

The use of dietary supplements by pregnant women in Poland

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A – Study Design, B – Data Collection, C – Statistical Analysis, D – Data Interpretation, E – Manuscript Preparation, F – Literature Search, G – Funds Collection

Summary Background. The increasing consumption of dietary supplements (DS) can be observed all over the world. DSs are classified as food and not medicine, which consumers are not always aware of. Currently, a very wide range of dietary supplements for pregnant women is available. This is due to the fact that during this period, the demand for selected nutrients and vitamins increases.

Objectives. The aim of the study was to assess the use of DS during pregnancy and to indicate the most frequently consumed ingredient during this period. Folic acid supplementation has also been reviewed.

Material and methods. The subject of the study was a self-designed questionnaire consisting of 30 questions. The survey was conducted on 280 pregnant women living in Poland, aged 20–39.

Results. Most of the surveyed women correctly defined DS. Over 90% of the surveyed women declared DS consumption during pregnancy. The decision to use DS was made in accordance with medical indications in the case of half of the subjects. Multi-ingredient products were used most often (81%).

Conclusions. Most of the surveyed women took folic acid and DHA, followed by iron, iodine, magnesium and calcium. More than half of the women felt the positive effects of dietary supplements, while only a smaller percentage of the respondents declared negative effects. Consumption of DS by the surveyed women was similar to consumption in other countries.

Key words: dietary supplements (DSs), vitamins, pregnant women, Poland.

Brodziak-Dopierała B, Fischer A, Dudek-Biskup J, Koziarz S. The use of dietary supplements by pregnant women in Poland. *Fam Med Prim Care Rev* 2024; 26(2): 161–169, doi: <https://doi.org/10.5114/fmpcr.2024.139024>.

Background

The market of dietary supplements in 2022 was estimated at USD 155.2 billion, and it is expected to grow by 7.3% by 2027. Growing health awareness of consumers and increasing income are the factors that encourage people to consume dietary supplements [1]. In the UK, sales of multivitamins aimed at pregnant women increased by approximately 2% between 2010 and 2015 and accounted for 17% of the total multivitamin market in this country [2, 3]. The use of DS during pregnancy is very common, ranging from 78% to 98% in various studies in the USA, Canada and Australia [4], while in European countries, it was from 81% to 94% [5].

Studies have shown that the mother's nutrition affects the health of her offspring, as micronutrients can be modulators of the epigenome, which has been described on the example of vitamin D [6, 7]. Nutritional deficiencies can be the cause of premature birth, abnormal development and low birth weight of the fetus [8–16]. It is believed that the long-term effects of dietary supplements are mediated by epigenetic mechanisms [6, 17]. In addition to folic acid supplementation, with proven health benefits for the fetus, other supplements are used to compensate for deficiencies in the mother's body [3, 18–20]. In some countries outside the EU (e.g. USA, Canada), food is fortified with folic acid, and the EU strategy is to advise the target group (women planning to become pregnant and pregnant women) to supplement their diet [3, 21–23].

There is a very wide range of dietary supplements for pregnant women on the market. This is due to the fact that during this period, the demand for selected nutrients and vitamins increases [23, 24]. In most cases, taking DS is advisable and necessary, but there are situations of their abuse. During pregnancy, multi-ingredient products dedicated to this group are most often consumed [25, 26].

DS differ from each other in composition, quality, bioavailability and manufacturing standards. The quality of the product is determined by GMP (*Good Manufacturing Practice*) standards. GMP certificates are granted to high-quality products, manufactured from proven ingredients, in appropriate conditions, in accordance with procedures [10, 27]. In addition to their quality and the actual content of the declared ingredients, the safety of DS use is also affected by the possible presence of impurities and additional substances. Selective control of the market and the lack of detailed guidelines for supplements gives manufacturers a lot of freedom, while at the same time enabling the launch of products of dubious quality on the market [28–33].

