped out by both ventricles per minute.
C. volume of blood pumped out be both ventricles per hour.
D. volume of blood pumped out by each ventricle per contraction.
E. volume of blood pumped out by both ventricles per contraction.

Ans: A
Given that CO (Cardiac output) $=$ HR(Heart rate) $*$ SV(Stroke Volume)
Where, HR=HB(number of heart beats)min^{-1}
And, SV=BV(volume of blood pumped out by a ventricle)HB^{-1}
Thus, CO=HR*SV=HBmin^{-1} * BVHB^{-1}=BVmin^{-1} (Volume of blood pumped out by **a** ventricle per minute)

Option C, D and E is incorrect, as the unit of time of Cardiac output should be per minute, but not per contraction or per hour.

Option B is incorrect, as the CO is the volume of blood pumped out by **one ventricle** per minute but not the volume of blood pumped out by **both ventricles.**

4. Air flows out of the lungs when

A. intrapleural pressure is lower than the atmospheric pressure.
B. intrapleural pressure is higher than the atmospheric pressure.
C. intrapleural pressure is higher than intrapulmonary pressure.
D. intrapulmonary pressure is lower than the atmospheric pressure.
E. intrapulmonary pressure is higher than the atmospheric pressure.

Ans: B
Air flows out of the lungs, means it is a process of expiration(exhalation). In this case, our thoracic cavity shrinks and air pressure in our lung is increased and higher than atmospheric pressure. By considering the gaseous exchange, the exhaust gas is diffused from our capillary to alveoli. In other to remove the exhaust gas from alveoli/lung and release to surroundings, the key factor is that the pressure of alveoli (Intrapulmonary pressure) should be greater than the atmospheric pressure but not the pressure within the pleural cavity (Intrapleural pressure). Thus, Option D and E are incorrect.

Option A is incorrect, when intrapleural pressure is lower than the atmospheric pressure, the air flows in but not air flows out.

Option C is incorrect, intrapleural pressure is always higher than intrapulmonary pressure, no matter air flows in or out of the lung, and it is not key factor to let the air flow out of the lungs.

5. Which of the following conditions is TRUE during an unforced expiration?

A. Alveolar pressure is lower than atmospheric pressure.
B. Intrapleural pressure is greater than alveolar pressure.
C. Intrapleural pressure becomes less negative.
D. External intercostal muscles contract.
E. Lung volume increases.

Ans: C
Unforced expiration, or quiet expiration, is a passive process occurring at rest. Elastic recoil of the lungs after inspiratory stretching, as well as elastic recoil of the costal cartilages, and the relaxation of the inspiratory muscles, are required in unforced expiration. The volume of the thoracic cage decreases by elastic recoil of the costal cartilages, and the lungs recoil when the inspiratory muscles relax. Thus, the pressure of alveoli (Intrapulmonary pressure) is then greater than the atmospheric pressure and air flows out. On the other hand, forced expiration the abdominal muscles contract with force, pressing the viscera against the passive diaphragm and depressing the rib cage to further reduce lung volume.[1]
Under mechanism of unforced expiration, the collapsing force of lung is decreased (when comparing the forced expiration). In this case, the surface tension is decreased too which let the Intrapleural pressure need to be greater in order to balance the pressure in lung. In order word, Intrapleural pressure become less negative.

Under mechanism of unforced expiration, the lung volume is needed to decrease, thus Option E is incorrect.
By physic formula, air will flows in when alveolar pressure is lower than atmospheric pressure. It is not expiration. Thus, Option A is incorrect.
Under mechanism of unforced expiration, Intrapleural pressure would be still smaller than alveolar pressure.
Under mechanism of unforced expiration, only internal intercostal muscles contracts while external intercostal muscles doesn't as external intercostal muscles are responsible to inspiration. Thus, Option D is false.

[1] Physiology of respiration. Physio. (n.d.). Retrieved September 12, 2022, from https://www.liverpool.ac.uk/~trh/local_html/asthmaDS/physio.htm

Part 2: Contextual Learning

Instructions:
The aim of this session is to make connections between knowledge and its applications to your clinical work. Please read the scenario and answer the questions before attending the tutorial.

