

Knowledge of pregnant women on the supplementation of selected micro and macro elements

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Abstract

The first and most important condition for the future health of the mother and child is adequate nutrition during pregnancy. Proper diet should provide necessary nutrients in the appropriate proportions. The aim of this study was to verify the knowledge of pregnant women about the selected micro and macro nutrients. The survey involved 109 pregnant women. Research method was a diagnostic survey with original questionnaire. The resulting material was subjected to statistical and descriptive analysis. The study group were women aged 18-38. 56% of surveyed women declared not taking any dietary supplements before pregnancy while 75.2% of women were taking supplements during pregnancy. In most cases the choice of a supplement was dictated by the doctor (52%). Food products containing the most assimilable iron chosen by pregnant women most frequently, were liver and meat (chosen by 86.2% of respondents) and spinach (38.5%). The consequence of iron deficiency according to 68.8% of surveyed women is mother's anemia. Sources of iodine as indicated by women were fish (51.4%) and salt (45%). Deficiency of this micronutrient according to 44% of the study group increases the risk of mental retardation of the child. 93.6%

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of respondents indicated milk and dairy products as the best source of calcium, and a shortage of this macroelement leads according to 67% of respondents to osteoporosis. 50.2% of respondents said that the buckwheat is the best source of magnesium and its deficiency symptoms are muscle cramps (79.8%). The majority of respondents (94.5%) indicated tomatoes as a source of potassium. According to the 68 of the respondents (62.4%) deficiency of this element leads to cardiac arrhythmia. Most pregnant women had not taken any supplements before pregnancy. Upon becoming pregnant they changed their diet and take mineral supplements mainly as a result of medical recommendations. The study group proved to have knowledge about the nutrients' sources and the effects of their deficit.

Key words:

supplements,
pregnancy, micro and
macro elements

Introduction

The primary and most important prerequisite for the future health of the mother and child is adequate nutrition during pregnancy. Proper nutrition during this time not only affects the child's development during pregnancy, but also has influence on his health in childhood and adulthood. Proper diet should provide the appropriate proportions of necessary nutrients such as protein, carbohydrates, fats and minerals and vitamins [1,2,3]. Minerals, which comprise about 4% of the human body tissues play an important role for the human's organism [4,5] as they are elements of the cells, body fluids, enzymes, hormones.

Iron

The primary role of this micro nutrient is the production of hemoglobin, which is essential in transporting oxygen from the lungs to all body cells of woman as well as the child. A optimal amount of iron intake during pregnancy is also important for the fetus because of the production and development of his and his mother's blood. During pregnancy it is crucial for a woman to include in her diet as much iron as possible. In the middle of the fourth month the demand for iron increases 2-3 times. In Poland, 1/3 of pregnant women suffer from anemia, that is why, besides a diet rich in iron, it is recommended to take 30-50 mg of this element a day after 20th week of pregnancy [6,7,8].

Iron deficiency is very harmful for pregnant woman and her child. Most often, the deficit related to insufficient supply or malabsorption of iron causes

hypochromic anemia which is the cause of reduced tolerance for exercise, and a sense of fatigue in pregnant women. Iron deficiency can also result in low infant birth weight and urinary tract infections. Severe forms of the disease can lead to intrauterine fetal death. Insufficient supply of iron can result in labor problems such as extended duration of labor or the risk of heavy bleeding during childbirth. What is more, perineum wounds of women who give birth naturally heal slowly and after cesarean section scarring of incisions is also problematic in case of iron deficiency. Among women whose iron supplementation is inappropriate, a post birth abnormal uterus shrinking can occur [5,9].

Iodine

Iodine plays an important role in the regulation of energy production, that is, metabolism, and is critical for thyroid hormones production. During pregnancy, the body's need for this element increases, because the fetus begins to absorb iodine from the mother to produce its own thyroid hormones from the twelfth week on. Taking inadequate amounts of this element can lead to disorders of the thyroid gland (hypothyroidism) both in the mother and the fetus. Iodine deficiency can cause miscarriage, intrauterine death of the fetus, retardation and disruption of psychomotor development of the child [7,10]. 15 percent of children whose mothers have hypothyroidism, in the age of 7-9 years old score only 85 IQ points. Children of mothers with severe iodine deficiency in early pregnancy, are 4 times more likely to give birth to their

own children who later develop ADHD and autism. In Poland, there is a widespread shortage of iodine, that is why, it is recommended to take 150-200 mcg of this element throughout the whole pregnancy. The research shows, however, that only every second pregnant woman takes the recommended dosage of iodine [7,11,12].