New recommendations of the Polish Society of Gynecologists and Obstetricians (PTGiP) regarding supplementation of pregnant women were published in July 2020 [34]. They take into account the specificity of Polish society and are based on current knowledge in this area. In the PTGiP guidelines, experts described in detail the role and indications and specified the recommended dosage of five active substances which are the main elements of rational supplementation for pregnant wom-



en, i.e. folic acid, iodine, vitamin D, docosahexaenoic acid (DHA) and iron. Compared to previous recommendations, the indications for iron supplementation have been changed, and the recommended daily doses of folic acid have been modified [34].

Folic acid salts are an essential component of the diet and participate in many chemical reactions in the body, e.g. transformation of amino acids, synthesis of nucleic acids, phospholipids and proteins. Deficiency of this component during pregnancy results in disorders of DNA synthesis and cell division in fetal tissues and bone marrow. This can lead to the development of megaloblastic anemia and birth defects in the fetus, in particular neural tube defects, which may result in anencephaly, spina bifida or brain displacement [24, 35, 36].

Iodine is a microelement necessary for the synthesis of thyroid hormones regulating the functions of many organs and systems, affecting, among others, nervous system development, metabolism, thermo- and lipogenesis, cardiovascular function and bone growth. Significant iodine deficiency can lead to hypothyroidism in the pregnant woman and the fetus, disorders of myelination of neurons and damage to the central nervous system and, consequently, mental retardation of the fetus. There may also be an increased risk of miscarriages and premature births [24, 26].

Vitamin D regulates the concentration of calcium and phosphorus in the plasma, determines the maintenance of normal bone mineral density and also stimulates the differentiation of cells in the hematopoietic system and has an immunomodulatory effect. Supplementation with this vitamin is recommended for all pregnant women [37–39]. Supplementing pregnant women with vitamin D alone probably reduces the risk of gestational diabetes, pre-eclampsia, low birthweight and may reduce the risk of severe postpartum hemorrhage. The risk of preterm birth < 37 weeks of gestation or low birthweight (less than 2,500 g) requires further randomized trials [40, 41]. It appears that patients with risk factors for prevention of preeclampsia development and vitamin D deficiency may require higher doses of vitamin D than commonly recommended for pregnant women [42]. Low vitamin D levels can increase the risk of spontaneous abortion and SGA (small-for-gestational age is also called small-like baby or intrauterine growth retardation baby) in pregnant women [43].

Docosahexaenoic acid (DHA) belongs to the group of omega-3 acids and is one of the most important polyunsaturated fatty acids. It is a component of phospholipid membranes and a building block of myelin sheaths of neurons and the retina of

the eye and protects nerve cells against apoptosis caused by oxidative stress. Deficiency or impaired DHA metabolism can lead to reduced cognitive abilities and an increased risk of mental or neurodegenerative diseases [15, 27, 44].

Iron is a component of hemoglobin and ferritin and is used in tissue respiration and for the formation of red blood cells. The need for iron increases during pregnancy. However, due to the potential adverse effects of excess iron, it is recommended to control the morphology and ferritin and start supplementation with confirmed iron deficiency anemia [13, 24, 45].

Objectives

The aim of the study was to assess DS use during pregnancy. The study also included the period preceding pregnancy. The ingredients of supplements most often used by women in this period and how long before and during pregnancy they were used were indicated. Particular attention was paid to folic acid supplementation. In addition, women's general knowledge of DS was verified. Questionnaire answers indicated: whether women know the definition of DS, whether they are aware of the differences between these products and drugs, whether they know about possible interactions, as well as the possibility of overdose and side effects. The subjective feelings of women during the use of supplementation were analyzed, i.e. whether positive or negative effects were noticeable. The research questions also concerned the place where products were purchased and what amount was spent on them.

Material and methods

The questionnaire was reviewed by the university's Bioethics Committee, and the study procedure was conducted in accordance with the requirements of the Medical University of Silesia, Poland. Participation in the study was voluntary, anonymous and confidential. All patients gave their verbal consent and could cease participation at any time or refuse to answer any question without reason.

