



The dietary composition of women who delivered preterm and full-term infants



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ABSTRACT

Objectives: Literature data show that excess and primary deficiency in particular nutrients, vitamins and minerals may lead to pre-eclampsia, gestational diabetes, hypertension and neural tube defects in the foetus. The aim of the study was to determine differences in average daily consumption of selected nutrients during pregnancy in women who did not supplement their diet and to evaluate the influence of dietary habits on the occurrence of pre-term delivery and hypertension in pregnant women.

Sample group and methods: Information on the course of pregnancy and the newborn's health status at birth was derived from the Charter of Pregnancy and documents recorded by the hospital. Women's eating habits and dietary composition were analyzed on the basis of a dietary questionnaire. The sample group was divided into four groups: women who delivered neonates appropriate for gestational age (AGA), women with gestosis who delivered AGA neonates by means of caesarean sections, women who delivered pre-term neonates (PTB) and women with gestosis who delivered PTB by means of caesarean sections.

Results: In the case of women with vaginal delivery at term the average intake of iodine was always higher than in other groups. Analysis of average daily intake of folates revealed a higher intake in the group of women who gave birth to full-term neonates with proper neonatal weight in comparison with the groups of women with pre-term delivery. $P \leq 0.05$.

Conclusions: Statistically significant differences in average daily intake of folates, iodine, retinol, magnesium and iron were observed between the group of women with vaginal delivery at term and the groups of women with diagnosed hypertension who delivered preterm. Correlation was demonstrated between average daily intake of iodine and vitamin D and the occurrence of arterial hypertension. Supplementation of the diet of women in the preconception and prenatal period with minerals and vitamins should be considered.

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1. Introduction

The diet of a pregnant woman, which conditions proper development of the foetus, should be the source of wholesome protein, fats and carbohydrates and take into account recommendations on the right proportions and caloric value which vary depending on the trimester of pregnancy. According to recommendations of the Food and Nutrition Board, daily intake of protein for pregnant women is about 1 g per kilogram of body weight, which constitutes 10–15% of daily energy demand (WHO, 2007a). Consumption of fats should be an average of 25–30% of daily energy demand. During pregnancy, depending on the trimester, fat content in the diet should be increased by 11–15 g daily on average, an adequate content of fatty acids should also be taken into account (Jarosz, 2012;

WHO, 2010). The remaining energy demand, i.e. 45–60%, should be provided by carbohydrates (Jarosz, 2012; WHO, 2007b).

Studies have shown that supplying an insufficient amount of protein to the body during pregnancy has an adverse effect on foetal development and birth body weight of neonates, and low birth weight is associated with the risk of hypertension, diabetes, obesity or hyperlipidemia at a later age (Jarosz, 2012; Akbari, Mansourian, & Kelishadi, 2015; Ostachowska-Gąsior, 2008). An excessive intake of carbohydrates during pregnancy is associated with the risk of hyperglycemia for the mother and leads to hyperglycemia and hyperinsulinemia in the foetus, leading to increased protein synthesis in the foetus and deposition of fat and glycogen in tissues, which result in macrosomia and the occurrence of polyhydramnios (Wang, Jiang, Yang, & Zhang, 2015).

An important element of proper nutrition of pregnant women is the supply of adequate amounts of vitamins and minerals, especially those scarcely present in food products.

In accordance with recommendations concerning deficiency of vitamin D - daily intake of the vitamin for pregnant women is 20–25 µg.

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Literature data show that vitamin D affects expression of genes regulating angiogenesis. During pregnancy vitamin D is essential to maintain the fetus. Vitamin D deficiency may lead to the occurrence of pre-eclampsia, gestational diabetes, and in the foetus - to the development of rickets (Gruber, 2015; Misiorowska & Misiorowski, 2014; Robinson, Wagner, Hollis, Baatz, & Johnson, 2011; Sadin, Pourghassem Gargari, Fard, & Tabrizi, 2015).

Calcitriol - an active form of vitamin D, affects calcium-phosphate metabolism of the organism and inhibits secretion of parathormone (Misiorowska & Misiorowski, 2014).

Another important vitamin in the diet of pregnant women is vitamin B9, also called folic acid. The consumption norm concerning folates during pregnancy is 600 µg.

Folates participate in the synthesis of red cells and joining of alkyl groups to nucleobases. They are also a cofactor of metabolic changes of homocysteine (Kapka-Skrzypczak, Niedźwiecka, Skrzypczak, & Wojtyła, 2012).

Deficiency of folates leads to an increase in homocysteine concentration, which is a risk factor of development of thrombotic disorders. During the preconception period and early pregnancy, deficiency of folates may lead to neural tube defects in the foetus, and later in pregnancy, it may increase the risk for premature birth, the occurrence of pre-eclampsia and hypertension (Kapka-Skrzypczak et al., 2012; Cieślak & Kościej, 2012; Seremak-Mrozikiewicz, 2013).

