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Comparison of Polish and international guidelines on diet supplements in pregnancy — review

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ABSTRACT

Proper nutrition is an important element that determines the course of pregnancy. Unfortunately, the everyday diet is not always able to cover the increased in pregnancy essential vitamins and minerals requirements. Therefore, pregnant women often use dietary supplements. This study aimed to compare Polish and international recommendations regarding dietary supplementation during pregnancy. The Polish Society of Gynaecologists and Obstetricians (PSGO) recommends in every pregnant woman the dietary supplementation of folates, vitamin D and iodine.

Additionally, the benefits of iron supplementation in pregnant women with anemia or at high risk of developing anemia are also highlighted. In the light of Polish guidelines, the magnesium supplementation is recommended in the condition of its reduced level in blood. In the case of limited consumption of DHA (docosahexaenoic acid), Polish guidelines recommend in pregnant women's diet, at least 600 mg of DHA every day. Still, in case of the high risk of premature birth — at least 1000 mg DHA a day during the entire pregnancy period should be taken.

Key words: diet supplements; gestation; pregnancy; polish recommendations

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INTRODUCTION

Diet supplements cover a wide range of products which, due to their vast diversity, are hard to be precisely defined. Still, there is no consensus of international societies and scientific bodies regarding the definition of diet supplements, and the preparations that should be included in this group. Polish legal regulations specify that a diet supplement is "a food product whose purpose is to supplement the standard diet. Being a concentrated source of vitamins or mineral ingredients, or other substances demonstrating nutritious or other physiological effect, single or combined, traded in a form allowing dosing the substances, in the form of capsules, tablets, dragées, and other similar forms, pouches with powder, ampoules with liquid, bottles with a dropper, and other similar forms of liquids and powders intended for consumption in small, measured unit amounts, with the exclusion of medicinal products, as defined in the regulations of pharmaceutical law" [1]. However, other countries' regulations describe diet supplements very inhomogeneously, defining them as natural health products (NPH), supplementary medications, or nutritional supplements. A product which is considered a diet supplement in one country, and to which the regulations of food safety apply, in another may be a therapeutic mean or a substance subject to strict control, and pharmaceutical law may regulate its production. The situation is complicated even more by the traditional medicine of Far-East countries, which may consider a diet supplement a substance which is not admitted for trading in other countries [2]. It is also to believe that many dietary supplements which are traditionally considered beneficial for health are lacking reliable proof that they affect, or studies examining such products are very limited in number.

Moreover, we must remember that nowadays, diet supplements are mostly compound products that considerably hinder the definition of the potential effect of a given product on human's health [2]. The above issues indicate the need to introduce reliable research in line with

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evidence-based medicine (EBM) doctrine and concerning potential benefits of the use of diet supplements. This matter is particularly important in such a sensitive period as pregnancy, both from the developing child and maternal requirements, especially as regards the exposure to a metabolic disorder such as gestational diabetes.

The aim of this study is to compare Polish and international recommendations regarding dietary supplementation during pregnancy.

METHODS

This review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement checklist. Data search of this review was performed in the Web of Science and PubMed databases ("all databases search"). The combinations of the following terms were used: "dietary supplementation" or "vitamins supplementation" or "minerals supplementation" or "supplementation" or "diet supplementation" or "DHA" or "folic acid" or "PUFA" or "iron" or "vitamin D" or "magnesium" or "zinc" and "pregnancy" or "gestation", or "polish society of gynecologists", "polish gynecologist society". The search criteria were narrowed down to articles with Polish affiliation. Papers with another affiliation were included exceptionally, only if provided important information essential to interpret included articles. The initial screening of title, abstract, and keyword were performed using the following filters: "supplementation", "vitamins", "minerals", "Polish recommendations", "polish society of gynecologists", "polish gynecologist society", "gestation", "pregnancy", "gestational". We systematically and thoroughly examined the reference lists of searched publications to identify both direct and indirect evidence to meet the aim of the review. We included papers from 2009 to December 2019. Only publications that were conducted human-only (both review and clinical trial) were included. We excluded case reports. Studies with data duplications, not in English or Polish, not with Polish affiliation, or published before 2009, were excluded.

