International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

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ARTICLE TITLE	IS SUPPLEMENTATION IN PREGNANCY NECESSARY? A REVIEW OF CURRENT RECOMMENDATIONS
DOI	https://doi.org/10.31435/ijitss.4(48).2025.4365
RECEIVED	27 October 2025
ACCEPTED	20 December 2025
PUBLISHED	26 December 2025
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IS SUPPLEMENTATION IN PREGNANCY NECESSARY? A REVIEW OF CURRENT RECOMMENDATIONS

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ABSTRACT

Background: Pregnancy is a challenging time for women both physiologically and emotionally. With much conflicting evidence regarding safety and necessity of supplementation it is crucial to understand the role of supplementation in prenatal care and rely only on the most current, high-quality, evidence-based recommendations and clinical guidelines to ensure appropriate maternal and fetal health.
Aim: The aim of the study was to summarize recommendations regarding the role of supplementation in pregnant women in Poland.
Material and methods: A structured non-systematic literature review was conducted using Pubmed and Google Scholar online databases. Search terms included “pregnancy”, “supplementation”, “vitamins”, “minerals”. Polish and international guidelines were also included in this review.
Results: Based on the review supplementation with folic acid, vitamin D, and iodine is recommended for all pregnant women. Supplementation with iron and docosahexaenoic acid (DHA) may also be advised in certain cases, depending on individual nutritional status, risk factors, and clinical evaluation.
Conclusions: Implementing appropriate, evidence-based, and individualized supplementation strategies during pregnancy plays a significant role in reducing the risk of adverse maternal and neonatal outcomes. Healthcare professionals should stay informed and offer clear, evidence-supported guidance on supplementation to ensure optimal prenatal care.

KEYWORDS

Pregnancy, Supplementation, Vitamins, Minerals

CITATION

Ewa Antonowicz, Dominika Kondyjowska, Natalia Bukała, Dorota Maria Komuńska, Zuzanna Sawiec, Sylwia Tomasiczek, Weronika Tomasiczek, Marta Rogozińska. (2025). Is Supplementation in Pregnancy Necessary? A Review of Current Recommendations. *International Journal of Innovative Technologies in Social Science*. 4(48). doi: 10.31435/ijitss.4(48).2025.4365

Introduction

During pregnancy, a series of complex physiological and psychological changes occur for the purpose of optimal fetal growth. This situation demands an increase in macro and microelements and it is commonly known that the fetus completely depends on the mother for growth and development. It is often a time when expectant women aim to implement healthy lifestyle changes, with dietary changes being one of them. Unfortunately modern, everyday diet is often insufficient in covering the nutritional needs for microelements, vitamins and minerals. With the growing dietary supplement market the urge to take more and more supplements is rising. Therefore it is essential to understand which of them may be beneficial and reduce risks of negative outcomes.

A healthy diet with an adequate intake of energy, macro and microelements is essential for both maternal and fetal needs and should be attained from various sources such as fruits, vegetables, meat, fish, beans and grains. Supplementation should be considered only in addition to a well balanced diet, not as a replacement. [1-3]

Folic Acid

Foliate play is critically needed in the synthesis of nucleic acids and proteins in rapidly proliferating tissues, including fetus and trophoblast. Foliate supplementation in the form of folic acid is a well established and widely accepted form of prevention of fetal neural tube defects such as spina bifida and anencephaly. It is important to acknowledge that neural tube closure happens during early embryonic development, usually 3-4 weeks post fertilization, often before a woman is aware she is pregnant [4]. Several food safety agencies successfully implied mandatory folic acid fortification to reduce the prevalence of neural tube defects [5], currently this type of fortification is not implemented in Poland. One of concerns regarding folic acid use is the risk of masking inadequate levels of vitamin B12 which is necessary in metabolism of folate. During B12 deficiency, folate is unable to convert from 5MTHF to THF and becomes “trapped” in methylated form, failing to support further enzymatic pathways, leading to elevated homocysteine blood level which is proven to be a risk factor for dementia, stroke, recurrent early pregnancy loss, endothelial cell injury, and cardiovascular disease [6,7]. 5-methyltetrahydrofolate (5-MTHF) is a highly bioavailable form of folate that constitutes up to 98% of folate in serum, and can be directly integrated into the folate cycle. In contrast to folic acid, it does not have a tolerable upper intake level and does not mask B12 deficiency [8]. It should be noted that genetic polymorphisms in genes encoding proteins involved in folate metabolism are fairly frequent, with the MTHFR 677C>T variant having the greatest clinical significance. This variant reduces enzyme activity, thereby impairing the conversion of folic acid to its biologically active form. Supplementation of active 5-MTHF form eliminates the effect of genetic polymorphisms bypassing the multistep process of folic acid conversion [9].