Calcium

Calcium is an essential mineral necessary for proper development of the child. Changes in pregnancy make it easier to cope with increased demand for calcium through proper nutrition. The changes include: two times increased the ability of calcium absorption in the intestine (depending on the production of 1,25-dihydroxyvitamin D in the bearing) and the active transport of calcium across the placenta. Although the total concentration of calcium decreases due to the physiological reduction of albumin, the level of ionized calcium in the blood remains stable [11,13]. The standards of the Institute of Food and Nutrition show that the consumption of this element during pregnancy should equal 1200 mg per day [14]. The most important task of calcium is participation in the metabolism of bone and teeth. It also plays a very important role in preventing osteoporosis and maintaining proper blood pressure. It is necessary for the heart, muscles, blood clotting, nerve forming and enzyme activity. Calcium ensures normal bone density of the newborn. It can also prevent the emergence of women preeclampsia and preterm delivery. This role of calcium is presumably possible due to its diastolic effect on smooth muscles of the uterus and arterial [9].

Magnesium

The most important role of magnesium is ensuring the proper operation of the circulatory system, bone metabolism and nervous system. Its role is also activating probably about 300 enzymes in the body. Moreover, bearing arising during pregnancy is dependent on magnesium. It can be concluded from

numerous studies that the increased supply of magnesium in early pregnancy contributes to greater infant birth weight [10]. About 50% of magnesium taken from the food is assimilated by the body. The largest amount of this element can be found in plant foods (soy, beans, peas, cocoa, wheat bran, nuts, dried fruit). During pregnancy the need for magnesium is increased, since the increased amount of dietary calcium and phosphorus inhibits its absorption. Pregnant women are advised to increase the daily intake of magnesium to about 350 mg [7]. It has been established, that with the proper functioning of kidneys magnesium intake that exceeds the norms is not harmful while its deficiency can cause nagging muscle cramps and increase risk of hypertension. It can also contribute to low birth weight, be one of the causes of preeclampsia, and thus cause premature birth [10,15].

Potassium

Potassium is an element, which can be found in most foods. The best source containing potassium are fresh, unprocessed and low-processed fruit and vegetables (tomatoes, potatoes, sunflower seeds, bananas, apricots). Processing the food reduces the amount of potassium in it. The element has many physiological functions and participates in related processes, similarly to sodium, fulfill the complementary function. A high intake of potassium lowers blood pressure. The ability of potassium to increase the excretion of sodium by the kidneys and antispasmodic effect on blood, lowers blood pressure [8,16]. Pregnant women should consume 3,500 mg of potassium a day [2,17].

The role of drinking water during pregnancy

Water is an essential ingredient for life of any organism. It is a factor enabling the formation of the most primitive forms of life [18,19]. It is a component of most macromolecules that make up the human body [17]. Water is the solvent and the transport of ions of different elements, carries nerve impulses and in

this way is responsible for the activity of nucleic acids, enzymes and the mineral system. It also allows the formation of weak bonds with other elements improving the preparation of the new compounds e.g.: proteins [10]. Proper hydration of pregnant women is a prerequisite for maintaining the proper homeostasis of the mother and fetus. The water consumption is necessary for the production of amniotic fluid and proper development and function of fetal tissues, especially cells of the central nervous system (CNS), which are extremely sensitive to water deficiency [17]. Appropriate hydration of pregnant woman can reduce the troublesome symptoms associated with pregnancy, such as constipation, dry skin, morning nausea and vomiting, and infections of the lower urinary tract. Especially the latter, in the event of improper fluid intake and reduced urine output daily, can lead to a recurrence of the disease or ascending infection, with all the perinatal consequences (premature labor, pyelonephritis, intrauterine growth retardation, low birth weight, chorioamnionitis, intrauterine infection of the fetus or puerperal infection) [17].