From the Web of Science and PubMed databases ("all databases" search), 219 titles were found and assessed by two independent reviewers. After the titles were read, 117 abstracts were excluded. The remaining 102 articles were screened, and 91 were excluded. After the selection process, a total of 11 articles were included in the review (Fig. 1).

The Polish Society of Gynaecologists and Obstetricians (PSGO) informs that, besides the recommendation concerning supplementation of folates, currently there are no separate guidelines on supplementation of microelements and vitamins in patients with gestational diabetes. However, the need to supplement vitamins and microelements in pregnancy after bariatric surgeries and partial gastrectomy is emphasized [3, 4].

RESULTS

The results of the literature review of the Polish recommendations on the diet supplementation in pregnancy are presented in Table 1.

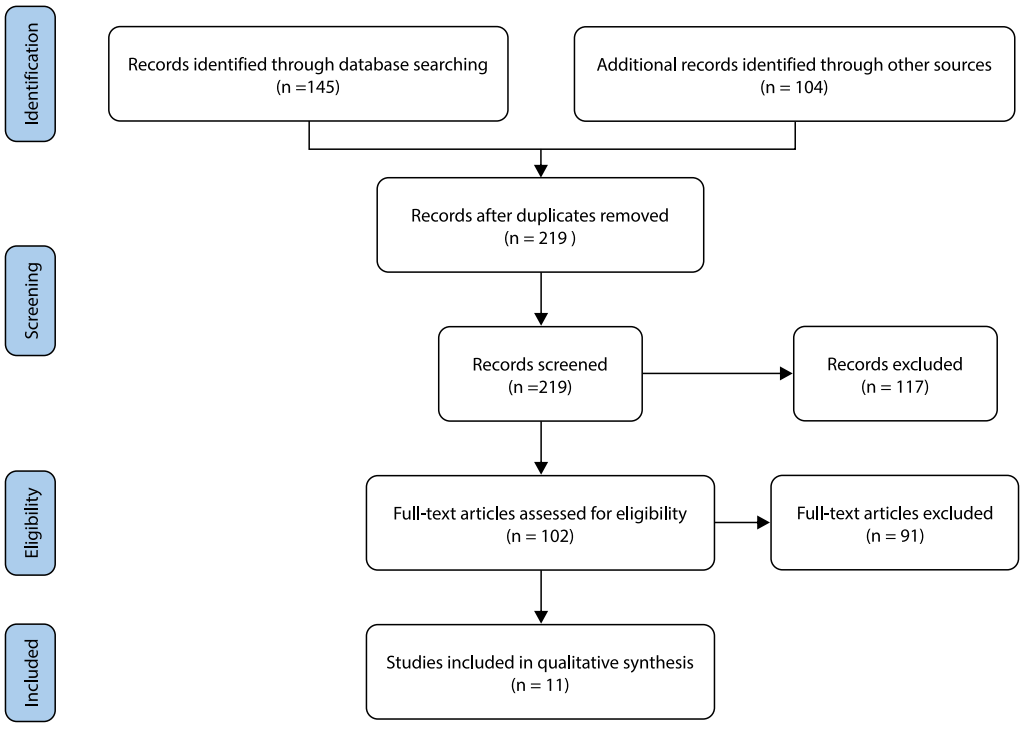

Figure 1. PRISMA flow chart

Table 1. Polish recommendations on the diet supplementation in pregnancy

No	Ref.	Supplementation recommendations
1	Wender-Ożegowska E, et al., 2018; [3]	Folic acid supplementation: • women planning pregnancy should start taking folic acid at least 12 weeks before pregnancy and continue using it during pregnancy, puerperium, and lactation • in women from the high-risk group (pre-pregnancy DM1 and DM2) the folates at a dose of 0.4 mg/day plus an additional 0.4 mg/day of active folates are recommended Vitamin D supplementation: • 1500–2000 IU/day
2	Wender-Ożegowska E, et al., 2012; [4]	In pregnant women who have undergone bariatric surgery, deficiencies of iron, folic acid, vitamin B12, and calcium should be corrected Supplementation should be continued during pregnancy and the postpartum period
3	Bomba-Opoń D, et al., 2017; [5]	Folic acid supplementation: • every woman in reproductive age should include products rich in folates in her diet, • the dose of folic acid depends on the risk of NTD (neural tube defects): — low risk: 0.4 mg/day, — intermediate risk (pre-diabetes DM1 or DM2, obesity, bariatric surgery, metformin use) — 0.8 mg/day, active folates at least 12 weeks before conception and during pregnancy, puerperium and lactation period, — high risk — 5 mg/day active folates in the preconception period and during the first trimester of pregnancy; 0.8 mg/d in the second and third trimester, and during the breastfeeding period • the active forms of folates and B12 vitamin supplementation are recommended
4	Polish Gynecological Society, 2014; [6]	Folic acid supplementation: • constant supplementation at least 6 weeks before conception until the end of organogenesis • the standard dose of folic acid 0.4 mg • higher doses in women with obesity, megaloblastic anemia, smokers, women using hormonal contraception, anti-epileptic drugs, hyperhomocysteinemia DHA supplementation: • 600 mg for women who consume small amounts of fish • up to 1000 mg for women at high risk of preterm labor Iron supplementation: • women with iron deficiency anemia: 30 mg/day before conception, and then, from the end of the 8th week of pregnancy, increase the dose to a maximum of 60–120 mg/day Iodine supplementation: • 200 mg/day Vitamin D supplementation: • 2000 IU/day for women planning to become pregnant and pregnant • the highest safe therapeutic dose: 10,000 IU Mg: • 600–1000 mg/day/depending on the indications
