THE EFFECT OF KETOGENIC DIET ON THE HEPATOBILIARY SYSTEM: BIOCHEMICAL ASPECT

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Introduction: The ketogenic diet (KD) is a high-fat , low-carbohydrate nutritional strategy aimed at putting the body into a state of ketosis . In this state, ketone bodies become the main source of energy, which significantly changes the biochemical processes in the body. The liver, as a key metabolic organ, plays a central role in this process. This article discusses the biochemical mechanisms of the KD's effect on liver function, fat metabolism, and the possible risks associated with following this diet.

Keyword: Ketogenic diet (KD), beta-oxidation, lipolysis

Biochemical Mechanisms of Ketosis - is a metabolic state in which the level of ketone bodies (acetoacetate , beta -hydroxybutyrate and acetone) increases in the blood as a result of fatty acid oxidation. This process begins in the liver and has many biochemical aspects. Activation of beta-oxidation. With low levels of carbohydrates and insulin in the blood, fatty acid oxidation increases. The main stages of this process include:

- Formation of acetyl -CoA : Free fatty acids are activated and transported into the mitochondria where they undergo beta-oxidation to form acetyl- CoA .

- Ketogenesis : Acetyl- CoA is used to synthesize ketone bodies in liver mitochondria through a sequence of reactions catalyzed by enzymes such as 3-hydroxybutyrate dehydrogenase and thiolase .

Gluconeogenesis inhibition . KD results in gluconeogenesis inhibition , which reduces the need for glucose as an energy source. This occurs due to:

- Decreased insulin levels: low carbohydrate levels lead to decreased insulin secretion, which inhibits the synthesis of glucose from amino acids and glycerol .

- Increased glucagon levels: levels of glucagon, the hormone that stimulates gluconeogenesis , also decrease, which promotes the transition to ketogenesis .

Effect on lipid metabolism. The ketogenic diet affects the lipid profile by changing the metabolism of fats and their distribution in the body. Increased levels of triglycerides and LDL. Although high fat intake can lead to increased triglyceride levels, the KD tends to reduce LDL (bad cholesterol) and increase HDL (good cholesterol). This is due to:

- Increased lipolysis : KD activates fat breakdown processes, which helps reduce triglyceride levels.

- Changes in liver function: Improved lipid metabolism in the liver also leads to a decrease in LDL production.

Increased fat oxidation. KD activates fat oxidation pathways, which is important for reducing fat mass and improving metabolic health. This is due to:

- Activation of enzymes: increase in carnitine activity palmitoyltransferase , which is responsible for the transport of fatty acids into the mitochondria.

- Stimulation of mitochondrial function: increasing the number of mitochondria in liver cells, which increases the overall ability to oxidize fats.

Effects on the hepatobiliary system. The ketogenic diet affects bile secretion and gallbladder function, which can have both positive and negative effects.

Changes in bile composition . Since KD increases fat intake, it can change the composition of bile:

- Increased cholesterol levels: Increased cholesterol levels in bile can lead to the formation of gallstones.

- Changes in the ratio of bile acids: a decrease in the level of primary bile acids and an increase in secondary ones, which can affect the digestion and absorption of fats.

Gallbladder function. Long-term adherence to the KD can affect the functioning of the gallbladder:

- Dyskinesia: Some patients may experience gallbladder dyskinesia, which results in pain and discomfort after eating.

- Changes in motility : changes in bile secretion may reduce the efficiency of fat emulsification .

Biochemical risks and side effects: Despite the potential benefits, KD can also cause a number of negative biochemical changes in the body.

Risk of fatty liver disease. In some people, following a KD can lead to accumulation of fat in the liver, especially if the quality of fats in the diet is not adequately controlled:

- Steatosis : accumulation of fat in hepatocytes can lead to steatosis .

- Steatohepatitis : This condition can progress to liver inflammation and cause cell damage.

Digestive problems: Changes in diet can affect your gastrointestinal health:

- Constipation and diarrhea: Lack of fiber and changes in intestinal microflora can cause digestive problems.

- Dysbacteriosis: Changes in diet can lead to an imbalance in the gut microbiota , which affects overall health.

The ketogenic diet has a significant impact on the hepatobiliary system through a series of biochemical changes related to fat and carbohydrate metabolism. The liver and gallbladder can adapt to the changes, but it is important to consider individual characteristics and risks. Regular monitoring of liver function and hepatobiliary status is an important aspect of long-term adherence to the ketogenic diet.

Future research should focus on the deeper biochemical mechanisms underlying the effects of KD on the hepatobiliary system, as well as on optimizing approaches to its use to achieve the best results.

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