The study was conducted among 280 Polish women who were patients of the Szpital Wielospecjalistyczny in Gliwice at the Department of Gynecology, Obstetrics and Pregnancy Pathology. The age of the study group was in the range of 20–39

Table 1. Socio-demographic data of respondents

Parameters	Response	Number	%
Place of residence	village	56	20.0
	city of up to 10,000 inhabitants	18	6.4
	city of 10–200,000 inhabitants	134	47.8
	city with more than 200,000 inhabitants	72	25.8
Education	primary	2	0.7
	basic vocational	8	2.9
	secondary	92	32.9
	higher	178	63.6
Professional work during pregnancy	yes	160	57.1
	no	120	42.9
Financial situation	very good	64	22.9
	good	156	55.7
	average	56	20.0
	quite good	4	1.4
	bad	0	0
Number of pregnancies	1	134	47.9
	2	96	34.3
	3	36	12.9
	≥ 4	14	5.0

years, and the average age was 30 years. All women were of normal weight. None of the surveyed women indicated a positive history of NTD (neural tube defects).

Among the surveyed women, it was the first pregnancy for 48%, the second for 34%, the third for 13%, and the fourth or subsequent for 5%. The largest number of respondents lived in medium-sized cities (10–20,000 thousand inhabitants) – 48%, followed by large cities (over 20,000 thousand inhabitants) – 26%, and rural areas – 20%. In the case of education, higher education prevailed (64% of the respondents) and secondary education – 33%. Most of the surveyed women were professionally active (57%) during pregnancy, and the declared material status was good (56%) and very good (23%) (Table 1).

The subject of the research was a self-designed questionnaire. The questionnaire was anonymous and consisted of 30 questions to be completed. The survey was conducted in the period from January to December 2022. The survey contained socio-demographic data describing the respondents (age, place of residence, education, professional work, financial situation – declared subjectively). It also included questions about dietary supplements (definition, frequency and amount of use, form, composition, purchase amount), the use of folic acid and knowledge about the effects, interactions or overdose. Statistical analysis of the data was carried out using the Statistica 13 program (TIBCO software, Cracow, Poland). The relationships between qualitative features were tested with the χ^2 test. Results for which $p < 0.05$ were considered statistically significant. The study analyzed the relationship between DS consumption and education, the financial situation of the surveyed women and the number of pregnancies. For this purpose, the Pearson χ^2 test was used.

Results

Most of the surveyed women (70%) did not follow a special diet (e.g. low-fat, high-protein, etc.) during pregnancy. Surprisingly, only 49% of the respondents changed their diet during this particular period. According to the available information, special attention should be paid to food intake, its quality and composition during pregnancy [11, 13, 26–28]. As for the definition of DS, 76% of the respondents correctly defined it and did not identify it as a drug. As many as 63% of the surveyed group of women had knowledge of the act to which DS are subject, while 37% of the respondents incorrectly qualified supervision over supplements by pharmaceutical law. 93% of the respon-

dents admitted to taking DS, and only 7% did not use them during pregnancy. More than half of the surveyed women (59%) believed that the use of DS was common sense, 32% claimed that it was a necessity, and 6% believed that it was unnecessary. DS was used by the majority of women (76%) throughout pregnancy: 9% of women used it only in the first trimester, approx. 4% in the second and third trimester. Most often, 2 DS were taken simultaneously – 49%, less often 3 (31%), and 4 or more products (12%). The use of 1 DS was declared by only about 8% of the respondents. The decision to use DS was made in accordance with medical indications in the case of over 50% of the surveyed women, 38% made such a decision on their own, and only 6% due to the suggestions of other people. In terms of the composition of DS, multi-component products were most often used (82%), single-component products accounted for 11%, and the remaining 7% of respondents used both types of products (Table 2).