5	Poreba R, et al., 2011; [16]	Folic acid supplementation: • 0.4 mg of folic acid/active form/supplementation is recommended for women planning pregnancy for at least 6 weeks before it and until the end of the second trimester of pregnancy Iron supplementation: • women with a high risk of iron deficiency anemia or with anemia should be supplemented with the iron before conception and then, from the 9th week of pregnancy • standard daily doses: 18 mg/day before pregnancy, 26–27 mg in pregnancy, 20mg/day in breastfeeding period Vitamin D supplementation: • 800–1000µg/day /in women with vitamin D deficiency Magnesium supplementation: • 200–1000 mg/day /in women with magnesium deficiency Iodine supplementation: • 150 µg potassium iodide/in every pregnant woman DHA supplementation: • 200–300 mg/day DHA/in every pregnant woman
6	Dębski R, et al., 2013; [17]	Iron supplementation: • women with a high risk of iron deficiency anemia or with anemia should be supplemented with the iron before conception and then, from the 9th week of pregnancy, • standard daily doses: 18 mg/day before pregnancy, 26–27 mg in pregnancy, 20 mg/day in breastfeeding period
7	Horvath A, et al., 2007; [19]	DHA supplementation: • due to the low level of consumption in Poland • foods that are a natural source of omega-3 fatty, in women with low risk of preterm birth the supplementation at least 600 mg/day of DHA • throughout pregnancy should be considered • Women with a high risk of premature birth: at least 1000 mg DHA/day during all pregnancy period

→

Table 1. Polish recommendations on the diet supplementation in pregnancy, continued

No	Ref.	Supplementation recommendations
8	Charzewska J, et al., 2010; [20]	Vitamin D supplementation: • 800–1000 IU/d should be supplemented from the second trimester of pregnancy, if not adequate dietary supply and/or skin synthesis is provided
9	Płudowski P, et al., 2013; [21]	Vitamin D supplementation: • women who plan pregnancy should start/maintain Vitamin D supplementation as recommended for adult, • vitamin D supplementation of 1,500–2,000 IU/day (37.5–50.0 µg/day) should begin at least from the second trimester of pregnancy • gynecologists/obstetricians should consider starting Vitamin D supplementation for pregnant women soon after the pregnancy is confirmed; if feasible, periodical monitoring of serum 25(OH)D concentration should be done to define optimum dosage and to verify the efficacy of supplementation • the goal of supplementation is to achieve and maintain 25(OH)D concentration of 30–50 ng/mL (75–125 nmol/L)
10	Szybiński Z, 2012; [24]	Iodine supplementation: • obligatory iodization of household salt (20–40 mg KI/1 kg) and neonates' formula (10 µg/100 mL of milk) • additional supplementation for pregnant and breastfeeding women with 150–200 µg of iodine as pharmacotherapy
11	Bednarek W, et al., 2010; [32]	DHA supplementation: • women with low fish consumption and other sources of DHA: 500 mg of DHA/day for as little as the first month of pregnancy • women with a high risk of premature birth: 1000 mg DHA/day

