

UNIVERSITY OF JAFFNA, SRI LANKA
FACULTY OF MEDICINE
FIRST EXAMINATION FOR MEDICAL DEGREES (1st) - AUGUST 2020

BIOCHEMISTRY PAPER II

Date: 25.08.2020

Time: 3 Hours

Answer all 10 questions.

Marks allotted to each part are indicated in brackets.

Answer Each Question on Separate Answer Book.

1. A 12 year-old- girl who had grossly enlarged abdomen reported with the history of frequent episodes of weakness, sweating and pallor in between meals, which were eliminated by eating. Her development had been slow; she sat at the age of 1 year, walked unassisted at the age of 2 years, and was doing poorly in school. Physical examination revealed normal blood pressure, temperature and a normal pulse rate but a subnormal weight (23kg). The liver was enlarged. The laboratory investigation report revealed, low blood glucose & low pH, and high lactate, triacylglycerol, ketones & free fatty acids. The liver biopsy revealed high glycogen content. Hepatic glycogen structure was normal.

1.1 What could be the probable defect in this girl? **(10 Marks)**

1.2 Explain the reasons for the

1.2.1 enlarged liver with normal glycogen structure. **(30 Marks)**

1.2.2 increased VLDL, ketone bodies and free fatty acid levels.

(60 Marks)

2. 2.1 Explain the blood adrenalins and glucagon levels of the girl mentioned in **Question 1** with reasons. **(30 Marks)**
- 2.2 Explain the reasons for the increased lactate and decreased pH. **(35 Marks)**
- 2.3 Explain how the decreased blood pH is dealt by different organs to maintain the pH? **(35 Marks)**

3. 3.1 Explain how fatty acid synthesis and breakdown are reciprocally controlled. **(40 Marks)**
- 3.2 Give the role of vitamin D in reducing the blood cholesterol level with reasons. **(20 Marks)**
- 3.3 Explain how the non-steroidal anti-inflammatory drugs prevent platelet aggregation. **(40 Marks)**

4. 4.1 4.1.1 Underline the basic principles of action of goitrogenic factors. **(15 Marks)**
- 4.1.2 Give examples for goitrogenic factors. **(15 Marks)**
- 4.1.3 How the active form of thyroid hormone is formed in peripheral tissues? **(10 Marks)**
- 4.1.4 List the iodine deficiency disorders in adults, adolescents, children and neonates. **(20 Marks)**
- 4.2 4.2.1 List the risk factors for iron deficiency anaemia in a premenopausal woman? **(20 Marks)**
- 4.2.2 Give the biochemical tests to confirm iron deficiency anaemia. **(20 Marks)**

5. Explain the biochemical basis of
 - 5.1 developingcoma due to elevated blood ammonia level. **(60 Marks)**
 - 5.2 homocystinuria Type I. **(20 Marks)**
 - 5.3 the use of the isoenzymes of creatine kinase for differential diagnosis. **(20 Marks)**

6. A 64-year old man was admitted to hospital because of progressive leg weakness, recurrent falls, exertion fatigue and anemia. He was missing two lower teeth but not due to trauma and had easily bruised arms and there were areas of gingival bleeding. Orthostatic hypotension was observed on examination.

Five months before admission, intermittent hypoesthesias and parasthesias developed in the feet. He reported 3 months of increased alcohol consumption and voluntarily restricted food intake to achieve weight loss. Gastric bypass surgery was performed 6 years before this admission. He reported taking prescribed vitamin B₁₂ injections and vitamin D supplement daily. Few of the laboratory evaluations done are given below:

Variable	Reference range	On presentation
Hematocrit (%)	41-53	36.1
Haemoglobin (g/dl)	13.5-17.5	10.7
Red cell count (per mm ³)	4.5x10 ⁶ – 5.9x10 ⁶	3.6x10 ⁶
MCV (fl)	80-100	90.9
Serum Folate (ng/ml)	>4.7	2
Serum Vitamin B ₆ (µg/Liter)	5-50	<2
Serum Vitamin C (mg/dl)	0.4-2.0	<0.1

Also the laboratory evaluations revealed normal levels of calcium, phosphorus, magnesium, total protein, albumin, troponin T, creatine kinase, vitamin B₁₂, 1,25 dihydroxy vitamin D and HbA_{1c}. Zinc level was mildly low.

