PATHOMORPHOLOGICAL CHANGES IN THE STRUCTURAL COMPONENTS OF PANCREATIC TISSUE IN THE OFFSPRING OF DIABETIC MOTHER RATS (LITERATURE REVIEW)

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Annotation. *In recent years, diabetes mellitus has become a widespread endocrine disorder and a significant medical and social problem for many countries. This is often associated with the high frequency of various complications of the disease (blindness, small intestine insufficiency, myocardial infarction, gastrointestinal system disorders, gangrene of the limbs, etc.). These complications, in turn, lead to loss of working capacity and disability in patients. Although damage to various organs in diabetes mellitus has been extensively studied, unfortunately, the morphofunctional condition of organs, particularly the vascular and tissue structures of the stomach, has not yet been sufficiently explored in depth. To date, the morphofunctional features and pathogenesis mechanisms of organ damage in diabetes mellitus, especially the ante- and postnatal morphogenesis of internal organs and the pathomorphological mechanisms of damage in offspring born to diabetic mothers, have not been adequately investigated. However, an in-depth study of this disease opens up opportunities to influence the outcome of complications, and to improve the quality and effectiveness of treatment.Thus, the search for solutions to these issues highlights the relevance and significance of problems in this field.*

Keywords: *Diabetes mellitus, morphology, morphometry, stomach, postnatal ontogenesis, intact rats.*

According to the World Health Organization, in 2010 the number of patients with diabetes mellitus (DM) worldwide reached 285 million, and according to expert forecasts, this number is expected to rise to 435 million by 2030. In Russia, the prevalence of DM was recorded in 3.36 million patients in 2011, fluctuating between 1.5% and 3.5% of the total population [15]. In Moscow, the incidence of DM increases by 6–8% annually, primarily due to type 2 diabetes, reflecting global trends. A notable increase in the number of pregnant women suffering from gestational diabetes mellitus (GDM) has been observed globally, ranging from 1% to 14% (average 7%), with the figure in Moscow reaching up to 4% [13]. According to official statistics, over the last decade, the incidence of DM among pregnant women in the Russian Federation increased by 20% [14]. Despite GDM being a transient condition, it significantly affects the health of both mother and fetus during pregnancy. GDM is associated with complications such as severe gestosis, preterm birth, polyhydramnios, and placental insufficiency, which in turn may cause fetal hypoxia, delivery asphyxia, trauma, asymmetric macrosomia, and impaired fetal nutrition [7,8]. Even with intensive treatment and screening, the rate of complications among newborns from GDM mothers varies between 12% and 28% [10,11]. Studies show that infants born to GDM mothers are prone to respiratory and metabolic disorders, central nervous system lesions, and a high incidence of macrosomia [12]. These complications are often linked to hormonal imbalances in the mother-fetus-newborn system. According to [2], placental insufficiency and specific features of the fetoplacental complex in GDM may disrupt the fetal hormonal profile. Chronic intrauterine hypoxia along with dishormonogenesis impairs the

differentiation and formation of fetal organs and tissues, as well as the postnatal onset of their functions. It is also known that children born to GDM mothers may exhibit health disturbances not only at birth but also later in life [7]. Although long-term consequences of GDM for future generations are understudied, reports indicate increasing cases of adolescent obesity and early onset of insulin-dependent diabetes [8]. Timely diagnosis and appropriate treatment of GDM significantly reduce pregnancy and delivery complications, and decrease the incidence of diabetic fetopathy (DF), increasing the likelihood of a healthy birth to 97–98% [5,6]. Therefore, GDM mothers and their newborns are currently under close supervision by obstetricians, endocrinologists, and neonatologists [1,3,4]. DF remains the leading cause of neonatal disorders among children born to mothers with GDM. According to [9], in infants born to women with type 1 diabetes, 71.65% exhibit early childhood hypoglycemia and hypoproteinemia, while DF-positive infants also show elevated triglycerides (TG) and low-density lipoproteins (LDL). In their first year of life, these infants present significantly higher average glycemia levels than control groups, and during the second half of the year, TG, LDL, and cholesterol levels increase markedly. An inverse correlation was observed between breastfeeding duration and cholesterol levels: the earlier breastfeeding is stopped, the higher the cholesterol level ($r = –0.44$, $p = 0.049$). According to [7], diabetes during pregnancy leads to specific fetal changes, such as increased abdominal diameter and shortened femur length. These features are more pronounced in fetuses of mothers with diabetic nephropathy. The presence of DM in pregnant women leads to a 96.6% chance of syndrome development in their offspring, and this rate rises to 100% in cases of diabetic nephropathy. Insulin deficiency reduces glucose delivery to insulin-dependent tissues, resulting in chronic hyperglycemia, glucosuria, osmotic diuresis, and dehydration. Enhanced gluconeogenesis and lipolysis lead to metabolic acidosis and weight loss. In early infancy, the high demand for insulin and unique water-salt metabolism make infants prone to rapid dehydration, while acidosis may develop slowly or remain unmanifested. Aplasia or hypoplasia of the pancreas disrupts its exocrine function, although malabsorption syndrome usually appears after DM manifests clinically.

