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**17/MHS01/176**

QUESTION1: DEFINE THE FOLLOWING TERMS; A. KETOGENESIS B. KETONAEMIA C. KETONURIA D. KETOGENESIS

ANSWER:

**Ketogenesis** is the biochemical process through which organisms produce ketone bodies through breakdown of fatty acids and ketogenic amino acids.

**Ketoanemia** is the presence of an abnormally high concentration of ketone bodies in the blood. It is a physiological consequence of lipid metabolism. The concentration of ketone bodies in blood is maintained around 1 mg/dL or 0.5mM. Pathological ketoacidosis is 15–25 mM.

**Ketonuria** is a medical condition in which ketone bodies are present in the urine It is seen in conditions in which the body produces excess ketones as an indication that it is using an alternative source of energy. It is seen during starvation or more commonly in type 1 diabetes mellitus it occurs when the concentration of ketone bodies in urine is greater that 7mg/dL.

QUESTION 2: WHAT ARE THE CONSEQUENCES OF KETOSIS?

ANSWER:

Ketosis is a metabolic process that occurs when the body begins to burn fat for energy because it does not have enough carbohydrates to burn. During this process, the liver produces chemicals called ketones. The ketogenic, or keto, diet aims to induce ketosis in order to burn more fat. Proponents of the diet claim that it boosts weight loss and improves overall health.

Normally the rate of synthesis of ketone bodies by the liver is such that they can be easily metabolized by the extra hepatic tissues. Hence the blood level of ketone bodies is less than 1 mg/dl and only traces are excreted in urine (not detectable by usual tests). But when the rate of synthesis exceeds the ability of extra hepatic tissues to utilize them, there will be accumulation of ketone bodies in blood. This leads to ketonemia, excretion in urine (ketonuria) and smell of acetone in breath. All these three together constitute the condition known as ketosis.

 The following are consequences of ketosis;

**1. Increased ketones**

A blood sample can indicate ketone levels.

Having ketones in the blood is probably the most definitive sign that someone is in ketosis. Doctors may also use urine and breath tests to check for ketone levels, but these are less reliable than blood samples. A special home testing kit allows people to measure their own blood ketone levels. Or, a doctor may take a blood sample and send it away for testing. When a person is in nutritional ketosis, they will have blood ketone levels of 0.5–3 millimoles per liter. Alternatively, people can use a breath analyzer to test for ketones in their breath, or they may use indicator strips to check their urinary levels.

**2. Weight loss**

Some research suggests that this type of very-low-carbohydrate diet is effective for weight loss. Therefore, people should expect to lose some weight when in ketosis. People on a ketogenic diet may notice weight loss in the first few days, but this is typically just a reduction in water weight. True fat loss may not occur for several weeks.

**3. Thirst**

Ketosis may cause some people to feel thirstier than usual, which may occur as a side effect of water loss. However, high levels of ketones in the body can also lead to dehydration and an electrolyte imbalance. Both of these reactions can cause complications. Research into ketogenic diets for sports performance lists dehydration as a side effect of ketosis. Athletes may also have a higher risk of kidney stones, which is a complication of dehydration. To avoid dehydration, drink plenty of water and other liquids. See a doctor if symptoms of dehydration, such as extreme thirst or dark-colored urine, occur.

**4. Muscle cramps and spasms**

Dehydration and electrolyte imbalances can cause muscle cramps. Electrolytes are substances that carry electrical signals between the body’s cells. Imbalances in these substances lead to disrupted electrical messages that may cause muscle contractions and spasms. People following the ketogenic diet should ensure that they are getting enough electrolytes from the food they eat to avoid muscle pains and other symptoms of an imbalance. Electrolytes include calcium, magnesium, potassium, and sodium. A person can get these from eating a balanced diet. However, if symptoms persist, a doctor may recommend supplements or other dietary changes.

**5. Headaches**

Ketosis headaches can last from 1 to 7 days, or longer. Headaches can be a common side effect of switching to a ketogenic diet. They may occur as a result of consuming fewer carbohydrates, especially sugar. Dehydration and electrolyte imbalances can also cause headaches. Ketosis headaches typically last from 1 day to 1 week, although some people may experience pain for longer. See a doctor if headaches persist. Interestingly, some recent research suggests the ketogenic diet as a potential treatment for migraines and cluster headaches. However, much more research is necessary to confirm the diet’s effectiveness for treating or preventing these types of headaches.

**6. Fatigue and weakness**

In the initial stages of a ketosis diet, people may feel more tired and weaker than usual. This fatigue occurs as the body switches from burning carbohydrates to burning fat for energy. Carbohydrates provide a quicker burst of energy to the body. A small 2017 study involving athletes found tiredness to be a common side effect of the ketosis diet. Participants typically observed this during the first few weeks. After several weeks on the diet, people should notice an increase in their energy levels. If not, they should seek medical attention, as fatigue is also a symptom of dehydration and nutrient deficiencies.