NTD — neural tube defects; DHA — docosahexaenoic acid; DM1 — diabetes mellitus type 1; DM2 — diabetes mellitus type 2

The comparison of the Polish recommendations, American College of Obstetricians and Gynecologists (ACOG) recommendations and National Institute for Health and Care Excellence/Royal College of Obstetricians and Gynaecologists (NICE/RCOG) recommendations on the diet supplementation in pregnancy is presented in Table 2.

DISCUSSION

Folic acid supplementation during pregnancy

The essential diet supplement used in the preconception period and during pregnancy is folic acid. 5-methyltetrahydrofolate is an active form of folic acid in the body [5]. It is a coenzyme of nucleic acids transformations and a catalyst of blood formation processes. It is absorbed in the intestines. In blood circulation, it is bound to plasma proteins. A deficit in folic acid in the diet leads to the total consumption of its reserves within the body, as quickly as within four months [6]. Due to higher demand for folates during pregnancy, it may only be satisfied with well-composed diet [7]. In breastfeeding women, the requirement for folic acid is even higher than during pregnancy [8].

In a pregnant woman, the deficit in folic acid may result in megaloblastic anaemia. It is caused by the reduced rate of DNA synthesis process and a prolonged period of red blood cells maturing in the marrow [6]. Diagnosis of megaloblastic anaemia is the indication for the increase of the supplemented dose of folic acid. The increased dose of folic acid should also be implemented in patients who smoke, have previously taken anti-epileptics, methotrexate, sulfasalazine, colestyramine or hormonal contraceptives. Also, in patients with celiac disease, Leśniowski-Crohn's disease, ulcerative colitis, alcoholism, liver failure, kidney failure requiring dialysis, and patients with pre-eclampsia and/or IUGR (intrauterine growth restriction) in medical history. Women with hyperhomocysteinemia being the result of reduced activity of methylenetetrahydrofolate reductase (MTHFR) also require a higher supply of folic acid. The reasons for reduced MTHFR include different kinds of polymorphisms of MTHFR gene, among which the most frequent is polymorphism MTHFR 677 C > T, which occurs with the frequency reaching up to 50% in the Asian population [5, 6, 9]. Complications resulting from irregularities in the metabolic processes of folic acid, besides megaloblastic anaemia, include reoccurring miscarriages and pre-eclampsia [5, 10, 11].

For the foetus, folic acid deficiency may result in a range of defects of the central nervous system, heart defects, urinary system obstructive defects, cleft lip and palate, increased risk of Down syndrome, and increased risk of miscarriage and thrombosis. Moreover, disturbances in the metabolic processes of folates may result in the inhibition of intrauterine growth of foetus [5, 6, 11, 12].

A cofactor of metabolic processes of folic acid is B12 vitamin. The high concentration of folates with the coexisting insufficiency of B12 is particularly adverse. It may lead to hyperhomocysteinemia resulting in pregnancy complications. The use of too high doses of folic acids increases the risk of early pregnancy damage. It may cause the development of insulin resistance, type 2 diabetes, and obesity in a child [5]. Current guidelines indicate that application of folic acid in a dose higher than 5mg is not justified and may

Table 2. The comparison of the Polish recommendations, American College of Obstetricians and Gynecologists (ACOG) recommendations and National Institute for Health and Care Excellence/Royal College of Obstetricians and Gynaecologists (NICE/RCOG) recommendations on the diet supplementation in pregnancy