Most of the surveyed pregnant women (68%) consciously chose DS instead of a drug and read the information on the packaging (84%). About 1/3 of the surveyed population of women (32%) did not pay attention to whether the purchased preparation was a drug or DS, and about 16% did not read the information on the packaging. Positive effects of supplementation were felt by 58% of women, while 42% did not observe such effects. On the other hand, the negative effects of using DS were experienced by only over 8%, and 91% had no such effects. The vast majority of respondents (88%) used DS in the recommended doses. 12% of respondents did not follow the recommendations. 88% of the surveyed population of women were aware of possible interactions between DS and drugs, and the remaining respondents (12%) had no such awareness. 61% of women were aware of the possibility of DS overdose, 24% considered it probable, and 3% claimed that there is no such possibility.

There are many forms of DS on the market, the most popular form of consumption among the respondents was capsules, and approx. 54% of all respondents consumed DS in this form, followed by tablets – 22%. It should be mentioned that women often took supplements in several forms (Table 2).

The surveyed women most often made DS purchases in pharmacies (approx. 68%), via the Internet (approx. 24%), and in other places (supermarkets, herbal shops, health food stores), purchases were made sporadically. DS purchases most often (49%) were in the amount of PLN 20–50 (5–10 EUR), the range between PLN 50–100 (10–20 EUR) was chosen by 35% of women, over 8% of respondents spent over PLN 100 (20 EUR) per month on DS, and 7% below PLN 20 (5 EUR).

Table 2. Information about DS (dietary supplements)

Survey questions	Response	Number	%
Following a special diet during pregnancy	yes	196	70.0
	no	84	30.0
Changing your eating habits during pregnancy	yes	134	47.9
	no	146	52.1
DS is:	chemical substance	58	20.4
	foodstuff	212	76.0
	food additive	4	1.4
	drug	6	2.1
DS are defined by	pharmaceutical law	104	37.2
	food and nutrition security	176	62.8
Have DS been used	on a regular basis	260	92.9
	I do not take dietary supplements	20	7.1
The use of DS during pregnancy is:	necessity	90	32.1
	fashion	10	3.6
	common sense	164	58.6
	unnecessary	16	5.7

Table 2. Information about DS (dietary supplements)			
Survey questions	Response	Number	%
In which trimester of pregnancy were DS taken	I	26	9.3
	I, II	16	5.7
	II	12	4.3
	II, III	2	0.7
	III	12	4.3
	all	212	75.7
Were more than one DS used simultaneously	no	22	7.8
	yes, I use 2 supplements	138	49.3
	yes, I use 3 supplements	86	30.7
	yes, I use more than 3 supplements	34	12.2
The decision to use DS has been made	independently	108	38.5
	under the guidance of a physician	144	51.4
	by the suggestion of others	18	6.4
	other	10	3.7
The consumed DS were	single component	30	10.7
	multicomponent	230	82.1
	single and multicomponent	20	7.2
Was DS deliberately chosen over drugs?	yes	190	67.8
	no	90	32.2
Have you read the information on the DS packaging?	yes	236	84.2
	no	44	15.8
Have you felt the positive effects of using DS?	yes	162	57.8
	no	118	42.2
Were there any negative effects of using DS?	yes	24	8.6
	no	256	91.4
Were DS consumed in recommended doses?	yes	246	87.8
	no	34	12.2
Was attention paid to possible interactions of DS with drugs?	yes	246	87.8
	no	34	12.2
Is it possible to overdose on DS?	yes	170	60.7
	rather yes	68	24.3
	rather not	22	7.9
	no	8	2.9
In what form was DS used?	capsule	150	53.6
	pill	62	22.1
	capsule, pill	58	20.7
	capsule, drops	4	1.4
	pill, drops	2	0.7
	pill, syrup	2	0.7
Where were DS purchased?	at the pharmacy	190	67.9
	over the Internet	66	23.6
	in the supermarket	12	4.3
	in herbal and health food stores	12	4.3
The amount that was allocated to DS per month	less than PLN 20 (EUR 5)	20	7.1
	PLN 20–50 (EUR 5–10)	138	49.3
	PLN 50–100 (EUR 10–20)	98	35.0
	more than PLN 100 (EUR 20)	24	8.6