**7. Stomach complaints**

Making any dietary changes can raise the risk of stomach upset and other digestive complaints. This may also occur when a person switches to the ketogenic diet. To reduce the risk of experiencing stomach complaints, drink plenty of water and other fluids. Eat non-starchy vegetables and other fiber-rich foods to alleviate constipation, and consider taking a probiotic supplement to encourage a healthy gut.

**8. Insomnia**

 Following a ketogenic diet may disrupt a person’s sleeping habits. Initially, they may experience difficulty falling asleep or nighttime waking. These symptoms typically go away within a few weeks. People in ketosis may experience a variety of side effects and symptoms, including headaches, stomach upset, and changes to their sleep and energy levels. For a more accurate way of determining ketosis, people can check the levels of ketones in their blood, breath, or urine.

QUESTION 3: WRITE CONCISELY ON THE MANAGEMENT OF KETOACIDOSIS

ANSWER:

The management of patients presenting with KETOACIDOSIS includes a full clinical assessment, while regular monitoring of vital signs and consciousness levels using the Glasgow Coma Scale is essential. Key areas in the management of KETOACIDOSIS include:

* Restoring circulatory volume;
* Insulin therapy (fixed-rate intravenous insulin infusion);
* Correcting metabolic acidosis and electrolyte imbalances;
* Identifying and treating precipitating factors;
* Early involvement of the diabetes specialist team

**Restoring circulatory volume**

Fluid replacement is one of the most important initial therapeutic interventions in the management of KETOACIDOSIS. Patients are usually dehydrated and correcting this deficit will result in significant metabolic improvement. The aims of fluid resuscitation are to:

* Restore circulatory volume;
* Clear ketones;
* Correct electrolyte imbalance.

Pulse and blood pressure should be used to assess the severity of dehydration, as hypotension (systolic BP<90mmHg) is likely to be due to low circulatory volume. Other causes such as heart failure, sepsis and factors such as age, sex and medication history should also be taken into consideration.

Normal saline (0.9% sodium chloride) is recommended for fluid resuscitation. Rapid fluid replacement is usually required in the first few hours of treatment; most patients require between 500ml and 1L to be given rapidly. However, the rate of fluid replacement must be tailored to patients’ clinical situation. Special attention must be paid to fluid balance in patients at high risk of complications - these include older people, pregnant women, children and young people (18-25 years), and those with heart and kidney failure.

**Insulin therapy**

The aim of insulin therapy in KETOACIDOSIS management is to suppress ketogenesis, reduce blood glucose and correct electrolyte imbalance. Insulin therapy increases peripheral glucose use and decreases hepatic glucose production, thereby lowering blood glucose concentration. It inhibits the release of free fatty acids from adipose tissues and decreases ketogenesis.

A continuous fixed-rate intravenous insulin infusion of 0.1 units/kg/hr is recommended. The recommendation for preparation of insulin infusion is 50 units of human soluble insulin made up with 50ml normal saline (0.9% sodium chloride). When the blood ketones are <0.6mmol/L, pH >7.3 and the patient is able to eat and drink, an appropriate subcutaneous insulin regimen should be recommenced. Recommending that background insulin should be continued along with the IV insulin infusion to reduce the risk of rebound hyperglycemia when the IV insulin infusion is discontinued. If background insulin is discontinued, a subcutaneous dose must be given before the IV insulin infusion is discontinued. The conversion to the subcutaneous insulin regimen should be planned around a mealtime; subcutaneous short-acting insulin should be given at the meal and then IV insulin discontinued one hour later.

**Correcting metabolic acidosis and electrolyte imbalance**

The following metabolic treatment targets for KETOACIDOSIS:

* Reduction in blood ketones of at least 0.5mmol/L/hr;
* Increase in venous bicarbonate by 3mmol/L/hr;
* Reduction in capillary blood glucose by 3mmol/L/hr;
* Maintenance of serum potassium at 4-5.5 mmol/L.

Blood glucose, ketones, electrolytes, including bicarbonate, and venous pH, should be monitored closely at or near the bedside. If the above targets for blood ketones and/or bicarbonate are not reached, the rate of the IV insulin infusion should be increased by 1 unit every hour until metabolic targets are achieved.

Potassium

Maintaining normal serum potassium and prevention of hypoglycemia are important in the management of KETOACIDOSIS as hypokalemia (low potassium level) and hyperkalemia (high potassium level) are both life-threatening conditions and common complications.

Serum potassium is often high on admission but falls rapidly with insulin treatment, so regular monitoring is essential and potassium should be added to IV infusions if serum potassium is <5.5mmol/L .

Capillary blood glucose

Prevention of hypoglycemia is vital, so bedside blood glucose monitoring should be performed every 1-2 hours. It is sometimes necessary to give dextrose infusions to stabilize blood glucose levels; this should be given concurrently with the sodium chloride infusions used to correct circulatory volume.