Supplementary recommendation	The Polish Society of Gynaecologists and Obstetricians (PSGO) [3, 5, 6, 24, 32]	American College of Obstetricians and Gynecologists (ACOG) [33, 34]	National Institute for Health and Care Excellence/ Royal College of Obstetricians and Gynaecologists (NICE/RCOG) [35–40]
Folic acid	every woman in reproductive age should include products rich in folates in her diet, the doses depend on the risk of NTD (neural tube defects): **low-risk** — 0.4 mg/day **intermediate risk** (pre-diabetes DM1 or DM2, obesity, bariatric surgery, metformin use) — 0.8 mg/day, active folates at least 12 weeks before conception and during pregnancy, puerperium and lactation period **high risk** — 5 mg/day active folates in the preconception period and during the first trimester of pregnancy; 0.8 mg/d in the second and third trimester, and during the breastfeeding period, the active forms of folates and B12 vitamin supplementation are recommended	all women capable of becoming pregnant should strive for intake of 400 µg (0.4 mg) of folic acid daily, in the form of a supplement, multivitamin, consumption of fortified foods, or a combination of the above. during pregnancy: 0.6 mg/day women who have had a previous NTD-affected pregnancy, who are themselves affected, have a first- or second-degree relative with a NTD, or who have DM1 should take 4 mg of folic acid commencing 3 months before conception and continuing throughout the first trimester	standard dose: 400 µg/day), ideally before conceiving and continue to 13th week of pregnancy women with high risk of NTD: 5 mg/day of folic acid
Iron	women with iron deficiency anemia: 30 mg/day before conception, and then, from the end of the 8th week of pregnancy, increase the dose to a maximum of 60–120 mg/day women with a high risk of iron deficiency anemia in pregnancy and breastfeeding period: 18 mg/day before conception, 26–27 mg/day during pregnancy, 20 mg/day during lactation	standard dose: 27 mg/day	iron supplementation should not be offered routinely to all pregnant women. it does not benefit the mother's or the baby's health and may have unpleasant maternal side effects
magnesium	200–1000 mg/day in women with a low level of magnesium in the blood serum or symptoms of magnesium deficiency	N/A	N/A
iodine	150–200 µg/day	200 µg/day	N/A
vitamin D	1500–2000 IU/day (4000 IU/day in women with obesity)	In pregnant women with increased risk of vitamin D deficiency, maternal serum 25-hydroxyvitamin D levels can be considered and should be interpreted in the context of the individual clinical circumstance when vitamin D deficiency is identified during pregnancy, 1.000–2.000 international units per day of vitamin D is safe	all pregnant and breastfeeding women — 10 micrograms/day women with high-risk of vitamin D deficiency: at least 1000 IU/d (women with increased skin pigmentation, reduced exposure to sunlight, or those who are socially excluded or obese) women with vitamin D deficiency — treatment for 4–6 weeks, either with cholecalciferol 20 000 IU/ week or ergocalciferol 10 000 IU/ twice a week, followed by standard supplementation
DHA	600 mg for women who consume small amounts of fish, up to 1000 mg for women at high risk of preterm labor,	N/A	N/A

N/A – not applicable; NTD — neural tube defects;, DHA — docosahexaenoic acid; DM1 — diabetes mellitus type 1; DM2 — diabetes mellitus type 2

lower the seizure threshold [5, 13]. Folic acid supplementation should be avoided in elderly patients and in neoplastic diseases as it may intensify the oncogenesis [6].

Folic acid supplementation considerably reduces the risk of neural tube defect, heart defect, urinary system and limbs defect, cleft lip and palate, and pre-eclampsia [5]. Therefore, it is recommended by PSGO that every woman in reproductive age should include products rich in folates (e.g., lettuce, cabbage, nuts) and food enriched with this nutrient in her diet. PSGO has qualified patients with pre-diabetes, diabetes mellitus type 1 or type 2, obese patients, as well as women after bariatric surgery and patients using metformin as the group of intermediate risk of developing foetus defects. The previous studies have shown that both hyperglycaemia and insulin resistance may cause a disturbance in folates metabolism [5, 14]. For that group of women, PSGO recommends that folic acid should be supplemented at least 12 weeks before conception and continued during pregnancy, puerperium and lactation period. The recommended dose of folates for that population of patients is 0.8 mg/day, including active folates. PSGO recommends the use of preparations with documented composition and effect, and supplementation of B12 [3, 5].