Current recommendation suggest:

Use 400 μg 5-MTHF and 400 μg of folic acid in all women of reproductive age, as a supplement to a natural, folate-rich diet, supplement 800 μg 5-MTHF during pregnancy and lactation in a population of women with no additional risk factors. In women who have previously given birth to a child with a neural tube defect, supplementation with 5 mg of folate per day is recommended. In women preparing for pregnancy, folate supplementation is recommended at least 12 weeks prior to planned conception, with a daily intake of 400 μg 5-MTHF and 400 μg folic acid advised during the periconceptional period. [7].

Iron

Iron is one of the essential trace minerals in the human body with up to 80% of it being incorporated into hemoglobin. [10] The absorption of iron from diet depends on many factors, the most important one being the form of it. Dietary iron occurs in two forms, heme iron that can be found in animal food such as meat, fish, poultry and nonheme iron that comes mostly from plant based food like grains, legumes and vegetables. Heme iron contributes to 10–15% of the total iron intake, however it is better absorbed resulting in accounting for more than 40% of total intestinal iron absorption. Bioavailability of nonheme iron can be enhanced by consuming food rich in ascorbic acid alongside meals and avoiding calcium, phytates, polyphenols that can inhibit the absorption. Interestingly, including even small amounts of heme iron into a meal that contains larger amounts of nonheme iron can increase its absorption due to the synergistic effect between the two forms [11, 12]. In response to increased maternal plasma and blood volume, elevated fetal requirement for metabolic and oxygen delivery, and placenta's ability to store iron to buffer against periods of low supply, overall maternal iron requirement is increased by 1mg in the first trimester and 7,5mg in third [13]. Iron deficiency is the most common cause of anemia amongst pregnant women. It has been associated with a variety of adverse outcomes, such as premature birth, intrauterine growth restriction, low birth weight and perinatal complications[14]. Routine screening for anemia consisting of Complete Blood Count (CBC) and ferritin level performed at first prenatal visit. CBC should also be performed at 15–20, 27–32, 33–37 and 38–39 weeks of gestation. Other iron biomarkers such as serum iron levels, total iron-binding capacity (TIBC) and transferrin saturation (TSAT), iron concentration × 100/TIBC (normal values 20–50%) and hepcidin should also be considered [15, 16]. To differentiate other causes of anemia serum vitamin B12 and folic acid levels should be evaluated. According to the Polish Society of Gynecologists and Obstetricians hemoglobin concentration < 11 g/dL at any point of pregnancy or < 10 g/dL in puerperium is considered anemia in pregnancy[13]. Iron deficiency can exist without the presence of anemia, when demand for iron is higher than intake. Meta-analysis conducted in 2014 demonstrates findings from trials comparing daily oral iron supplementation to no iron or placebo. Women supplementing iron had lower risk of low birth weight and premature birth. Oral iron intake reduced the risk of anemia at birth but increased the risk of high hemoglobin concentration during the second and third trimesters[15]. Limiting factors of oral iron supplementation are gastrointestinal side effects that include nausea, vomiting, constipation, diarrhea and metallic taste in the mouth [17]. In anemic patients when oral augmentation is inadequate intravenous therapy may be considered; however currently it is limited only to the second and third trimester [13].

Current recommendation suggest:

Iron supplementation in pregnant women at the daily dose of up to 30 mg should be recommended only to non-anemic women, with ferritin levels under 60 mcg/L after 16 weeks of gestation.

