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CARBOHYDRATE METABOLISM CHARACTERISTICS IN THE FETUS DURING THE ANTENATAL PERIOD

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ANNOTATION*: The biochemical characteristics of the fetus in the late antenatal period largely determine the chemical composition and metabolic processes in the newborn's body. Fetal metabolism and biochemical indicators are influenced by both processes occurring within the fetus itself and those taking place in the mother's body, including the transport of metabolites through the placental barrier from the mother to the fetus.*

KEYWORDS: *antenatal, fetus, glucose, insulin, glycogen, diglyceride.*

RESEARCH OBJECTIVE

To study the biochemical characteristics of carbohydrate metabolism in the fetus during the antenatal period.

RESEARCH RESULTS AND DISCUSSION

During intrauterine development, carbohydrates serve as the primary energy source for the fetus. The state of carbohydrate metabolism in the fetus and newborns is determined by the maturity of endocrine regulatory mechanisms. Glucose transport through the placenta plays a crucial role in maintaining fetal homeostasis. However, the amount of glucose transferred to the fetus via the placenta is not constant, as maternal blood glucose levels fluctuate throughout the day. Changes in the insulin/glucose ratio in the fetus can lead to acute or long-term metabolic disorders.

During the last trimester of intrauterine development, glycogen stores in the fetal liver and muscles significantly increase. At this stage, glycogenolysis and gluconeogenesis become essential sources of glucose for the fetus.

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The presence of placental circulation creates unique metabolic features in the fetus, primarily characterized by limited oxygen supply. As a result, anaerobic glycolysis is intensified, leading to metabolic acidosis. Due to the relatively low oxygen content, the fetal tissues predominantly utilize the ancient anaerobic pathway of carbohydrate oxidation.

Glucose catabolism in the fetus proceeds through the aldose reductase reaction, converting glucose into sorbitol, which is then oxidized by sorbitol dehydrogenase into fructose. This explains the presence of fructose and sorbitol in fetal blood. In adults, this pathway is physiologically insignificant since glucose is primarily metabolized via glucokinase and hexokinase reactions.

The pentose phosphate pathway of glucose oxidation is highly active in the fetus, providing pentoses and $NADPH_2$, which are essential for nucleic acid synthesis, high-energy compounds, and lipids. The activity of the key oxidative enzyme of this pathway, glucose-6-phosphate dehydrogenase, is maximal in the fetus and decreases after birth.

Glycogen synthesis in the fetus is most active during the last 2–3 months of intrauterine development. By the final weeks of pregnancy, glycogen content in the liver reaches 10%, while in muscle tissue, it reaches 3%. The fetus also exhibits relative hypoglycemia.

Carbohydrate-digesting enzymes are synthesized in the fetal intestinal mucosa, participating in the breakdown of disaccharides into monosaccharides, which are then absorbed. By the 32nd week of pregnancy, their activity reaches 70% of the level found in full-term newborns. The key enzyme, lactase, develops more slowly and is only detected in trace amounts by the 30th–34th week of pregnancy, with its activity increasing towards the end of normal gestation.

CONCLUSION

Studying carbohydrate metabolism in the fetus during the antenatal period enables early detection, accurate diagnosis, and therapeutic correction of pathological conditions that may arise in the postnatal period.

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