HOMILADORLIK DAVRIDA MIKROELEMENTLAR YETISHMOVCHILIGINING ONA VA HOMILA RIVOJLANISHIGA TA'SIRINI BAHOLASH: ZAMONAVIY DIAGNOSTIKA VA PROFILAKTIKA YONDASHUVLARI

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Annotatsiya. Homiladorlik davrida ona organizmida yuz beradigan fiziologik o'zgarishlar mikroelementlarga bo'lgan ehtiyojning oshishiga olib keladi. Temir, yod, rux, kalsiy, magniy, selen kabi muhim mikroelementlarning yetishmovchiligi ona salomatligi va homila rivojlanishiga salbiy ta'sir ko'rsatishi mumkin. Ushbu maqolada homiladorlik davrida mikroelementlar tanqisligining asosiy sabablari, klinik oqibatlari, diagnostika usullari hamda zamonaviy profilaktik yondashuvlar tahlil qilingan. Mikroelementlar yetishmovchiligi kamqonlik, immun tizimi faoliyatining pasayishi, homila o'sishining sekinlashuvi, muddatidan oldin tug'ruq va boshqa asoratlarning rivojlanish xavfini oshirishi mumkin. O'z vaqtida laborator diagnostika va ratsional ovqatlanishni tashkil etish ona va bola salomatligini saqlashda muhim ahamiyatga ega.[2,4]

Kalit so'zlar: homiladorlik, mikroelementlar yetishmovchiligi, temir tanqisligi, yod, rux, kalsiy, homila rivojlanishi, kamqonlik, profilaktika, diagnostika.

ASSESSMENT OF THE IMPACT OF MICRONUTRIENT DEFICIENCY DURING PREGNANCY ON MATERNAL AND FETAL DEVELOPMENT: MODERN DIAGNOSTIC AND PREVENTIVE APPROACHES

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Abstract. Physiological changes during pregnancy increase the demand for essential micronutrients required for maternal health and fetal development. Deficiencies of important elements such as iron, iodine, zinc, calcium, magnesium, and selenium may negatively affect pregnancy outcomes and fetal growth. This article analyzes the main causes, clinical consequences, diagnostic methods, and

modern preventive approaches related to micronutrient deficiencies during pregnancy. Micronutrient deficiency may contribute to anemia, impaired immune function, fetal growth restriction, preterm birth, and other pregnancy complications. Timely laboratory assessment, balanced nutrition, and appropriate supplementation strategies play an important role in maintaining maternal and neonatal health.[2,4]

Keywords: pregnancy, micronutrient deficiency, iron deficiency, iodine, zinc, calcium, fetal development, anemia, prevention, diagnosis.

ОЦЕНКА ВЛИЯНИЯ ДЕФИЦИТА МИКРОЭЛЕМЕНТОВ В ПЕРИОД БЕРЕМЕННОСТИ НА РАЗВИТИЕ МАТЕРИ И ПЛОДА СОВРЕМЕННЫЕ МЕТОДЫ ДИАГНОСТИКИ И ПРОФИЛАКТИКИ

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Аннотация. Физиологические изменения, происходящие в организме женщины во время беременности, приводят к повышению потребности в жизненно важных микроэлементах. Недостаток таких элементов, как железо, йод, цинк, кальций, магний и селен, может оказывать негативное влияние на здоровье матери и развитие плода. В статье рассмотрены основные причины дефицита микроэлементов, его клинические последствия, современные методы диагностики и профилактические мероприятия. Недостаток микроэлементов может способствовать развитию анемии, снижению иммунитета, задержке внутриутробного развития плода, преждевременным родам и другим осложнениям беременности. Своевременная лабораторная диагностика, рациональное питание и профилактическое применение необходимых микроэлементов имеют важное значение для сохранения здоровья матери и ребенка.[2,4]

Ключевые слова: беременность, дефицит микроэлементов, дефицит железа, йод, цинк, кальций, развитие плода, анемия, профилактика, диагностика.

Relevance of the Topic. Micronutrient deficiency during pregnancy remains one of the important public health problems worldwide because it can negatively affect both maternal health and fetal development. During pregnancy, the demand for essential micronutrients increases significantly due to intensive growth of fetal tissues, formation of organs, development of the nervous system, and increased metabolic requirements of the mother. Deficiency of key micronutrients such as iron, iodine, zinc, calcium, magnesium, and selenium may lead to serious complications, including anemia, impaired immune function, pregnancy complications, intrauterine growth restriction, and adverse neonatal outcomes.

Iron deficiency anemia is one of the most common nutritional disorders among pregnant women and is associated with increased risks of maternal fatigue, reduced physical capacity, premature birth, and low birth weight. Iodine deficiency can impair thyroid function and negatively influence fetal brain development, while insufficient levels of zinc, calcium, and other essential elements may affect bone formation, immune protection, and overall fetal growth.

Early detection and prevention of micronutrient deficiencies through laboratory screening, nutritional assessment, and evidence-based supplementation programs are essential components of modern obstetric care. The development and implementation of effective diagnostic and preventive strategies can improve pregnancy outcomes, reduce maternal and neonatal complications, and contribute to improving the quality of healthcare services.

Therefore, studying the consequences of micronutrient deficiency during pregnancy and developing modern approaches for its diagnosis and prevention is highly relevant for contemporary medicine and public health.[1,3]

Main Part. Pregnancy is a critical physiological period characterized by significant metabolic, hormonal, and structural changes in the maternal organism. During this period, the requirements for essential micronutrients increase considerably to support maternal health, placental function, fetal growth, and the development of vital organs and systems. Insufficient intake or impaired

absorption of micronutrients may result in deficiencies that negatively affect both the mother and the fetus.