According to standards developed and recommended by the Institute of Food and Nutrition pregnant woman should consume 3,000 ml of water per day, that is about 300 ml more than normal [17].

Aim

The aim of this study was to verify the knowledge of pregnant women about the selected micro and macro elements affecting their health, the fetus as well as generally important for pregnancy.

Material and methods

The survey involved 109 pregnant women from the region of south-eastern Polish. Research method was a diagnostic survey with original questionnaire. The resulting material was subjected to statistical and descriptive analysis. The values of the parameters

analyzed, measured in nominal scale, were characterized using the frequencies and percentage. To investigate the existence of dependency or the differences between the two features, cross tabulation tables and χ^2 test of homogeneity were used. The 5% inference error was accepted and connected with the level of significance $p \leq 0,05$.

Results

The study group was comprised of women aged 18-38 years. 50.5% of the surveyed women had higher education completed, 30.3% graduated from high school and 19.3% had vocational training. Half (50.5%) of the respondents lived in the city. Nearly half of the respondents identified their financial situation as good (45.9%) and satisfactory (30.3%) (Fig. 1). The study included taking supplements before and during pregnancy, the consumption of mineral water and knowledge about deficiencies of micronutrients such as iron, iodine, macro elements such as calcium, magnesium, potassium as well as the awareness of their occurrence in food products.

61 respondents (56%) declared not taking any dietary supplements before pregnancy while 44% of respondents indicated taking dietary supplements. The table above shows that there is no statistically significant relation ($p > 0.05$) between the use of supplementation before pregnancy, education and the economic status. Among surveyed women, 25 respondents (52.1%) who had been taking supplements before pregnancy took them for more than 3 months.

82 respondents (75.2%) apply nutritional supplements during pregnancy while the remaining 27 women (24.8%) reported that they do not take any supplements. Detailed data on the supplements intake are shown in Table 3.

68 respondents (62.4%) answered that they regularly take supplements during pregnancy while 14 women (12.8%) take supplements irregularly. The relationship between the use of dietary supplements in pregnancy and the place of residence and the economic status are presented in Table 4.

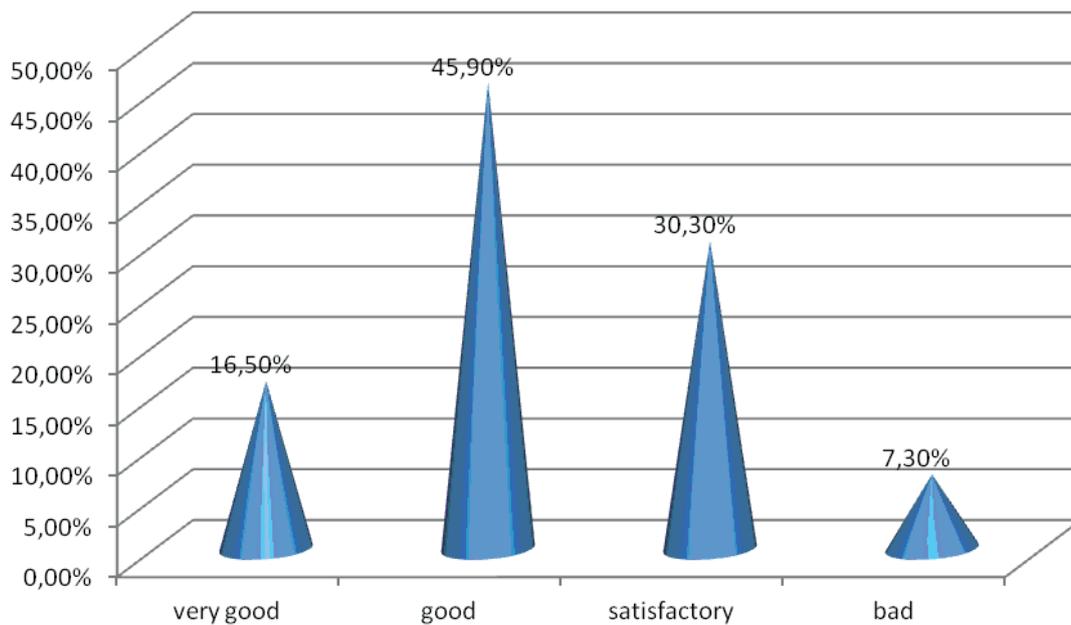


Fig. 1.
The economic status of respondents

Table 1.
Use of dietary supplements before pregnancy, education and financial situation