If a patient with diabetes mellitus (DM) has given birth to a child with neural tube defect, according to PSGO guidelines, she belongs to the group of women with a high risk of giving birth to another child with neural tube defect. In such population, PSGO recommends folates supplementation in the dose of 5 mg a day in the preconception period and during the first trimester of pregnancy. In the second and third trimester, and during the breastfeeding period, the dose of folates should be reduced to 0.8 mg/day. It is recommended that active forms of folates and B12 vitamin supplementation are considered [5].

American College of Obstetricians and Gynecologists (ACOG) recommends that all women capable of becoming pregnant should strive for intake of 400 µg (0.4 mg) of folic acid daily, in the form of a supplement, multivitamin, consumption of fortified foods, or a combination of the above. The dose recommended during pregnancy is 0.6 mg/day. Women who have had a previous NTD-affected pregnancy, who are themselves affected, whose first- or second-degree relative has NTD, or suffering from DM1 should take 4 mg of folic acid commencing three months before conception and continuing throughout the first trimester [34].

National Institute for Health and Care Excellence/Royal College of Obstetricians and Gynaecologists (NICE/RCOG) recommends a standard dose of 400 µg/day of folic acid before conceive and continue the supplementation until 13th week of pregnancy. Women with high risk of NTD should take 5mg/day of folic acid [35, 37, 39].

Iron supplementation during pregnancy

Pregnant women often demonstrate iron deficiency anaemia and the so-called physiological anaemia resulting from haematocrit drop. Anaemia resulting from iron deficiency is recognised when the haemoglobin concentration is below 11 mg%. Anaemia during pregnancy leads to reduced tolerance to effort, tiredness and increased risk of premature birth. A drop in the iron content in feeding mother's milk may result in anaemia and reduced psychomotor development of the child [6]. Risk factors of iron deficiency in mother include vegetarian or vegan diet, heavy menstrual bleeding, lactation, malabsorption, and the pregnancy itself [6, 15].

In women who are not pregnant, iron content in the diet should amount to no less than 18 mg/day, during pregnancy 26–27 mg/day and 20 mg/day during lactation [16]. British Committee for Standards in Haematology indicates that iron supplementation is required in patients with haemoglobin level below 11.0 g% in the first trimester, below 10.5 g% in the second or third trimester, below 10 g% during puerperium or lactation period, or with ferritin level below 30 mg/L [17, 18]. Women with anaemia should start oral supplementation of iron during the pregnancy planning period. After the conception, they should begin iron supplementation after the eight weeks of pregnancy, in a daily dose of 30 mg. Afterwards, depending on the anaemia level, the dose should be increased to 60–120 mg/day. Iron supplementation before the eighth week of pregnancy may cause a high concentration of iron in vesicular fluid, which can harm the development of an embryo and cause developmental defects [6, 19]. Specialists emphasize that the most beneficial form of oral iron supplementation is supplying it in small doses over a long period. It is dependent on the metabolism of proteins responsible for iron transport in blood circulation. Moreover, during iron supplementation, it is essential to ensure proper supply of magnesium and B6 vitamin [6, 15]. Absorption of non-heme iron is assisted by vitamin C [17].

Iron supplementation is also recommended in women in the preconception period in which the risk of anaemia in the future is present. Moreover, PSGO recommends iron supplementation in pregnant women with the risk of iron deficiency anaemia and during the lactation. In the situations mentioned above the doses of iron supplement should be 18 mg before conception, 26–27 mg during pregnancy, and 20 mg during breastfeeding [6, 17].

PSGO experts recommend the use of iron bis-glycinate both to prevent and treat anaemia in obstetrics and gynaecology [17]. PSGO also points out to numerous benefits, including efficiency and the safety of use of low-dose heme iron preparations. PSGO emphasize that iron supplementa-

tion may be individually adjusted with the use of different preparations of various pharmacological properties [17].