Among the most common micronutrient deficiencies during pregnancy, iron deficiency has the greatest clinical significance. Iron plays an essential role in hemoglobin synthesis, oxygen transport, and cellular metabolism. Increased blood volume and the growing needs of the developing fetus significantly increase iron requirements. Iron deficiency can lead to anemia, which is associated with maternal weakness, reduced immunity, increased risk of infections, premature delivery, and low birth weight.

Iodine deficiency is another important nutritional problem during pregnancy. Iodine is necessary for the synthesis of thyroid hormones, which regulate fetal brain development, nervous system maturation, and metabolic processes. Insufficient iodine intake may contribute to impaired cognitive development, thyroid dysfunction, and growth abnormalities in the fetus.

Zinc is an essential trace element involved in DNA synthesis, cell division, immune regulation, and fetal tissue development. Zinc deficiency during pregnancy may increase the risk of impaired fetal growth, congenital abnormalities, prolonged labor, and weakened maternal immune responses. Adequate zinc levels are important for maintaining normal pregnancy progression and fetal development.

Calcium and magnesium also have significant roles during pregnancy. Calcium is required for the formation of fetal bones and teeth, as well as for maintaining maternal bone health. Magnesium participates in neuromuscular regulation, energy metabolism, and prevention of pregnancy-related complications. Deficiency of these minerals may contribute to muscle cramps, hypertension, impaired fetal skeletal development, and other adverse outcomes.

Selenium is an important antioxidant micronutrient involved in protecting cells from oxidative stress and regulating immune function. Selenium deficiency may affect thyroid activity, increase oxidative damage, and contribute to

pregnancy complications. Adequate selenium levels support normal placental function and fetal development.[6,7]

Modern diagnostic approaches for detecting micronutrient deficiencies include clinical assessment, dietary evaluation, and laboratory investigations. Measurement of hemoglobin, serum ferritin, thyroid hormones, vitamin and mineral concentrations, and specific biochemical markers allows early identification of nutritional disorders. Advanced diagnostic technologies improve the accuracy of deficiency detection and help develop individualized treatment strategies.

Prevention of micronutrient deficiencies during pregnancy requires a comprehensive approach, including balanced nutrition, health education, regular antenatal monitoring, and appropriate supplementation when necessary. Prenatal vitamin and mineral supplementation programs have demonstrated effectiveness in reducing the incidence of anemia, fetal growth disorders, and other pregnancy-related complications.

Thus, maintaining adequate levels of essential micronutrients during pregnancy is a key factor in ensuring maternal well-being and healthy fetal development. Early diagnosis, preventive measures, and individualized nutritional support are important components of modern obstetric care.[8,9]

Materials and Methods. This study was conducted based on the analysis of scientific literature and clinical research data related to micronutrient deficiencies during pregnancy and their impact on maternal and fetal health. Scientific publications from international databases, including PubMed, Scopus, Web of Science, and Google Scholar, were reviewed to assess current knowledge regarding the prevalence, diagnostic methods, and preventive strategies of micronutrient deficiency. The research materials included clinical and laboratory data obtained from pregnant women, focusing on the assessment of essential micronutrients such as iron, iodine, zinc, calcium, magnesium, and selenium. The evaluation methods included hematological parameters (hemoglobin, hematocrit,

erythrocyte indices), biochemical indicators (serum ferritin, serum iron, transferrin levels), hormonal markers (thyroid function indicators), and mineral status assessment. Clinical examination methods, dietary assessment questionnaires, and analysis of nutritional habits were used to identify risk factors associated with micronutrient deficiency. Laboratory diagnostic methods included biochemical analysis, immunological tests, and spectrophotometric techniques for determining the concentration of essential elements in biological samples. The collected information was analyzed using comparative, descriptive, and statistical methods. The relationship between micronutrient deficiency and pregnancy complications, including anemia, fetal growth restriction, preterm birth, and impaired neonatal outcomes, was evaluated.

The effectiveness of preventive measures, including balanced nutrition, prenatal supplementation, and regular antenatal screening programs, was also assessed. The obtained results were used to determine the importance of early diagnosis and individualized prevention strategies for reducing the negative consequences of micronutrient deficiency during pregnancy.

Conclusion. Micronutrient deficiency during pregnancy remains a significant medical and public health concern because of its potential negative effects on maternal well-being and fetal development. Adequate levels of essential micronutrients such as iron, iodine, zinc, calcium, magnesium, and selenium are necessary for maintaining normal physiological processes, supporting placental function, and ensuring proper growth and development of the fetus.

The analysis shows that deficiencies of these micronutrients are associated with increased risks of anemia, impaired immune function, fetal growth restriction, premature birth, and other pregnancy complications. Early identification of micronutrient deficiencies through clinical evaluation, laboratory screening, and nutritional assessment allows timely implementation of preventive and therapeutic measures. A comprehensive approach that includes balanced nutrition, regular antenatal monitoring, targeted supplementation, and health education plays an

important role in preventing micronutrient-related complications. Improving diagnostic strategies and strengthening preventive programs can contribute to better maternal and neonatal outcomes and improve the overall quality of pregnancy care.

Further research is needed to develop more effective individualized approaches for the early detection, prevention, and correction of micronutrient deficiencies during pregnancy.[9,10]

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