Conclusion. Our research indicates that diabetes mellitus is a globally prevalent disease. While its clinical-functional features, pathogenesis, and pathophysiology are well-studied, the pathomorphology and morphofunctional changes it induces—especially in offspring born to diabetic parents—remain insufficiently explored. These include the morphological alterations in internal organs caused by the disease, which require further investigation.

REFERENCES

1. Belousov Yu. A., Trefilov G. V. Morphological changes in some internal organs of white rats with alloxan diabetes // Endocrine mechanisms of regulation of the body's adaptation to muscular activity. – P. 233.
2. Boychuk T. N., Olenovich O. A., Gritsyuk M. I., Gozhenko A. I. Functional state abnormalities of the kidneys in the early period of experimental diabetes mellitus // International Endocrinology Journal. – 2017. – Vol. 13, No. 6. – Pp. 463-467.
3. Bolin E. H., Spray B. J., Mourani P. M., Porter C., Collins R. T. 2nd. Mortality among infants of diabetic mothers with hypertrophic cardiomyopathy // Journal of Maternal-Fetal & Neonatal Medicine. – 2022 Dec; 35(25): 9893-9899.
4. Kharitonova L. A. et al. Health status of children born to mothers with diabetes mellitus // Russian Journal of Perinatology and Pediatrics. – 2018. – Vol. 63. – No. 3. – Pp. 26-31.
5. Koshelskaia O. A. Features of intrarenal blood flow Doppler indicators in type 2 diabetes mellitus and its association with arterial hypertension: Scientific publication.

6. Kharitonova L. A., Papysheva O. V., Bogomaz L. V., Bogomaz D. S. Monitoring of children born to mothers with various carbohydrate metabolism disorders // St. Petersburg Gastroenterology. – 2019. – No. 2. – Pp. 45-46.

7. Kharitonova L. A., Papysheva O. V., Mayatskaya T. A. Functional activity and formation features of intestinal microbiota in children born to mothers with gestational diabetes mellitus // Higher School: Scientific Research. Materials of the Interuniversity International Congress. – Moscow, 2021. – Pp. 92-103.

8. Lysenko S. N. et al. The fetal pancreas in normal and diabetes-complicated pregnancies // Doctor. – 2013. – No. 8. – Pp. 62-64.

9. Mayatskaya T. A., Kharitonova L. A., Papysheva O. V., Zatevalov A. M. Formation of intestinal microbiocenosis in children born to mothers with gestational diabetes mellitus // Experimental and Clinical Gastroenterology. – 2021. – No. 1 (185). – Pp. 96-105

10. Oksuzyan A. V. Sialoglycoprotein metabolism in the small intestine tissues of rats with different stress resistance under dalargin administration in experimental diabetes conditions // Modern Problems of Science and Education. – 2019. – No. 1. – P. 24.

11. Palchikova N. A., Kuznetsova N. V., Kuzminova O. I., Selyatitskaya V. G. Hormonal and biochemical characteristics of alloxan and streptozotocin models of experimental diabetes // Siberian Scientific Medical Journal. – 2013. – Vol. 33, No. 6. – Pp. 18-24.

12. Yuldashev A. Yu. et al. Morphological features of fundic stomach mucosa formation in rats during postnatal ontogenesis // World of Medicine and Biology. – 2014. – Vol. 10. – No. 4-2 (47). – Pp. 214-219.

13. Yuldasheva S. Z., Abdiramonova S. A. Development of digestive-absorptive and immune systems in the small intestine mucosa during early postnatal ontogenesis // Innovative Processes in the Scientific Environment: International Scientific and Practical Conference Proceedings. – Perm: Aeterna LLC, 2017. – Pp. 220-226.

14. Zverev Ya. F., Rykunova A. Ya. Nephroprotective effects of new hypoglycemic drugs: SGLT2 inhibitors: review // Nephrology: scientific and practical peer-reviewed journal. – St. Petersburg: “Levsha” Publishing House. – 2021. – Vol. 25, No. 4. – Pp. 11-22.

15. Zatolokina M. A. Morphological features of the small intestine mucosa in embryos and newborn rats // Regional Bulletin. – 2020. – No. 12. – Pp. 11-12.