A very important component of the diet in the period before pregnancy and during pregnancy is folic acid. The overwhelming majority of preparations containing folic acid available on the Polish market are dietary supplements. A comparable number of women used folic acid regularly – 41%, and about 39% did not take it at all, while 20% used it occasionally. Among the surveyed women, 24% started using this preparation 1 month before pregnancy, 32% – 3 months before pregnancy, about 18%

of respondents – 6 months before the planned pregnancy, and about 26% used it more than half a year before getting pregnant. The vast majority of the surveyed women took folic acid throughout pregnancy – 75%, 11% only in the first trimester, and 5% in the first and second trimester (Table 3).

Products intended for supplementation during pregnancy were most often multi-ingredient. Among the respondents, the highest intake of folic acid was 91%, followed by DHA – 81%,

Survey questions	Response	Number	%
Were you taking folic acid before you got pregnant?	yes, regularly	116	41.4
	yes, occasionally	56	20.0
	no	108	38.6
How long before pregnancy were you taking folic acid?	1 month	42	24.3
	3 months	55	32.1
	6 months	31	17.9
	over 6 months	44	25.7
In which trimester of pregnancy was folic acid consumed?	throughout pregnancy	210	75.0
	1 trimester	30	10.7
	2 trimester	12	4.3
	1, 2 trimesters	14	5.0
	3 trimester	10	3.6
	2, 3 trimesters	4	1.4

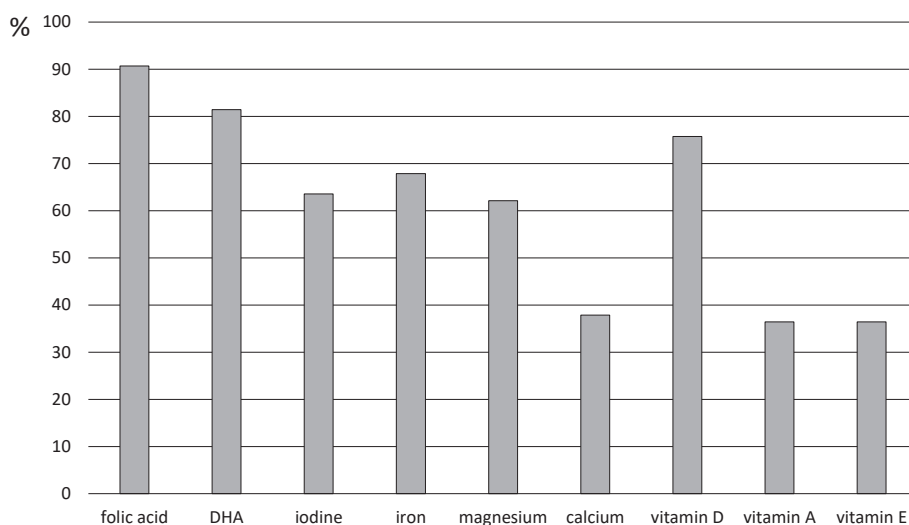


Figure 1. Frequency of taking various supplementary ingredients by pregnant women

DHA – docosahexaenoic acid.

iron – 68%, iodine – 64%, magnesium – 62% and calcium – 38%. Among the vitamins, vitamin D was the most frequently consumed – approx. 76%, with vitamin E and A being 36% each (Figure 1).

Discussion

DS are not checked in terms of composition and degree of purity before being placed on the market. There is a lack of information on side effects and drug and food interactions. In addition, products containing the same ingredients may be marketed commercially as DS and as drugs. The use of herbal DS in particular is very popular, accounting for 10% to 70% depending on population and country. The vast majority of patients do not inform doctors about the use of herbal products, and this can even amount to 90%. Many of these people used products potentially interacting with anesthetics or surgical procedures, e.g. garlic, ginkgo, ginseng, valerian and St. John's wort [4, 46]. In a survey of 1,800 subjects, approximately 40% used DS, and 107 clinically significant interactions were observed [46].