Studied features		Use of dietary supplements before pregnancy				Significance
		YES n=48; 44.0%		NO n=61; 56.0%		
		n	%	n	%	
Education	Higher n=55, 28.3%	29	26.6	26	23.9	$\chi^2 = 3.520$ p=0.172
	Secondary n=33, 49.3%	11	10.1	22	20.2	
	Vocational n=21, 16.4%	8	7.3	13	11.9	
Economic status	Very good n=18; 16.5 %	14	12.8	4	3.7	$\chi^2 = 3.335$ p=0.343
	Good n=50; 44.9%	45	41.3	5	4.6	
	Satisfactory n=33; 30.3 %	26	23.9	7	6.4	
	Bad n=8; 7.3 %	4	3.7	4	3.7	

Table 2.

Period of taking a dietary supplement before pregnancy

Period of taking a dietary supplement before pregnancy	N	%
1 month	7	14.6
3 months	16	33.3
More than 3 months	25	52.1
Total	48	100.0

Table 3.

Use of dietary supplements during pregnancy

Use of dietary supplements during pregnancy	N	%
Yes, regularly	regu68	62.4
Yes, not regularly	14	12.8
No, I'm not using	27	24.8
Total	109	100.0

Table 4.

Use of supplements during pregnancy and the place of residence and economic status

Studied features		Use of supplements during pregnancy						Significance
		Yes, regularly n=68; 62.4 %		Yes, not regularly n=14; 12.8%		No n=27; 24.8%		
		n	%	n	%	n	%	
Place of residence	Rural n=54; 49.5%	32	30.3	6	5.5	16	14.7	$\chi^2 = 1.261$ p=0.532
	Urban n=55; 50.5%	36	32.1	8	7.3	11	10.1	
Economic status	Very good n=18; 16.5%	12	11.0	3	2.8	3	2.8	$\chi^2 = 3.487$ p=0.746
	Good n=50; 45.9%	32	29.4	6	5.5	12	11.0	
	Satisfactory n=33; 30.3%	21	19.3	3	2.8	9	8.3	
	Bad n=8; 7.3%	3	2.8	2	1.8	3	2.8	

There was no statistically significant correlation between the studied features ($p > 0.05$). When choosing a product 59 women followed doctor's suggestion (72%), 9 respondents took advice of friends (11%), and 8 women (9.8%) followed the suggestion of the pharmacist. Further 5 respondents (6.1%), chose the product by its prize, and only one woman (1.2%) paid attention to the composition of the supplement.

84 pregnant women (77.1%) indicated that they drink at least 1.5 liters of water per day and 25 (22.9%) admitted that they do not drink required amount of water. Respondents were asked about the type of water they usually drink. In the study group, 34.9% of women chose the medium-carbonized water. 28 respondents (25.7%) could not decide on the type of water they drink. 25 women (22.9%) answered that they drink low mineral water, and 18 respondents (16.5%) drink high mineral water.

Subsequent analysis regard the knowledge of respondents on selected macro and micronutrients. Data concerning the products which, according to respondents, contain the most assimilable iron, and the consequences of its deficiency are included in Table 5 and 6.

Table 5.

Products containing the most assimilable iron according to respondents

Products containing the most assimilable iron	N	%
Liver and meat	94	86.2
Egg yolk	32	29.4
Nuts	38	34.9
Beetroots	42	38.5
Bean	17	15.6
Spinach	60	55.0
Cocoa	21	19.3
Poultry	6	5.5

* The values do not add up to 100% due to the possibility to select multiple answers

Majority of respondents indicated that products rich in assimilable iron are liver and meat (86.2%) as well as spinach (38.5%).

The most common (68.8%) consequence of iron deficiency, according to surveyed women, is anemia.

Pregnant women were asked what is the source of iodine. The structure of the answers is presented in Table 7.