Scenario:
You are a nursing student who is having practicum in a medical unit. Mr Chan is a 62-year-old man with diabetes mellitus admitted to your ward with a wound on his right arm. He is on insulin injection every morning. This morning at 7am, he received insulin injection as usual. However, he skipped breakfast because his friends from China visited him and they went to the garden for a walk. After he returned to the ward at 10 am, you had to perform wound dressing for him. Mr Chan complained of decrease in energy level, palpitations and dizziness. You found his skin cold and clammy. The nurse in charge asked you to check his vital signs immediately along with a glucometer.

Questions:

1. What is the use of glucometer?

Glucometer is a device that can measure the blood sugar levels of our human body.

2. What should be the normal range for the blood glucose level? *(Unit: mmol/L)*

The normal range for the blood glucose level is 75-95Mg/dl, after conversion, it is 4.1667mmol/L ~ 5.2778mmol/L.

3. Mr Chan's glucose level is found to be 3.1 mmol/L. Based on your nursing assessment, what is wrong with Mr Chan?

The Mr Chan has hypoglycemia as the Mr Chan's glucose level is lower than the normal range for the blood glucose level. This can be explained by the followings. Insulin is a hormone that promote the conversion of glucose to glycogen. Mr Chan receive the injection of insulin in the 7AM, but he didn't have breakfast. In this case, the glucose level in blood doesn't have a sharp rise and it is further decreased because of the excess insulin. The body cannot maintain the homeostasis and he has hypoglycemia.

4. What is the function of glucose for the body?

Glucose is a monosaccharide and it is used in the internal respiration of the cell in the mitochondrion in order to provide ATP for body metabolism and other body activity.

5. Where does the glucose in the body come from?

The body absorb polysaccharide, like Starch, through the intake of food. The food is digested in our digestive system, in which case polysaccharide is decomposed by the enzymes from our body to form

monosaccharides, such as glucose. Those monosaccharides, including glucose, are absorbed by intestine into our capillary system.

6. How do body cells obtain energy from glucose?

The body cells obtain energy (ATP) from cellular respiration, the reaction in the mitochondrion while glucose is essential in the cellular respiration.

7. Mr Chan has diabetes mellitus (DM). What is diabetes mellitus? What are the signs and symptoms of this disease?

Diabetes mellitus means a high blood glucose level caused by insulin deficiency, insulin resistance. The symptoms include thirst, excessive urination, weight loss, lethargy, poor wound healing.

8. Mr Chan is given insulin to treat diabetes mellitus. However, he forgot what insulin is and how insulin functions. Can you explain to him?

Insulin is a hormone that you can find it inside your body. It is not a harmful chemicals and will not leave long-term damage to your under doctor's proper instructions. It can help you to lower the blood sugar level effectively by storing excessive blood sugar in your liver safely for our daily activities.

9. What is the normal physiological stimulus for the release of insulin?

The increased blood sugar level can stimulate the beta cell of the pancreas, and then, it will release insulin to the blood vessel. In which case, insulin can promote the conversion of glucose to glycogen and lower the blood sugar level to maintain the homeostasis

10. What nursing interventions should be implemented for Mr Chan's condition?

First, clam Mr Chan down by the current situation. Then, injection of glucose to Mr Chan's Body should be implemented immediately. After that, write a report for the current situation to the doctors and let patient take a rest. Finally, educate Mr Chan to prevent the same condition in the future.

11. What kind of health education should you give Mr Chan to prevent the same condition in future?

Told Mr Chan the importance of following the advice from health-care professions.

References

Glucometer Video Demonstration
https://www.youtube.com/watch?v=rMMpeLLgdgY

Blood Sugar Test: National Institutes of Health U.S. National Library of Medicine
https://www.nlm.nih.gov/medlineplus/ency/article/003482.htm

Hypoglycemia
http://emedicine.medscape.com/article/122122-overview
(You need to register a free account for reading materials on this site)

Actions of insulin
http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/pancreas/insulin_phys.html