Micronutrient and vitamin supplementation is a key intervention in maternal and child health, especially during pregnancy among mothers living in low- and middle-income countries, as confirmed by research. It was indicated that supplementation with multi-ingredient products should be considered the preferred option of standard prenatal care [44].

The fetus is affected by various environmental factors, e.g. the mother's nutritional status, including the intake of supplements. It is believed that the fetus adapts to the conditions in the womb by making epigenetic changes necessary for survival. The epigenome involves various chemical changes in the DNA structure without changing the underlying DNA sequence. This may influence responses to environmental factors in adulthood. Consumption of DS does not cause immediate effects; however, potential negative effects of consumption of this food group should be identified and assessed [17, 35].

The benefits of supplementing with micronutrients and vitamins during pregnancy have been well established in numerous studies [9–11, 22]. Attention should be paid to the pregnant adolescent population given their unique health and developmental needs. Meta-analyses showed improvements in several key outcomes, such as preterm birth and low birth weight with multi-nutrient supplementation compared to supplementation with iron and folic acid. Iron/folic acid supplementation showed significant improvement in maternal anemia and low birth weight, while supplementation with lipid supplements had no apparent effect on these results [29]. Fatty acids, particularly long-chain polyunsaturated fatty acids (PUFAs): DHA and EPA, are important during pregnancy for the mother and the developing fetus. DHA can influence the development of the brain and retina in the fetus, while EPA may reduce the synthesis of thromboxane, thereby reducing the risk of preeclampsia [29]. When supple-

mented with a single micronutrient, improvement was noted in one area, e.g. preeclampsia/eclampsia (calcium), maternal anaemia (iron), preterm birth (vitamin D). Micronutrient supplementation should be tailored to specific needs [9, 36–39].

Most people have the misconception that natural products such as herbs and foods are safe. High-risk patients, e.g. people taking three or more medications for chronic conditions, patients with diabetes, high blood pressure, depression or high cholesterol, should pay special attention to possible drug-food interactions [32].

According to research by Grzelak et al. [47], DS use was declared by 89% of pregnant women and 56% of those planning pregnancy. The average age of these women was 28.9 years. In our research, a very similar number of women (approx. 93%) declared DS use, and the age of the surveyed population was also similar (30 years). The distribution of education among the surveyed women was similar to that in our own research, with the highest number of respondents declaring higher education (approx. 68% in both studies), followed by secondary education, while women with vocational education were the fewest. Trend towards differences in the use of DS by women who are pregnant or planning pregnancy in relation to the general population has been demonstrated ($p = 0.054$) [47]. There was no relationship between education and taking supplements in the study by Grzelak et al. [47], while there was such a relationship in our study ($p = 0.035$). More than half (58%) of the women surveyed by us felt the positive effects of taking DS, and in the studies of Grzelak et al. [47], this was 25%. The most frequently supplemented vitamin in both studies was folic acid, taken by 43% of the respondents [47], and in our study, it was as much as 91%. On the other hand, among minerals, most women used magnesium: in our study, it was 62%, and in the study of Grzelak et al., it was 33% [47]. The amount spent on supplementation products was in the range of PLN 20–60 (5–12 EUR) per month (approx. 56%), and in our research, 48% were in the range of PLN 20–50 (5–10 EUR), and 34% were in the range of PLN 50–100 (10–20 EUR) [47].

