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Gestational diabetes mellitus as a social problem

Abstract

The incidence of diagnosing diabetes in pregnancy in different parts of the world is 3-20%. Members of the world-wide organizations dealing with diabetes of the pregnant women emphasize the need of introducing changes in its definition in the foreseeable future. Such changes could significantly increase the rate of diagnosing the disease. Due to the existence of more numerous evidence of decreasing the risk of complications in mother and child as a result of treatment of even mild hyper-glycaemia conditions, redefinitions of gestational diabetes mellitus (GDM) are inevitable. Gestational diabetes is diagnosed in a growing number of women in the light of the increasing rates of obesity, type 2 diabetes, as well as the later biological age of women planning to become pregnant. Because of this tendency, and in connection with the proven risk of complications in the mother and child, both during pregnancy and after the birth due to the increased risk of the development of type 2 diabetes in future, the development of diabetes during pregnancy is becoming a growing social problem. The implementation of the appropriate scheme of preventive tests, early diagnosis, and the correct glycemic control may contribute to the limitation of its dangerous effects. Awareness of the value of monitoring over the pregnant woman and the fetus, especially in the presence of the factors of risk of the development of gestational diabetes and the proper perinatological care, are the basic factors used to limit the development of complications. Detection of GDM and the implementation of the appropriate management are important because the effects of uncontrolled diabetes impinge on the future of both the mother and the child, and thus the next generations.

Keywords: gestational diabetes, public environment and health, health promotion, pregnancy complications.

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INTRODUCTION

Disorders of the carbohydrate metabolism in pregnant women in Poland are observed in 3-5% of pregnancies and include: pregestational diabetes (PGDM - pregestational diabetes mellitus) and gestational diabetes (GDM - gestational diabetes mellitus). Pregestational diabetes, or the occurrence of type 1, 2 or MODY diabetes (MODY – Maturity Onset Diabetes of the Young) already before getting pregnant, concerns about 0.3% of pregnant women in Poland. This corresponds to 10-20% of diagnoses of diabetes during pregnancy. Other 80-90% of carbohydrate disorders in pregnancy is the gestational diabetes, that is various degrees of carbohydrates tolerance or developing diabetes or the one diagnosed for the first time during pregnancy [1-4]. The prevalence of diabetes in pregnancy in the world varies between 3 and 20% [5,6] and depends on demographic and ethnic factors, as well as on criteria of diagnosis diabetes in pregnancy, which are different in different countries. Studies of numerous centers note the gradual increase in the incidence of gestational diabetes, what is connected, among others,

with the increasing rates of obesity [7-9], type 2 diabetes [10], as well as the older age of women getting pregnant [11]. Due to these tendencies, but also the risk of complications in the mother and child, both during pregnancy and in the distant time after the birth, and the increased risk of type 2 diabetes in the future, diabetes occurring in pregnancy is one of the basic problems of the public health. During the pre-conceptual period, the development of gestational diabetes may be actively counteracted, preventing the occurrence of overweight and obesity. In pregnancy, the key meaning is placed on screening tests, diagnosing the asymptomatic hyperglycaemia in the 1st trimester of pregnancy, adequate monitoring of the pregnancy, as well as proper treatment of the potential disease in order to avoid the development of its complications.

Among various centers in the world, there is no consensus on the criteria of the GDM diagnosis. Polish Diabetes Association (PDA) and Polish Gynaecological Association (PGA) predict the algorithms of screening tests to diagnose carbohydrate metabolism disturbances based on the recommendations of the World Health Organisation WHO.

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In order to diagnose the asymptomatic pre-gestational diabetes (PGDM) every woman being pregnant, already during the first visit at the obstetrician-gynaecologist, should be subjected to the preliminary tests of blood glucose concentration. The first test is conducted on an empty stomach. Further action depends on the result of this measurement (Table 1).

TABLE 1. Screening and diagnostic strategies of gestational diabetes.

Fasting plasma glucose concentration	Recommendation
<100 mg/dl (<5.6 mmol/l)	The result is normal. Perform a 50 g oral glycemic load or 75 g oral glycemic load between 24 and 28 week of pregnancy
100 mg/dl (5.6 mmol/l) - 125 mg/dl (6.9 mmol/l)	The result is too high. Perform 75 g oral glycemic load as soon as possible.
>125 mg/dl (6.9 mmol/l)	The result is too high. Repeat the fasting plasma glucose test.
	If the result is >125 mg/dl again – recognize gestational diabetes, send the patient to the hospital.
	If the result is <125 mg/dl – perform a 75 g oral glycemic load.

Oral glucose tolerance test (OGTT) is conducted in patients with the elevated glucose on an empty stomach, but also in women from GDM risk groups. Factors significantly increasing the GDM development risk, accepted by PDA include: parity, pregnancy after 35 years of age, previous births of children with high body weight (>4000 g), previous birth of a newborn with congenital malformation, stillbirths, hypertension or overweight before pregnancy (BMI>27 kg/m²), family history of type 2 diabetes or the diagnosis of GDM in previous pregnancies. In women burdened with at least one of the above-mentioned risk factors, it is recommended to conduct the load test of 75 g glucose [12].