ACOG recommends that pregnant women should take a standard dose: 27 mg/day of iron [33, 34]. NICE/RCOG states that iron supplementation should not be offered routinely to all pregnant women. Moreover, according to NICE/RCOG iron supplementation during pregnancy does not benefit the mother's or the baby's health and may even has unpleasant maternal side effects [35, 39].

Vitamin D supplementation during pregnancy

Vitamin D regulates calcium and phosphorus concentration in blood. It is responsible for mineral density of skeleton, reduces excessive proliferation, stimulates the development of cells in the hematopoietic system, and plays an immunomodulatory role [6]. Vitamin D is produced in human skin during exposure to sunlight. However, in Poland, such exposure is somewhat limited, which considerably reduces the production of vitamin D in the body [6]. Vitamin D insufficiency disturbs calcium and phosphate homeostasis and may be a cause of osteoporosis. Pregnant and lactating women are the group particularly susceptible to the inadequacy of that nutrient [6]. A correlation between vitamin D insufficiency and glucose tolerance disturbances and diabetes mellitus type 2 has been confirmed. Vitamin D insufficiency in Polish population is widespread [20]. Therefore, PSGO recommends the measurement of 25-OH-D3, especially in pregnant women with diabetes diagnosed during pregnancy, gestational diabetes in the early pregnancy, or obese pregnant women with hyperglycaemia during pregnancy. Standard recommended dose of vitamin D for a pregnant woman is 1.5–2 000 IU/d. Whereas, in an obese patient, it is recommended to use a daily dose of up to 4 000 IU/day [3, 21]. The highest clinically safe dose of vitamin D is 10 000 IU/day [6].

ACOG claims that when vitamin D deficiency is identified during pregnancy, a dose of 1 000–2 000 international units per day of vitamin D is safe [33]. NICE/RCOG recommends 10 micrograms/day of vitamin D to all pregnant and breastfeeding women. Women with high-risk of vitamin D deficiency should take at least 1 000 IU/day — these are women with increased skin pigmentation, reduced exposure to sunlight, or those who are socially excluded or obese. In women with vitamin D deficiency a 4–6 weeks-long treatment, either with cholecalciferol 20 000 IU/week or ergocalciferol 10 000 IU/twice a week, should be followed by standard supplementation [35–40].

Magnesium supplementation during pregnancy

Magnesium is responsible for the regulation of neuromuscular transmission and regulations of minerals management in the skeleton. Magnesium insufficiency increases muscle contractility demonstrated by painful contractions. It also leads to an elevated risk of arterial hypertension. Human body demand for this element is 6 mg/kg/day and doubles during pregnancy and breastfeeding period. Magnesium supplementation is recommended in the condition of its reduced concentration in blood, or case of clinical manifestations of the insufficiency. Magnesium is supplemented orally in a daily dose of 200 to 1000 mg, depending on the indications [6, 16, 22, 23].

No ACOG or NICE/RCOG recommendations on magnesium supplementation in pregnancy have been found.

Iodine supplementation during pregnancy

The risk of too low supply of iodine in the diet in Poland has become the basis for preventive supplementation of iodine in kitchen salt. Iodine demand during pregnancy increases and the recommendation for pregnant women to reduce salt content in their food may intensify the insufficiency [24, 25]. Iodine insufficiency may result in the occurrence of thyroid goitre, increased risk of central nervous system damage, hearing impairment, and mental disorders of the child. In a pregnant woman, hypothyroidism leads to an increased risk of premature birth and miscarriages. It may also result in hypothyroidism of the foetus and newborn child [24, 26].

In the first trimester of pregnancy, daily demand for iodine increases to about 200 µg. Breastfeeding is also the reason for the high need for this element. Recommended daily dose of iodine supplementation in pregnancy planning, pregnant and lactating women is 200 µg [6]. According to WHO (World Health Organisation), the treatment in pregnant and lactating women may amount to 200–500 µg [27].

ACOG recommends a daily dose of 200 µg of iodine during pregnancy [34].