Women with non-anemic iron deficiency should receive a daily dose of 65 mg elemental iron. In iron deficiency anemia, the initial daily dose of 60–200 mg elemental iron is recommended. [13]

Vitamin D

Vitamin D is a group of fat soluble vitamins with a wide range of pleiotropic effects. The two most important compounds in this group are vitamin D3 (cholecalciferol) and vitamin D2 (ergocalciferol). It is essential in maintaining calcium-phosphate. Vitamin D deficiency may result in reduced absorption of those micronutrients leading to creation of biochemical abnormalities such as hypocalcemia, hypophosphatemia and elevated alkaline phosphatase levels. Low serum calcium triggers secretion of parathyroid hormone (PTH) resulting in secondary hyperparathyroidism, increased bone turnover and decreased mineralisation of skeletal bones. These processes can ultimately lead to osteopenia and osteoporosis [18]. Although the human body may synthesize vitamin D endogenously through sun exposure, all epidemiological data suggest that hypovitaminosis is a common public health issue in Poland caused by many factors including inadequate skin synthesis and insufficient dietary intake, obesity, chronic liver and kidney disease. [19]. Optimal levels of vitamin D is still a topic of debate amongst scientists but most of them agree that it is likely to fall within the range of serum 25(OH)D levels between 50 and 75 nmol/L (20–30 ng/mL). The same guidelines apply to pregnant women, as well as to those who are women planning pregnancy or breastfeeding. [18, 20]. Low maternal vitamin D serum concentration has been linked to many adverse outcomes such as preterm birth, small-for gestational age/low birth weight infants, recurrent miscarriage, bacterial vaginosis and gestational diabetes mellitus [21]. Supplementation may reduce risk of preeclampsia and consequently risk of neonatal or fetal death, however it is still unknown whether the benefits are greater for women who continue to have a vitamin D deficiency or/and those who achieve optimal serum vitamin D levels. Further, quality, randomized clinical trials are needed to identify the most effective therapy[22]. Vitamin D also contributes to the prevention of depression, in part by modulating inflammatory cytokines in the central nervous system, controlling neurotransmitter synthesis such as serotonin, dopamine, adrenalin, noradrenaline and modulating the expression of calcium homoeostasis genes [23]. Many studies have looked into correlation between vitamin D concentrations and development of depression during pregnancy and postpartum. Low serum levels measured during pregnancy, at birth and up to 10 weeks after birth are associated with increased risk of developing depression, however not all research consistently supports the presence of the effect [24, 25].

Current recommendation suggest:

Vitamin D supplementation should start before conception in the same doses as for the general population, preferable under control of serum 25(OH)D concentration, after confirming pregnancy serum 25(OH)D level should sustain within optimal ranges (>30-50ng/mL), if this assessment is not possible, it is recommended to use a dose of 2000IU/day during pregnancy and lactation. To enhance the absorption of vitamin D, supplements should be taken with a meal containing fat [18, 20].

Iodine

Iodine is an essential micronutrient required for synthesis of thyroid hormones thyroxine (T4) and triiodothyronine (T3) which are required for neuronal migration, myelination, and synaptic transmission-processes that are essential for normal fetal development. A significant amount of studies have shown correlation between severe iodine deficiency and irreversible brain damage, neurocognitive delay, congenital iodine deficiency syndrome, fetal hypothyroxinemia [26, 27]. It is one of the most common micronutrient deficiencies in the world and it is the leading preventable cause of brain damage [28]. Mandatory salt iodisation regulation in WHO European Region contributed to eliminating severe iodine deficiency. Mild deficiency is still a concern in some central European countries, including Poland, where Median Urinary Iodine Concentration (µg/L), a diagnostic marker of iodine intake, in pregnant women is still insufficient (112 (95% BCI 98, 124; IQR 44, 179) [29]. During pregnancy iodine demand rises due to increased production of thyroid hormones, renal loss and iodine transfer to fetus. In response to iodine deficiency resulting in inadequate thyroid hormone production, the hypothalamic pituitary axis activates a negative feedback mechanism, resulting in elevated secretion of thyroid stimulating hormone (TSH). Prolonged TSH stimulation induces thyroid hyperplasia and hypertrophy, which may present as goitre, one of the earliest visible signs of iodine deficiency [30, 31]. While severe iodine deficiency can have devastating consequences for the child, mild to moderate deficiency may lead to more subtle yet significant effects on the developing fetus. Consequences include increased risk of language delays, lower IQ, reduced reading and motor skills, and impaired psychomotor development in children [30]. Several meta-analysts and systematic reviews confirmed the connection between maternal iodine deficiency and intellectual outcomes in children, suggesting association between maternal high TSH and/or low T4 levels in the serum and impaired neurological development and behavioral issues in children[32].