Majority of surveyed women (51.4%) often indicated fish as a source of iodine, 49 respondents (45%) picked salt, 8 women (7.3%) chose seafood, and 14 (12.8%) did not know which products are high in iodine. 69 women (63.3%) consumed foods rich in iodine, and 40 (36.7%) did not. Data on the effects of insufficient supply of iodine, according to respondents are included in Table 8.

The surveyed women asked about the effects of iodine deficiency responded as follows: 48 respondents (44%) indicated increase in the risk of mental retardation in children, 38 women (34.9%) did not answer, 18 women (16.5%) picked neurosis, 5 of the respondents (4.6%) indicated rickets as a possible effect on iodine shortage in organism.

Table 6.

The effects of iron deficiency

The effects of iron deficiency according to respondents	N	%
Rickets	4	3.6
Mother's anemia	75	68.8
The risk of premature birth	15	13.8
I don't know	15	13.8
Total	109	100

Table 7.

Sources of iodine according to respondents

Sources of iodine	N	%
Seafood	8	7.3
Fish	56	51.4
Salt	49	45.0
I don't know	14	12.8

*The values do not add up to 100% due to the possibility to select multiple answers

Table 8.

Consequences of iodine deficiency according to respondents

Iodine deficiency	N	%
Increased risk of mental retardation in children	48	44.0
Rickets	5	4.6
Neurosis	18	16.5
I don't know	38	34.9
Total	109	100.0

Table 9.

Consumption of foods rich in iodine, education and economic status of the study group

Studied features		Consumption of foods rich in iodine				Significance
		Yes n=69; 63.3 %		No n=40; 36.7%		
		n	%	n	%	
Education	Higher n=55; 50.5%	36	33.0	19	17.4	$\chi^2 = 4.540$ p=0.797
	Secondary n=33; 30.3%	21	19.3	12	11.0	
	Vocational n=21; 19.3 %	12	11.0	9	8.3	
Economic status	Very good n=18; 16.5%	16	14.7	2	1.8	$\chi^2 = 8.295$ p=0.040
	Good n=50; 45.9%	26	23.9	24	22.0	
	Satisfactory n=33; 30.3%	21	19.3	12	11.0	
	Bad n=8; 7.3%	6	5.5	2	1.8	

Table 10.

The best sources of calcium according to respondents

The best sources of calcium	N	%
Milk and dairy products	102	93.6
Cheese	80	73.4
Legumes	23	21.1
Nuts	19	17.4
Chives	3	2.8
Dark green vegetables	1	0.9
Wheat	15	13.8

* The values do not add up to 100% due to the possibility to select multiple answers

The relationship between the consumption of foods high in iodine by pregnant women and their economic status and education are presented in Table 9.

Statistical analysis shows that the economic status significantly affects the consumption of foods rich in iodine ($p = 0.040$) while there was no statistically significant correlation between education and consumption of products containing iodine ($p = 0.797$).

Information about products that contain the most calcium according to the surveyed women are presented in Table 10.

The majority of respondents (93.6%) indicated milk and dairy products as the best source of calcium. Successively, 80 respondents (73.4%) picked yellow cheese, 23 respondents (21.1%) indicated legumes, 19 women (17.4%) chose nuts, 15 respondents (13.8%) indicated grains, 3 women of the study group (2.8%) picked chives and 1 woman (0.9%) chose legumes as products high in calcium.

Insufficient intake of calcium according to the surveyed women is shown in Table 11.

The majority of the study group 73 (67%) indicated osteoporosis as a result of calcium deficiency. 28 respondents (25.7%) picked decay, and 6 respondents (5.5%) did not know the answer. Only 2 women (1.8%) indicated lowered immunity as a result of the absence of calcium in the organism. 50.2% of respondents said that buckwheat is highest in magnesium, 26.3% said that chocolate is the high magnesium food product. Data on magnesium deficiency are presented in Table 12.

More than half of the of the respondents (79.8%) indicate painful muscle cramps as a result of magnesium deficiency. 16 women did not know the consequences of magnesium shortage for the organism. Four of the surveyed women (3.7%) indicated anemia as a consequence of magnesium deficiency and 2 of the respondents (1.8%) said that the consequence is insulin resistance.