Polyunsaturated fatty acids during pregnancy

PUFA (polyunsaturated fatty acids) are the components of phospholipid membranes. Proper supply of PUFA during pregnancy contributes to the extension of pregnancy duration, increased body mass of the newborn child without the risk of macrosomia, and reduced risk of premature birth [6]. It has been demonstrated that omega-3 acids supply minimises the occurrence of diabetes mellitus type 1, allergies and hypertension in adult life [28]. The most crucial omega-3 acid during pregnancy and lactating period is docosahexaenoic acid (DHA) present in seafood, algae, and fatty sea fish. Proper DHA supply during pregnancy and lactation results in undisturbed psychomotor development of the child. It also beneficially modifies the risk of postpartum depression in women. Favorable effects of DHA supply in pregnancy have been emphasized by European Food Safety Authority (EFSA) [6, 29]. PUFA supply demonstrates a positive impact on the cardiovascular system, reducing inflam-

matory condition in atherosclerotic plaques or decreasing triglyceride and low-density lipoprotein (LDL) cholesterol levels in blood [30].

PSGO recommends that in case of limited consumption of DHA in pregnant women's diet, at least 600 mg of DHA should be supplemented every day. In case of the high risk of premature birth — at least 1000 mg DHA a day during the entire pregnancy period should be taken. DHA supplementation is recommended at least from the 20th week of pregnancy [6, 31]. Considering the effect of DHA on the child's development, it is recommended to supplement DHA during breastfeeding period to maintain its optimal content in the milk. It is emphasized that DHA source should be safe and controlled, to prevent potential poisoning with heavy metals, dioxins and polychlorinated biphenyls (PCBs), resulting from impurities. The reliable source of DHA should be small fish and algae of the type Schizochytriumsp grown under artificial conditions [6, 15, 32].

The numerous studies have shown that DHA supplementation prolongs the duration of pregnancy and increases the birth weight of the child. The mechanisms of that phenomenon are based on reduced production of prostaglandins E2 and F2 by omega-3 acids and stabilization of cell membranes [15].

No current ACOG or NICE/RCOG recommendations on DHA supplementation in pregnancy have been found.

CONCLUSIONS

In the light of current Polish recommendation, the dietary supplementation of folates, vitamin D and iodine is recommended in every pregnant woman. Additionally, PSGO highlighted the benefits of iron supplementation in pregnant women with anaemia or at high risk of developing anaemia. Magnesium supplementation is needed in the condition of its reduced level in blood. In the case of limited consumption of DHA in pregnant women's diet and a group of pregnant women with a high risk of premature birth, DHA supplementation is also recommended.

PSGO, ACOG and NICE/RCOG recommend a standard dose of 0.4 mg/day of folic acid in women at low NTD risk. However, only PSGO considers a group of women at intermediate risk, in which a dose of 0.8 mg/day of active folates is recommended. In women at high NTD risk both PSGO and NICE/RCOG recommend 5 mg/day of folates, while in such case ACOG recommends 4 mg/day.

PSGO recommends iron supplementation during pregnancy and lactation depending on the woman's iron status, while ACOG advise a standard dose of 27 mg/day of iron. NICE/RCOG does not recommend iron supplementation routinely during pregnancy.

PSGO recommends 150–200 µg of iodine daily during pregnancy, similarly ACOG advices a daily dose of 200 ug of iodine. NICE/RCOG did not develop recommendations of iodine supply during pregnancy.

In relation to vitamin D supplementation in pregnancy PSGO advices 1500-2000 IU/day (4000 IU/day in women with obesity). Similarly, ACOG states that in vitamin D deficiency a dose of 1000–2000 IU of vitamin D per day is safe. NICE/RCOG recommends a dose of 10 micrograms/day of vitamin D to all pregnant and breastfeeding women; at least 1000 IU/day to women with high-risk of vitamin D deficiency; and 20 000 IU/week of cholecalciferol or 10 000 IU/twice a week of ergocalciferol, followed by standard supplementation to women with vitamin D deficiency.

Conflicts of interest

The authors declare no conflict of interest.

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