Nazaruk Viktoriia, student of higher medical education, Bukovinian State Medical University, Chernivtsi, Ukraine

Pecheriaha Svitlana, Candidate of Medical Sciences, assistant Department of Obstetrics, Gynecology and Perinatology, Bukovinian State Medical University, Chernivtsi, Ukraine, https://orcid.org/0000-0003-3884-9109

RATIONAL NUTRITION OF WOMEN DURING PHYSIOLOGICAL PREGNANCY

Abstract

Nutrition during pregnancy is one of the key modifiable factors determining the course of gestation and perinatal outcomes. The aim of this study was to summarize current scientific evidence on the characteristics of nutritional support in physiological pregnancy and to assess the role of macro- and micronutrients in shaping maternal and fetal health. The paper analyzes findings from recent systematic reviews, meta-analyses, and cohort studies, which confirm the significant impact of both the quantitative and qualitative composition of the diet on intrauterine development. It has been demonstrated that low dietary diversity and a high inflammatory potential of the maternal diet are associated with an increased risk of low birth weight and intrauterine growth restriction. The crucial role of macronutrients has been established: adequate protein intake is essential for fetal tissue growth, the quality of dietary fats influences the development of the nervous system, and carbohydrates ensure stable energy balance. Particular attention is given to micronutrients, including folates, iron, iodine, vitamin D, and choline, which are involved in organogenesis, neurodevelopment, and metabolic programming. It is substantiated that nutrient deficiencies or imbalances during pregnancy may lead to obstetric complications and adversely affect long-term child health outcomes. At the same time, rational, balanced, and diverse nutrition

is considered an effective tool for the prevention of intrauterine developmental disorders. The need for an individualized approach to nutritional support for pregnant women is emphasized, taking into account metabolic demands, regional characteristics, and lifestyle factors. Thus, optimization of nutrition during pregnancy is an essential component of modern prenatal care and is aimed at improving both short-term and long-term health outcomes for the mother and child.

Keywords: maternal nutrition, physiological pregnancy, macronutrients, micronutrients, healthy diet, birth weight, perinatal outcomes.

Problem statement. Modern approaches to the management of physiological pregnancy identify nutrition as one of the key modifiable factors that directly influences the course of gestation and perinatal outcomes. Despite the availability of numerous recommendations, the issue of optimizing nutritional support for pregnant women remains relevant, which is associated with the high prevalence of both deficient and imbalanced diets, insufficient awareness of diet quality, and the lack of an individualized approach to nutritional care. Particular importance is attributed not only to the quantitative but also to the qualitative composition of the diet, including its diversity, inflammatory potential, and adequacy of macro- and micronutrient intake, which necessitates further synthesis of current scientific evidence and its implementation into clinical practice.

Analysis of recent research and publications. Recent studies confirm the significant role of maternal diet quality in shaping perinatal outcomes. In particular, the systematic review and meta-analysis *Association between maternal dietary diversity during pregnancy and birth outcomes* conducted by Amare Abera Tareke et al. (2024) demonstrated that low dietary diversity is associated with an increased risk of low birth weight and intrauterine growth restriction. At the same time, an individual participant data pooled analysis of seven European cohorts

within the ALPHABET consortium, performed by Ling-Wei Chen et al. (2021) in the study *Associations of maternal dietary inflammatory potential and quality with offspring birth outcomes*, showed that a high inflammatory potential of the maternal diet is correlated with lower birth weight and a higher risk of small-for-gestational-age infants. In contrast, a higher-quality, balanced, and anti-inflammatory diet is associated with improved intrauterine development outcomes. These findings indicate that not only the quantitative composition of the diet, but also its qualitative characteristics - particularly diversity and inflammatory potential - are important modifiable determinants of pregnancy course and offspring health [1-2].

Some studies indicate that a pro-inflammatory maternal diet is associated with lower birth weight and poorer growth outcomes in children later in life. The meta-analysis *Dietary Inflammatory Index during pregnancy is associated with birth weight and child anthropometry up to 10 years old* and the study *Maternal Dietary Inflammatory Potential and Offspring Birth Outcomes in a Chinese Population* confirm that the inflammatory potential of the diet is an important factor influencing perinatal outcomes and subsequent child development [3-4].

Purpose of the article. The aim of this study is to summarize current scientific evidence on the characteristics of nutrition during physiological pregnancy, to assess the role of macro- and micronutrients in ensuring normal gestational progression and fetal development, and to identify key directions for optimizing nutritional support for pregnant women from an evidence-based perspective.