Current recommendation suggest:

Supplement iodine in all pregnant women with no history of thyroid gland disease at a dose of 150–200 mcg per day,

Supplement iodine in women with thyroid gland disease while controlling thyroid hormones and the concentration of anti-thyroid antibodies [16].

DHA

Docosahexaenoic acid (DHA) is long chain polyunsaturated fatty acid (LCPUFA) of the omega-3 family that is a vital component of gray matter of the brain as it is crucial in the development of myelin sheath, which supports efficient nerve conduction. It can also be found in the photoreceptor cells of the retina and is essential for retinal maturation. It is widely recognized that DHA plays an important role in the fetal neurological development. During pregnancy maternal DHA requirements increase significantly as the fetus relies solely on material intake. The highest demand occurs in the third trimester, which coincides during the final stages of brain development. [33, 34]. One study suggests that children of mothers who used DHA supplementation during pregnancy had significantly better problem-solving skills and higher scores for eye and hand coordination than those in the placebo group[35], however, a systematic review conducted in 2018 reported very few differences in cognition, IQ, vision, other neurodevelopmental and growth outcomes, language, and behavior between omega-3 supplementation during pregnancy and no supplementation [36]. Evidence shows that low DHA plasma levels may be associated with an increased preterm birth risk. It was found that women with the percentage of plasma DHA + EPA in total fatty acids < 1.6% had a 10.27 time higher risk of early preterm birth (<34 weeks) than the women with concentration above 1,8% [37]. DHA supplementation has been shown to play a protective role in reducing the incidence of both preterm and early preterm births. Among mothers who received omega 3 supplementation during pregnancy, incidents of preterm birth (<37 weeks) and early preterm birth (<34 weeks) were significantly lower than those without supplementation [36].

Current recommendation suggest:

Supplement at least 200 mg of DHA in all pregnant women, consider using higher doses of DHA in women consuming small amounts of fish during pregnancy and in the preconception period. Use 1,000 mg of DHA daily in the group of women at risk of premature birth [16].

Conclusions

Ensuring maternal supplementation during pregnancy is key component of prenatal care, influencing both maternal and fetal well-being. This strategy may contribute to optimal health outcomes, reducing risks and support development throughout gestation. The Polish Society of Gynecologists and Obstetricians currently recommends that every pregnant woman should supplement folates, vitamin D and iodine. Additionally some women may benefit from supplementation of iron and DHA. Folic acid is vital for neural tube development and may help with the risk of congenital anomalies. Iron is essential to meet the increased demands of pregnancy and to prevent anemia-related complications. Vitamin D influences bone health, immune modulation, and may play a role in mood regulation. Iodine is crucial for fetal neurological development. DHA, as a structural component of the brain and retina, supports neurodevelopment and helps reduce the risk of preterm birth. Clinical guidelines endorse individualized supplementation plans, however these should not replace a nutrient-rich diet, which should remain the primary source of essential vitamins and minerals. Nonetheless, supplementation is often necessary to meet the increased physiological demands of pregnancy. By following evidence-based strategies, we can improve pregnancy outcomes with lasting implications for both maternal and child health.

Disclosure
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All authors have read and agreed with the published version of the manuscript.

Funding Statement: This research did not receive any special funding or grants for conducting this research.
Institutional Review Board Statement: Not applicable.
Informed Consent Statement: Not applicable.
Data Availability Statement: Not applicable.
Acknowledgments: Not applicable.
Conflict of Interest Statement: Authors have declared no conflict of interests.

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