In other studies from Poland, slightly fewer women took DS during pregnancy – 74%, and before pregnancy – 40% [25]. In our research, a larger percentage of the surveyed women consumed DS – approx. 93%. DS were used mostly for medical indications, was confirmed this by 51% of women in own research, and 55% – Sobek et al. [25]. Most often, women reached for folic acid – 83.3%, of which 28% used it before pregnancy. In relation to our research, the percentage share was higher: 91% and 41%. The use of mineral and vitamin supplements was common among the respondents (60.4%), and less often products containing DHA (25.2%), iron (19.8%), vitamin D (9.9%), iodine (8.1%) and magnesium with vitamin B₆ (5.4%) [25]. The rates of use of these ingredients were lower than in our studies.

Research by Swedish scientists [48] indicated that three out of four women used folic acid supplements in the first trimester of pregnancy, while less than half of women used vitamin D. 78% of the subjects used at least 1 DS in the first trimester of pregnancy [48]. In our research, the same number of women (75%) used folic acid and vitamin D throughout their pregnancies.

In light of the research conducted in Colombia, about 70% of women aged 13–49 took prenatal DS [49]. Most of the women surveyed were aged 30–49 (74.0%), lived in the central region of Colombia (73.8%), had a high socio-economic background (79.5%) and were in the third trimester of pregnancy (79.5%). The prevalence of DS use among pregnant women in Colombia was found to be significant, and its use was significantly related to factors such as education level, socio-economic status and ethnicity [49].

Among pregnant women in China, as many as 94.8% used at least 1 DS, and in the month preceding the study, 29.8% used more than 4 products [50].

Most of the pregnant women (81.2%) were highly educated, with a bachelor's degree or higher. DS were used to prevent

(89.2%) or treat disease (78.7%). The study found that pregnant women who took more than 4 supplements were older in age, treated for infertility, had more prenatal visits and had hypothyroidism during pregnancy. Women purchased supplements not only through hospitals (72.6%) and pharmacies (45.0%) but also via the Internet (31.8%) [50]. In our own research, DS were purchased mainly in pharmacies (68%) and via the Internet (24%). Other studies indicate that the use of the Internet to obtain health information is related to the use of supplements [51]. The same number of Shanghai women (94.8%) used DS in the study by Xiang et al. [50], most in the first trimester of pregnancy (96.2%) [52].

Studies of pregnant women in Jordan showed that 96.8% used DS during pregnancy, which was an even higher percentage than in our own study – 93% [52]. The most commonly used ingredients in combination with multivitamins were iron (71.9%), vitamin D (64.2%) and folic acid (33%). In contrast, the most commonly used single nutrients were: calcium (67%), iron (55.8%), vitamin D (47.8%), folic acid (15.6%) and omega-3 fatty acids (6.3%). Supplement intake was observed to vary across the three trimesters of pregnancy. The use of supplements containing vitamin D, calcium and iron was highest in the third trimester of pregnancy (85.6%, 89.2% and 91.4%) compared to the second trimester (62.5%, 67.7% and 77.1%), and this was lowest in the first trimester (8%, 4% and 8%) [53]. This was completely different in our research, where most of the surveyed women reached for folic acid (91%), which was three times more than in the studies of Asalia et al. [53]. DHA acid was declared by over 81% of the respondents. Iron and vitamin D intake was also higher at 68% and 76%, respectively.

In the USA, 64% of women used DS before pregnancy and 77% during pregnancy. Women in the first trimester of pregnancy with lower incomes consumed fewer supplements. About half of pregnant women took supplements on the recommendation of a healthcare professional. The average intake of thiamine, riboflavin, niacin, folic acid, vitamins B₆, B₁₂ and C, iron and zinc from supplements was equal to or higher than the recommended daily allowances [54].

