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*Proper nutrition of pregnant women with diabetes is essential  
for health of the mother and child*

Having a healthy baby without complications in pregnancy and labour is essential for the mother-to-be. In this respect, proper nutrition of the pregnant woman is extremely important, which is to provide energy, proteins, carbohydrates and fats, particularly unsaturated fatty acids, vitamins, minerals and to prevent excessive food amounts (7). However, the situations which can generate adverse effects are not always consciously avoided. During pregnancy significant hormonal and metabolic changes develop, which provide energy and building needs of the developing fetus. The fetal tissues and placentas are very sensitive to metabolic changes, e.g. slightly increased glucose concentrations in blood cause the development of complications (11). In this period diabetes poses even a greater risk.

Two types of diabetes are observed in women in the procreation period – pre-pregnancy and pregnancy diabetes, which is also called gestational. The former concerns patients in whom diabetes developed and was diagnosed before pregnancy, the latter is related to women who developed it during pregnancy (11).

Gestational diabetes mellitus (GDM) is defined as glucose tolerance disorders of various severity, which accompany pregnancy. This type of diabetes is most often revealed during pregnancy by metabolic effects depending on pregnancy itself: the placenta hormones start to work, which require increased secretory activity of  $\beta$  islet cells to maintain proper glycaemia tolerance. In women with reduced abilities to adjust, some biochemical and clinical changes develop in the form of impaired glucose tolerance or overt diabetes. Pregnancy does not cause diabetes but discloses its presence (2).

Despite immense advances in the diagnosis and treatment of this disease, diabetes detected during pregnancy is still a serious problem for the mother and developing fetus. This type of diabetes accounts for 80% of all cases of carbohydrate tolerance disorders during pregnancy. The literature data about the incidence of GDM vary. It is generally estimated that the GDM incidence in the European population is 2–4% and in Poland – 3% (11). The number of diabetes cases has been increasing (civilization disease), so has the number of pregnant women with diabetes. Paradoxically, despite advances in modern medicine, the problem of pregnant women afflicted with diabetes increases and requires appropriate diagnostic procedures and special management of pregnancy.

Irrespective of the mechanisms leading to the above-mentioned disorders, however, possible consequences of diabetes during pregnancy should be pointed out. The consequences may concern both the mother and the fetus. Mothers are at increased risk of life-threatening preeclampsia and

eclampsia, their susceptibility to infections is higher. Moreover, the risk of delivery by surgery becomes greater. The diabetes-related risks for fetuses and neonates are even higher. The incidence of congenital defects in children of diabetic mothers is found to be 2–5 times higher than that in the general population. The defects affect the skeletal, nervous, cardiovascular, genitourinary and alimentary systems. The genetic defects are also likely to develop, e.g. Down's syndrome. Furthermore, an increased risk of death, peridelivery injury (due to high birth weight of neonates), respiratory disorders and diabetes in the next generation are observed (2, 7).

#### PRE-PREGNANCY DIET

Women can influence the proper course of pregnancy and fetal development still before pregnancy. The pre-conception period should be devoted by mothers-to-be to institution of rational nutrition and proper dietary habits. The woman's organism requires about three months to accumulate indispensable supplies of vitamins and minerals and to eliminate undesirable substances. However, vitamin preparations should not be overused as their excessive amounts may be dangerous both for the fetus and the mother. In the pre-conception period, obese women should normalize their body weight to prevent more severe complications during delivery. However, too drastic diets which are likely to lead to hormonal imbalance and stop the ovulation should be avoided. The diet should be varied, contain bigger amounts of fresh, less processed food products and be rich in vegetables and fruits. Diabetic women should have their glycaemia controlled several months before planned pregnancy (5, 7).

#### PREGNANCY, DIABETES AND DIET

Women who were afflicted with diabetes before becoming pregnant have broad knowledge and experience in the management of the disease. Thus the problem of diabetic diet occurs in women diagnosed with diabetes during pregnancy. The rules of therapeutic management depend on the type of diabetes, however the main aim is to maintain the optimal blood sugar level and to avoid too high glycaemia fluctuations. Complete control of other metabolic disturbances during pregnancy is necessary. This is essential for normal pregnancy and delivery of a healthy child at term. In GMD-complicated pregnancy, diabetes may be controlled by proper diet and physical effort in 40–60% of cases, at least in its larger part (10, 11).

Diet in pregnancy does not essentially differ from normal diabetic diet. It is low in well-absorbable carbohydrates and easily digestible diet. Its composition should be selected individually according to energy needs and doctor's orders. In order to provide the fetus with suitable amounts of energy, the daily dietary energy intake of mothers should be increased by 200–300 kcal in the first half of pregnancy and by 300–400 kcal in the second half, which in the majority of cases is about 10–15% of energy more than before pregnancy. The mean weight increase in pregnancy is about 12.5 kg, of which proteins constitute 0.9 kg. About 50% of protein mass increase involves the fetus, 25% – the uterus and mammary tissues and about 10% – the placental tissue. Blood and amniotic fluid contain the remaining 15%. The biggest fetal growth is observed in the last 10 weeks of pregnancy, therefore the accumulation of fetal proteins is the highest one in this period. While planning the diet, special attention is paid to the amount of proteins, which should be min. 1.5–2 g/kg of body weight/day (5).