Table 11.

Effects of calcium deficiency according to respondents

Calcium deficiency	N	%
Osteoporosis	73	67.0
Decay	28	25.7
Lowered immunity	2	1.8
I don't know	6	5.5
Total	109	100.0

Table 12.

Magnesium deficiency according to respondents

Magnesium deficiency	N	%
Painful muscle cramps	87	79.8
Anemia	4	3.7
Insulin resistance	2	1.8
I don't know	16	14.7
Total	109	100.0

The list of products high in potassium is shown in Table 13.

103 respondents (94.5%) indicated tomatoes and potatoes as products high in potassium. 40 surveyed women (36.7%) answered that dried fruit are rich in potassium, 33 indicated oranges and tangerines, 7 (6.4%) picked pickles and sauerkraut, and 4 women (3.7%) did not know which products are highest in potassium.

The data showing the effects of potassium deficiency as indicated by respondents are presented in Table 14.

Great majority of respondents (62.4%) indicated cardiac arrhythmias as a result of deficiency of potassium in the organism. According to 8 respondents (7.3%) lack of potassium causes rise in blood pressure, for 6 respondents (5.5%) it is weakness of the body. 23 respondents (21.1%) did not know the answer, and 4 (3.7%) reported edema as a result of potassium deficiency.

Table 13.

Products highest in potassium according to respondents

Products highest in potassium	N	%
Tomatoes, potatoes	103	94.5P
Pickles and sauerkraut	7	6.4
Oranges and tangerines	33	30.3
Dried fruit	40	36.7
I don't know	4	3.7

* The values do not add up to 100% due to the possibility to select multiple answ

Table 14.

The effects of potassium deficiency according to respondents

Potassium deficiency	N	%
Cardiac arrhythmias	68	62.4
Swelling	4	3.7
Weakness of the body	6	5.5
High blood pressure	8	7.3
I don't know	23	21.1
Total	109	100

Discussion

Results of the study can be considered satisfactory. The majority of surveyed women have knowledge of which food products contain important micro and macro elements. To prevent qualitative and quantitative shortage of elements and its consequences, a proper diet has to be composed for a pregnant woman. The diet should meet the principles of dietary reference intake, meet woman's nutritional needs, be varied, balanced and wholesome [1,20,21,22].

The diet should be rich in vitamins and minerals and should consist of optimal amounts of protein, carbohydrates and fats [3,23,24,25]. The increase in demand for nutrients in pregnant women is caused by the development of the fetus, placenta and maternal tissues [23,27]. A positive phenomenon is the fact that upon becoming pregnant women change their eating habits, start taking nutrient supplements and follow medical recommendations concerning nutrition during pregnancy. Unfortunately, before the conception only 44% of respondents were taking supplements of micro and macronutrients. It cannot be denied that appropriate diet before pregnancy provides optimal conditions for the development of the fetus [13, 21,28,29].

Iodine deficiency can be observed in 50% of the Europe population, including pregnant women. Small and moderate deficiency leads to disorders of psychomotor development, while heavy leads to the development of cretinism. Hypothyroidism resulting from iodine deficiency increases the risk of miscarriage and premature birth [13]. In our study, most respondents knew which products are the source of iodine, and nearly half of the study group had knowledge of its deficiency. Our study shows that the consumption of products containing iodine is related to the good economic status of the respondents.

Magnesium remains in a dynamic equilibrium with the calcium and improves absorption of potassium. Moreover, magnesium is essential for the proper operation of the heart muscle, preventing its hypoxia and ischemia. It prevents the occurrence of arrhythmias and hypertensive disease and blockages in the blood vessels. Magnesium deficiency in

pregnancy causes muscle spasms and contractions of the uterus as well as increases the risk of eclampsia [18, 30,22,31]. In our study, the majority of women knew the products with a high content of this element, as well as the consequences of its deficiency.

Conclusions

Most pregnant women do not take supplements before pregnancy. Upon becoming pregnant they change their diet and start taking mineral supplements mainly in accordance with medical recommendations. The majority of the study group has knowledge about the particular element's sources and the effects of its deficit.

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