The results of a study of pregnant women in Alexandria, Egypt, are a big surprise, where 96.3% of the respondents took drugs during pregnancy, mainly prescription drugs (95.6%). Drugs in gastrointestinal disorders were most frequently used (25.3%). There was a relatively high prevalence of herbal intake (41.8%), especially in the first trimester of pregnancy, which requires special attention [55]. Many herbs are traditionally used for symptoms that are common during pregnancy, such as nausea and vomiting. In the same study group, the percentage of women who consumed DS during pregnancy was 42.5%. Among DS, the most popular were iron – 75.5%, folic acid – 51.6%, vitamin B₁₂ – 40%, calcium – 30.5%, multivitamin – 12.2% and vitamin C – 6%. The highest intake was in the first trimester (80%), much lower in the second trimester (17.1%) and lowest in the third trimester of pregnancy, amounting to only 2.2% [55]. Folic acid intake was low mainly in the first trimester of pregnancy and in women planning pregnancy (4.2%). According to the authors, this was due to insufficient knowledge of doctors and/or non-compliance with recommendations by women [55].

The use of DS among Saudi pregnant women was lower than in other studies [48, 51, 53], and our own, this was on average (71.5%), significantly correlated with the level of education ($p = 0.005$), income ($p = 0.039$) and the number of children ($p = 0.007$) [56]. In our study, the percentage of women consuming DS was higher and depended on variables: education ($p = 0.035$), financial situation ($p = 0.038$) and number of pregnancies ($p = 0.002$). For the majority of the surveyed women, as in our research, the primary source of information about the use of DS was the doctor. The most commonly used type of DS was folic acid (95.9%), iron (88.8%), calcium (81.6%) and vitamin D (41%). When it comes to folic acid, more than half of the women did not take it in the 3 months before pregnancy [56].

In light of subsequent studies from the USA, the use of DS was common among pregnant women and amounted to an average of 77%. It was observed that they were more common among pregnant women aged 35–44 compared to pregnant women aged 20–34 [30]. This may indicate the greater health awareness of the mature group of women.

Among pregnant women in Israel, only half were aware of the Ministry of Health's dietary recommendations. Consumption of dietary supplements (folic acid, DHA acids) was significantly correlated with the socio-economic status, and this was higher in the group of women with a higher status [57].

Similar conclusions were drawn by French scientists. In these studies, women from a lower socio-economic class used folic acid supplementation less often. Especially at the beginning of pregnancy, supplementation with this ingredient was insufficient (only 50%) [58].

In studies in Japan, the same problem was observed, and the use of supplements began after the confirmation of pregnancy, which suggests that there is a lack of knowledge about the proper start of taking folic acid [5]. Compared to our study, significantly fewer pregnant women took dietary supplements daily (93% vs 37%). It was also pointed out that pregnant women were not aware of DS safety issues [5].

DS helps pregnant women replenish deficiencies, but they also contribute to potentially overconsumption of certain nutrients, including iron and folic acid. There is a need for improved guidelines to help pregnant and lactating women meet, but not exceed, recommendations for the intake of various nutrients. There are differences in prenatal products (e.g. different forms of iron, different units used to express concentration) that affect

the absorption and ultimately the level of the nutrient in the formulas and are not understood by consumers [30]. Supplementation is especially important for women who follow a diet that eliminates e.g. meat, animal products or in those who are more at risk of deficiencies [4].

Limitations of the study

About 1/3 of the surveyed population of women (32%) did not pay attention to whether the purchased preparation was a drug or DS, and about 16% did not read the information on the packaging.

Conclusions

1. DS was used by 92.9% of the surveyed women. At the same time, the surveyed pregnant women declared no changes in their diet during pregnancy.
2. Pregnant women most often took folic acid, DHA, iron and vitamin D.
3. Most of the respondents consciously chose supplements instead of drugs, read the information on the packaging and used supplements in the recommended doses.
4. More than half of the women felt the positive effects of dietary supplements, while only a small percentage of the respondents declared negative effects.
5. The analysis of literature data showed that there are differences depending on the place of residence regarding the type of supplementation used by pregnant women.

Source of funding: This work was financed by the Medical University of Silesia in Katowice (contract No. BNW-1-112/N/3/I).

Conflicts of interest: The authors declare no conflicts of interest.

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Received: 24.10.2023

Reviewed: 05.11.2023

Accepted: 02.12.2023

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