If the tolerance test of 75 g glucose in the 1st trimester of pregnancy:

- is proper, it should be repeated between 24th and 28th week of pregnancy, that is during pregnancy, in which this test is routinely and in accordance with the norms performed in other pregnant women;
- confirms GDM, you should repeat the diagnostic test between 24th and 28th week of pregnancy or when the first symptoms suggesting diabetes occur.

According to PDA, apart from the one-stage procedure, i.e. the glucose tolerance test using the solution of 75g of glucose, there is an alternative way of diagnosis, which is performed in the III trimester of pregnancy. This is a two-stage protocol, in which you first additionally use the screening test consisting of the oral challenge of 50 g glucose (GCT – *glucose challenge test*). The woman performing this test does not have to have an empty stomach. The test should be performed between 24^{th} and 28^{th} week of pregnancy, while in the patients with several risk factors of developing the gestational diabetes, it should be performed about the 24^{th} pregnancy week. Marking the glucose level in blood is performed after an hour from taking 50 g of glucose (Table 2).

TABLE 2. Diagnosis of GDM with 50 g oral glycemic load.

1 h plasma glucose value	Interpretation
<140 mg/dl (7.8 mmol)	Normal
141-199 mg/dl (7.8-11,1 mmol/l)	Needs verifying with 75 g oral glycemic load.
>200 mg/dl (11.1 mmol/l)	Recognise GDM. Send the patient to the hospital promptly.
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More than half of women with gestational diabetes are not at risk of developing the disease [13]. Therefore, tests for diabetes are conducted in Poland in all pregnant women. In contrast to recommendations adopted in Poland, the American Diabetes Association (ADA) recommends conducting screening tests only in women from the GDM risk group. It is believed that this risk is not elevated, if the women are not over 25 years old, have a proper BMI, do not belong to the ethnic group at risk of the disease, have no family history of diabetes and in the past they had no intolerance of glucose or pregnancy complications [14]. The American College of Obstetrics and Gynecology (ACOG) has formed similar recommendations [15,16].

The latest ADA recommendations of 2013 include the results of the international prospective cohort study HAPO (HAPO - Hyperglycaemia and Adverse Pregnancy Outcome), showing the relation between the glucose concentration on an empty stomach and in the 1st and 2nd hour of OGTT and the birth body mass of the newborn and the occurrence of obstetric failures. The test was conducted in the group of 24 000 pregnant women, in 15 centers and in 9 countries of the world. The results of 7-year studies, published in May 2008, showed that the risk of developing complications increases proportionally with the growth of glucose concentration in blood of the tested women, and the values of glucose adversely affecting the fetus are lower than it has been previously believed [17]. Therefore, the members of the International Association of Diabetes and Pregnancy Study Groups (IADSPG) which also includes the ADA activists, made the change of the value of glucose qualifying to the diagnosis and treatment of hyperglycaemia in pregnancy [18] (Table 3).

 TABLE 3. Gestational diabetes screening and diagnosis according to HAPO study.

Results after 75 g oral glucose load	Diagnosis of GDM
fasting	≥92 mg/dl (5,1 mmol/l)
1 hour	≥180 mg/dl (10 mmol/l)
2 hours	≥153 mg/dl (8,5 mmol/l)

ACOG in 2011 announced, after familiarizing themselves with the HAPO results, that they intended to stick to the previous strategy of gestational diabetes diagnosis [16]. So far, the organisation has not changed its position. In the current year (2013), the update of the WHO strategy concerning the diagnosing of diabetes in pregnancy is predicted. In March 2013, there was an international conference, aiming to present new strategies concerning gestational diabetes. It was organized by the National Institute of Health of the United States (NIH), the most important government institution in the USA dealing with biomedical research and connected with health. Currently PDA does not recommend using the three-point glucose test, i.e. the so-called three-point sugar curve. In the current WHO criteria, there is no scope of reference values of glucose after 1 hour after the glucose load. However, according to PGA, the results of HAPO speak for the inclusion of this marking, with the adoption of the values over 180 mg/dl as abnormal (10 mmol/l).

In recent years, especially the significance of maintaining the proper body mass before getting pregnant and during pregnancy has been emphasized. Epidemiological tests of recent years show that overweight and obesity constitute a more serious problem throughout the world [19], also in Poland [7,8]. NATPOL 2011 study has shown the adverse health tendencies in the context of overweight and obesity in both sexes, especially in the age group of 18-34 years of age, so in the reproductive age. The percentage of overweight people in this age range increased from 21.5% in 2002, to 25.7% in the study from 2012. The problem of the overweight concerns both sexes, with the predominance of males, while the increase of the percentage of the obese concerns mostly females – 7.4% in 2011 compared to 4.4% – 9 years earlier [9].