Presentation of the main material of the study. The gestational period is characterized by a complex of metabolic, physiological, and hormonal changes that lead to increased nutritional and energy requirements aimed at supporting placental and fetal growth. During this period, adherence to a balanced diet increases the likelihood of full-term pregnancy, reduces the risk of obstetric

complications, and creates favorable conditions for achieving normal birth weight [5–7].

As fetal growth progresses, maternal metabolism also increases, leading to higher nutritional demands. However, in the first trimester, there is no need for additional caloric intake [8]. In contrast, during the second and third trimesters, the basal metabolic rate increases by approximately 390 kcal/day [9]. Accordingly, an additional intake of 360 kcal/day in the second trimester and 475 kcal/day in the third trimester is recommended [10].

Optimal gestational weight gain depends on pre-pregnancy BMI. For underweight women (<18.5), total gain is highest, while it decreases progressively for normal weight, overweight, and obese women. Recommended ranges across trimesters are lower with increasing BMI, serving as guidance for monitoring appropriate weight gain during pregnancy [11].

Analysis of current guidelines indicates that the optimal macronutrient distribution is 15–20% protein, 30–35% fat, and 35–50% carbohydrates [15]. Particular attention should be paid to the increased protein requirements for the synthesis of maternal and fetal structural tissues, which amount to 46 g/day (0.8 g/kg/day) in the first trimester and 71 g/day (1.1 g/kg/day) in the second and third trimesters [12].

In a prospective cohort study led by Hanyue Zhang, the impact of protein intake during pregnancy on the risk of obesity in mothers and their children was investigated. The authors found that not only the quantity but also the source of protein plays an important role in metabolic programming of the offspring. In particular, inadequate or imbalanced protein intake was associated with an increased risk of metabolic disorders, including obesity, in both mothers and their children later in life. The study highlights the importance of high-quality protein intake during pregnancy as a factor influencing long-term health outcomes [13].

In a study conducted by Jiaomei Yang et al., (2025) the association between protein intake and birth weight among pregnant women with low-protein diets was evaluated. It was shown that insufficient protein intake is significantly associated with lower birth weight and an increased risk of small-for-gestational-age infants. The authors concluded that adequate protein intake is critically important for normal fetal growth, particularly in populations at risk of nutritional deficiencies [13].

Fats are not only an important source of energy but also essential components of cell membranes, playing a key role in the development of the fetal nervous and visual systems, particularly polyunsaturated fatty acids such as long-chain omega-3 fatty acids [16]. At the same time, the quality of dietary fats is equally important, including the need to minimize or eliminate trans fats and to reduce saturated fat intake to less than 10% of total energy intake. Adequate intake of omega-3 and omega-6 fatty acids is recommended, including 250 mg/day of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), and 13 g/day of omega-6 fatty acids. Cholesterol intake is recommended to be less than 200 mg/day [17].

Carbohydrates play a central role in maintaining physiological glucose levels in maternal and fetal blood, with a recommended intake of at least 175 g/day. The glycemic index is important: values >70 are associated with rapid absorption, whereas <55 indicates slower metabolism. High-GI foods include white flour, rice, and potatoes, while whole grains, vegetables, legumes, and some fruits have a low GI. Carbohydrates are classified into simple and complex forms, with the latter being preferable due to slower digestion and absorption [19, 20]. Dietary fiber, a type of complex carbohydrate, further supports glycemic control and intestinal function, with a recommended intake of 28 g/day [21, 22].

Folate (the synthetic form is folic acid) is one of the most important cofactors in nucleotide synthesis and DNA methylation. Given the rapid

proliferation of fetal cells, it is critically important for neural tube formation during the first 28 days of pregnancy. Recent literature reviews confirm that normalization of maternal folic acid levels reduces the risk of neural tube defects [23, 24]. Women are recommended to take 0.4–0.8 mg daily starting 1–3 months before conception and continuing throughout pregnancy. Increasing attention is being given to obtaining folate from dietary sources rather than supplements, including dark green leafy vegetables (spinach, broccoli, parsley), legumes (lentils, chickpeas, peas, beans), liver, and citrus fruits (oranges, grapefruit). Authors Anne-Lise Bjørke-Monsen and Per Magne Ueland (2023) also analyze the potential risks of both deficiency and excessive folic acid intake, highlighting the possibility of masking vitamin B_{12} deficiency and other clinical consequences. A significant part of their work focuses on evaluating the effectiveness of food fortification programs with folic acid and their impact on population health outcomes [24].