- 6.1 Discuss the importance of taking B₁₂ supplementation in this patient after gastric bypass surgery. **(10 Marks)**
- 6.2 Discuss the biochemical basis of the anemia in this patient. **(50 Marks)**
- 6.3 Give the specific reason/s for the nutrient deficiencies associated with
 - 6.3.1 Gingival bleeding and bruised arms. **(05 Marks)**
 - 6.3.2 Orthostatic hypotension. **(05 Marks)**
 - 6.3.3 Neurological disorders. **(20 Marks)**
 - 6.3.2 Zn and exertion fatigue. **(10 Marks)**

7. 7.1 The patient recorded in **question 6** had a history of treatment for gout with allopurinol. The condition was observed to be aggravated during high consumption of beer.

7.1.1 Explain how beer consumption could aggravate gout? **(20 Marks)**

7.1.2 Explain the mechanism of action of allopurinol in gout. **(20 Marks)**

7.2 A 30 year old woman who was admitted to psychiatric unit with acute mental changes and hallucinations had severe abdominal pain, nausea, vomiting and diarrhoea. Evaluations did not establish any intestinal infection. She was disoriented but had no focal neurological signs. Urinary porphobilinogen was reported as 44mg/ 24 hours (reference range 0-4 mg/24hours). She was diagnosed to have porphyria.

7.2.1 What type of porphyria does this woman has? **(10 Marks)**

7.2.2 Explain the biochemical reasons for your suggestion. **(25 Marks)**

7.3 What is the mechanism of cyanide toxicity? **(25 Marks)**

8. A 31-year-old man was seen after losing consciousness after breakfast; his plasma glucose concentration was 38 mg/dl. During the preceding year he had noted tiredness, weakness, hunger, and shakiness in midmorning that was relieved by eating foods containing carbohydrates. Hypoglycemia with hyperinsulinemia was documented while the patient was fasting. Counter regulatory hormone responses to hypoglycemia (plasma glucose, 31 mg/dl) were normal. The results of clinical and laboratory evaluations were otherwise normal. The patient had two children, both of whom had non-ketotic hypoglycemic seizures with inappropriate hyperinsulinemia. During hypoglycemia, their plasma insulin and C-peptide concentrations were inappropriately elevated. Glucokinase gene analysis confirmed autosomal dominant familial hyperinsulinism.

8.1 8.1.1 Explain the role of glucokinase in glucose homeostasis. **(30 Marks)**

8.1.2 What could be the altered kinetic property of glucokinase leading to familial hyperinsulinism in this patient? Explain. **(30 Marks)**

8.2 Diagrammatically show how the following biosynthetic pathways are controlled at molecular level,

8.2.1 Cholesterol biosynthesis. **(20 Marks)**

8.2.2 Haem biosynthesis during drug metabolism. **(20 Marks)**

9. 9.1 Skin of a 13-year-old boy was very sensitive on exposure to sunlight. His skin fibroblast cell culture was UV irradiated and the extracted DNA had abnormally high percentage of thymine dimmers.
- 9.1.1 What is the probable defect in this boy? **(05 Marks)**
- 9.1.2 Show how intra-chain thymine dimmers in DNA are repaired in a normal individual? **(20 Marks)**
- 9.2 9.2.1 What is convalescent plasma therapy for COVID-19? **(10 Marks)**
- 9.2.2 Diagrammatically show how SARS-CoV-2 enters host cells? **(15 Marks)**
- 9.2.3 Explain the formation of acquired immunity present in convalescent plasma against SARS-CoV-2. **(50 Marks)**
10. 10.1 Dietary approach to stop hypertension (DASH) is a lifelong approach.
- 10.1.1 How will you formulate a DASH diet consisting 1600Kcal for a Sri Lankan with elevated blood pressure. **(30 Marks)**
- 10.1.2 Explain the beneficial effects of the nutrient components, which are either increased or reduced in the above diet to control blood pressure. **(30 Marks)**
- 10.2 Tabulate the key features of the dietary recommendations to manage insulin resistance. **(40 Marks)**