The diet of diabetic women should include foodstuffs which mainly supply wholesome proteins, e.g. lean meat, particularly poultry and veal, fish as well as milk and its products, which additionally provide the best absorbable calcium. Increased consumption of calcium in pregnancy is extremely

important as calcium used by the developing fetus comes from mother's reserves. Milk diet is recommended as 1 l of milk provides 1200 mg of calcium. In order to add variety to diets, natural and fruit yogurts as well as kefir and cottage cheese may be consumed (8).

The fat content in the pregnant woman diet should cover 30% of energy requirements, including up to 10% of fatty acids. The requirements for unsaturated fatty acids significantly increase and should provide at least 4.5% of energy needs. The polyunsaturated fatty acids omega-3 play an important role in the proper development of the fetal cerebrum and retina, both during fetal life and after birth. Moreover, they reduce the risk and intensity of symptoms of allergy. Deficient intake of these acids increases the risk of pre-term labour and low birth weight (8). The dietary intake of cholesterol should not exceed 300 mg/day. The intake of trans isomers of fatty acids should also be limited. The dietary deficiencies of fats in pregnancy are rare. They are likely to be accompanied by vitamin A deficiency. The proper relation between saturated and unsaturated fats is essential, which allows to maintain a suitable level of LDL cholesterol (3). The main source of polyunsaturated fatty acids should be: soya, sunflower and corn oil, saltwater fish while monounsaturated fatty acids should come from olive and rape oil (7). The pregnant woman should consume limited amounts of fats, mostly plant fats which contain necessary unsaturated fatty acids and vitamin E. For salads and fresh vegetable salads, soya or sunflower oil is recommended, for frying – olive and never butter or margarine due to low temperature of decomposition (1).

The amount of carbohydrates in the pregnant woman diet should depend on her individual energy needs. Carbohydrates should cover 50–60% of energy requirements, they ought to be complex carbohydrates from coarse products (wholemeal bread, groats) which are a rich source of such dietary components as thiamin, niacin, pyridoxine, iron, fibre. To prevent constipation in pregnancy, the amount of dietary fibre should be 30–40 g/day. Sweets should be excluded from the diet of pregnant women as they supply substantial amounts of saccharose and fat while being low in other nutrients. Since many women cannot do without sweets, especially during pregnancy, dietetic sweeteners may be used, e.g. aspartame, acesulfan. The consumption of saccharine is not allowed both during pregnancy and breast-feeding (10).

An important role in the diet is also played by vegetables and fruits providing the organism with carbohydrates and antioxidative vitamins which neutralize cyclic lipid superoxides involved in the development of peri-labour diseases (8).

Moreover, an important element of the diet of pregnant women should be folic acid which prevents congenital defects of the nervous system (e.g. rachischisis). Apart from foodstuffs rich in this vitamin (lettuce, parsley leaves, broccoli, citrus fruits, whole grains), the administration of folic acid is recommended (400 µg/day) three months before conception (6, 7).

Another important dietary element is iron, whose deficiency leads to hypochromic anaemia, decreased physical efficiency, disorders of the immune system. Pregnancy is the condition in which anaemia is extremely common. Iron deficiency is mainly caused by dietary errors and disturbances in its absorption. Moreover, caffeine in coffee and coke-type carbonated drinks decreases the absorption of iron. The main source of iron in the diet of pregnant diabetic women should be: meat and its products, particularly poultry and fish, whole grains and green vegetables. It should be remembered, however, that deficiencies of mineral components and vitamins in pregnancy are equally dangerous as their excessive amounts, particularly of vitamin A, D and E. Excessive amounts usually result from over-supplementation of diet with vitamin preparations (4).

The amount and quality of meals should be carefully planned taking into account blood sugar levels. Diets of pregnant women should be well absorbable, attractive in their composition, taste and colour. The diabetic pregnant women should consume regular, light meals, 6–8 a day. This

will prevent typical complaints of pregnancy – constipation, heartburn, morning sickness. The most important is an evening meal which is to protect the pregnant woman against hypoglycaemia and hunger ketogenesis (1, 2).

The women who had GDM are in the high risk group of metabolic disorders, mainly of carbohydrate metabolism but also other disturbances which may precede the development of diabetes of some other type. Therefore women with past GDM should continue their rational dietary habits after labour. This will prevent many complications concerning them and their family.

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#### SUMMARY

The aim of the study was to stress the role of diet in diabetic pregnant women, to indicate dietary errors which may have adverse effects on health and proper development of the mother and the fetus, and to present guidelines of rational nutrition, which should be followed by pregnant women with diabetes.

#### Wpływ żywienia ciężarnej z cukrzycą na stan zdrowia matki i dziecka

Celem pracy było zwrócenie uwagi na rolę diety w żywieniu kobiet ciężarnych z cukrzycą, wskazanie błędów żywieniowych, mogących oddziaływać niekorzystnie na zdrowie matki i prawidłowy rozwój płodu oraz przedstawienie zasad racjonalnego odżywiania się, jakimi powinna się kierować kobieta ciężarna z cukrzycą.