Particular attention should be paid to iron intake, as it is a key element for oxygen transport (a component of hemoglobin) and fetal organogenesis through erythropoiesis. Iron deficiency anemia in pregnancy is associated with an increased risk of preterm birth, low birth weight, and impaired development of the fetal central nervous system [25]. During gestation, hemoglobin concentration changes due to a 40–50% increase in maternal plasma volume starting at 6–8 weeks and peaking at 32 weeks, leading to hemodilution of erythrocytes [27]. Therefore, screening for iron levels is recommended using a complete blood count at the first prenatal visit and again after 28 weeks of gestation. The total iron requirement during pregnancy reaches 1000–1200 mg [28], and hemoglobin levels below 11 g/dL indicate anemia throughout pregnancy. Due to increased demand, prophylactic supplementation with 30–60 mg of elemental iron orally is recommended, taken in the morning either 1 hour before or 2 hours after meals. Vitamin C intake is considered beneficial to enhance iron absorption [26]. Despite

existing recommendations and numerous clinical observations confirming the effectiveness of iron supplementation in pregnancy, further expansion of the evidence base regarding its routine use remains an актуальне area for future research.

Iodine is a critically important element for the synthesis of thyroid hormones T3 and T4, which regulate cellular growth and basal metabolism and are essential for the development of the embryonic nervous system, as well as neuropsychological development and cognitive function. Due to transplacental transfer and increased renal clearance, iodine requirements increase during pregnancy [29]. However, recent systematic reviews indicate the absence of routine screening for iodine deficiency in pregnant women [30]. At the same time, in regions where iodine deficiency is prevalent, prophylactic supplementation is recommended. A comprehensive review of the literature has shown a positive effect on iodine status with supplementation at a dose of 200 μg/day, although some studies report no significant therapeutic effect [31, 32]. Currently, an individualized approach that takes into account regional factors, dietary habits, and thyroid function is considered the most appropriate.

Vitamin D is a fat-soluble vitamin essential for the regulation of calcium and phosphate levels, which are crucial for bone metabolism and mineralization [32]. Mineral content and bone mineral density are associated with fetal skeletal strength and a reduced risk of perinatal complications and fractures. A review of 23 studies demonstrated that vitamin D supplementation is associated with increased neonatal length [33], while another study identified a relationship between maternal vitamin D intake and increased fetal weight [34]. Additionally, a reduction in the risk of preeclampsia (by 44.8%) has been observed with vitamin D supplementation [35]. The median recommended supplementation dose to meet maternal and fetal needs is 2000–4000 IU/day, as reported by Wen-Chien Yang, Ramaa Chitale, and all. [36]. Therefore, it can be concluded that implementing

screening for 25(OH)D levels in pregnant women and appropriate supplementation is important in current clinical practice.

Choline is an essential micronutrient that plays a key role in phospholipid synthesis (a structural component of cell membranes), acetylcholine production, and methyl group metabolism. During pregnancy, its requirement increases, with its primary role being in neurogenesis, myelination, and the development of cognitive functions in the fetus [37]. In Europe and beyond, choline intake among adults has remained insufficient over the past decade [38]. Randomized cohort studies have demonstrated beneficial effects of choline intake up to 1 g/day during the second half of pregnancy on the child's neurocognitive development. Conversely, inadequate intake of this nutrient has been associated with a higher risk of developmental disorders [37]. The National Academy of Medicine recommends 450 mg/day of choline up to 12 weeks of pregnancy and 550 mg/day thereafter [39, 40]. Rich sources include animal products (eggs, meat, fish), while plant sources contain lower amounts. Current trends favor dietary intake over supplementation.

Conclusions. The obtained data indicate that balanced nutrition is a fundamental component of prenatal care and one of the leading factors in the prevention of obstetric and perinatal complications. Diet quality - including its diversity, adequate energy intake, and sufficient intake of key nutrients - has a direct impact on fetal intrauterine development, the formation of organs and systems, and long-term child health outcomes. At the same time, maternal nutritional status has been shown to be a modifiable factor, the optimization of which can improve the course of pregnancy and perinatal outcomes. A promising direction for future research is the development of individualized approaches to maternal nutrition, taking into account regional, metabolic, and genetic characteristics.

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