Another important element of the diet during pregnancy is iodine. Daily intake of iodine recommended by WHO is 250 µg (Hubalewska-Dydejczyk, Lewiński, Milewicz, et al., 2011). Iodine is essential for the production of the thyroid hormone - thyroxine, which participates in, among others, proliferation of neural cells of the developing foetus (Zygmunt & Lewiński, 2015).

Severe iodine deficiency during pregnancy may lead to an increased risk of miscarriage, preterm delivery, impaired foetal lung development, deafness, damage to the central nervous system and even to irreversible brain underdevelopment in the foetus (Zygmunt & Lewiński, 2015).

The risk of hypertension in pregnant women is increased in the case of magnesium deficiency. Magnesium is a cofactor of carbohydrate, fat and protein metabolism. Magnesium takes part in glycolysis, calcium homeostasis, vitamin D hydroxylation and synthesis of high-energy bonds (ATP, GTP). By creating complex formations with phospholipids, magnesium is also part of the structure of cell membranes (Iskra, Krasieńska, & Tykarski, 2013).

Pregnancy complications concerning both the mother and foetus affect the increase of perinatal mortality, which constitutes an important public health issue.

To date, research has proved that women's awareness of balanced nutrition during pregnancy and the influence of nutrition on the health of the mother and her future child is insufficient, both in terms of choice of nutritional ingredients and dietary supplements (Akbari et al., 2015; Kapka-Skrzypczak et al., 2012; Seremak-Mrozikiewicz, 2013; Zygmunt & Lewiński, 2015; Hamułka, Wawrzyniak, & Pawłowska, 2010; Suliga, 2013; Waszkowiak, Szymandera-Buszcza, & Szewczyk, 2010).

2. Aim of the study

The aim of the study was to determine differences in average daily consumption of selected nutrients during pregnancy in women who did not supplement their diet, and to evaluate the influence of dietary habits on the occurrence of preterm delivery and hypertension in pregnant women.

3. Research and method

In accordance with Polish perinatology protocols, mothers and children were admitted onto the Maternity Ward in Hospital in Tychy in I–II 2016, for 3 days after the delivery.

To obtain a homogeneous group of women, the following inclusion criteria were applied:

1. Polish nationality (excluding naturalized Polish citizens); single pregnancy; pregnancy I–III (consider parity);
 2. Stable socioeconomic status. Socioeconomic status was determined based on factors such as income, marital status, education, place of residence. Women eligible for the study were married, had good housing conditions, had secondary or higher education level; lived in a highly industrialized urban region, both the women and their husbands had a steady job;
 3. Following a typical diet for the Polish population. The diet of the women was determined on the basis of "Album of Photographs of Food products and Dishes" (Szponar, Wolnicka, & Rychlik, 2010) (the women accepted into the study were neither vegetarians nor followed any other special diets). Their diet was not modified in any way;
 4. Granting consent to participate in the study.
- The following exclusion criteria were applied:

1. Chronic diseases occurring in the women before pregnancy, such as chronic hypertension, pre-gestational diabetes; infections during pregnancy (any kind of infection in the perinatal period, such as fever, respiratory infections, urinary infections, etc.); miscarriages and/or premature birth resulting in the death of the child or developmental anomalies in the foetus;
2. AIDS and sexually transmitted diseases;
3. Adherence to a vegetarian diet, Mediterranean diet, or any other special diet;
4. Lack of the mother's consent to take part in the research program or withdrawal of consent during the study.

Women who participated in the research program were classified into four groups according to the following criteria:

–Group A - Group of women who delivered neonates appropriate for gestational age. (AGA), healthy mothers, routine, uneventful pregnancy (neonatal weight 10th–90th percentile) (n = 11),

–Group B - Group of women who delivered neonates appropriate for gestational age by means of caesarean sections due to gestational high blood-pressure (neonatal weight 10th–90th percentile) (n = 10),

–Group C - Group of women who delivered preterm neonates (PTB), healthy mothers, routine, uneventful pregnancy (n = 7),

–Group D - Group of women who delivered preterm neonates (PTB), by mean of caesarean sections due to gestational high blood-pressure (n = 8) (Table 1).

Women eligible for the study underwent three ultrasound examinations (between the 12th and 14th weeks of gestation, between the 20th and 22nd weeks and between the 32nd and 33rd week). All the fetuses had normal karyotypes and no malformation at birth.

The mothers did not receive any dietary supplementation during pregnancy. The mothers in PTB did not receive corticosteroids. Those children whose weight exceeded the 90th percentile (Large for gestational age - LGA) were not included in the study.

The information on the course of pregnancy of the women came from the Charter of Pregnancy, i.e. the document recorded by the gynecologist who took care of the pregnant woman. All the information

Table 1
Analysis of the studied groups, g - gram.

Studied group	Size of group	Mean age of participants	Birth order defined in %			Average birth weight (g)
			I	II	III	
Group A	11	32	9%	91%	–	3470.45
Group B	10	31	60%	40%	–	3433
Group C	7	32	43%	–	57%	2137.14
Group D	8	27	100%	–	–	2052

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