The incidence of gestational diabetes GDM has doubled in the last 6-8 years, remaining in the analogous dependency to the epidemic of obesity in the world [20]. Studies have shown that the pre-gestational elevated BMI values significantly influence the occurrence of diabetes during pregnancy [21,22].

In pregnancy, the weight gain is a physiological phenomenon [23]. The norm is the average weight gain 8-12 kg. The recommended norms depend on the body mass from before pregnancy. PGA recommendations within the pre-gestational care in pregnancy in detail describe, among others, standards of the proper nutrition and physical activity for women in pregnancy [24]. During pregnancy, regardless of the baseline BMI, the body mass loss is not recommended, as the prolonged restrictive diet is potentially dangerous, it may lead to hypoglycaemia with the development of ketoacidosis and ketonuria. Insufficient calories supply may induce metabolic and hormonal response of the mother leading to the disturbances in the functioning of the fetus, including neurological disorders or the impaired intellectual development [25,26]. Moreover, the over-restrictive diet during pregnancy can paradoxically constitute the risk factor of developing obesity in the child in the future [27].

However it is recommended to prevent the excessive weight gain, which can reduce the risk of the occurrence of obstetric complications [28]. Studies concerning the relation of GDM development with overweight or obesity also prove that the excessive body mass growth during pregnancy increases the risk of the long-term obesity in the mother and the child, hence increasing the risk of diseases connected with it [29-31].

It is worth noting that epidemiological studies show an inverse dependency between the level of education of women and social and economic conditions, in which they live, and the incidence of gestational diabetes. Most probably, this is connected with low health awareness, lifestyle, as well as the lack of proper, systematic medical care [32].

Pregnancy is the period predisposing to a number of physiological hormonal and metabolic changes, also within the carbohydrate economy. In order to ensure the best conditions for the child's development, the mother's body increases the pool of glucose for the synthesis of nutrients in the developing fetus. Per one gram of tissue, the fetus consumes 2-3 times more glucose than the body of an adult. The transfer of such a large amount of glucose to the fetus threatens its relative deficiency in the mother's body. Therefore, the production and release of glucose from the liver of the pregnant woman increases by 16-50% [33,34], and the use of glucose by the mother decreases. During physiological pregnancy the sensitivity of tissues on insulin, transporting glucose to cells, decreases by approx. 50-70 % in comparison to the values from before pregnancy. In healthy women, this decrease is equaled with the 200-250% increase of the insulin secretion in order to keep the proper glucose level in blood [20]. However, in women at risk of GDM, insulin secretion becomes insufficient and the process of glucose uptake by the tissues is disturbed, which results in hyperglycaemic states.

Development of insulin resistance is multi-factorial and depends on the duration of pregnancy. In its development, there is emphasized a role of placental hormones, low level of mediators of insulin resistance, so-called adipokinin (leptin, adiponectin, tumour necrosis factor alpha-TNF alpha, interleukin 6, resistin and others), subclinical inflammatory state, excessive lipolysis, as well as changes concerning the structure or functions of insulin receptor subunits. Often insulin resistance occurs just before pregnancy, while during pregnancy it increases and reveals itself [20]. The biggest increase of placental hormone concentration and the relative deficiency of insulin take place in the second half of pregnancy, i.e. in the 24-28 week, so at this time the diagnostic test is normally performed.

The screening and diagnostic tests in the gestational pregnancy are of great clinical importance. Undetected or poorly treated disease may lead to a number of serious metabolic disorders in the child. The risk of the occurrence and intensification of hyperbilirubinemia, birth hypoglycaemia, hyaline membrane complex, birth defects, intrauterine fetal death, perinatal injury, as well as hypocalcaemia, hypomagnesaemia, and polycythemia is increased [35,36]. It has been shown that GDM diagnosed in screening tests is connected with a significantly smaller amount of fetal complications than GDM diagnosed based on clinical symptoms, at a later stadium of its advancement [37].

Women with the diagnosed gestational diabetes belong to a group of the increased risk of developing type 2 diabetes [38]. The annual risk of developing type 2 diabetes in the group of GDM women with the history of the disease is more than two-fold higher than in the general population [39]. According to *Gestational Diabetes Guidelines* the probability of developing type 2 diabetes during 9 months after birth is 3.9%, during 15 months it increases to 4.9%, during 5 years – to 13.1 %, and during 9 years – it reaches 18.9 % [40]. For comparison, in the population of women without the GDM history, the risk of type 2 diabetes during 9 years after birth is 1.95 % [41]. It is predicted that during 10 years the type 2 diabetes will affect about 30-50% of women, who had gestational diabetes [42]. Awareness of the increased risk of developing type 2 diabetes after the pregnancy diabetes is crucial for the effective prevention, change of the lifestyle, diet and medication in order to avoid or delay the development of the disease [43]. The potential factors that predispose the onset of carbohydrate economy after GDM and which are most often listed in literature include: patients' age, parity, family history towards diabetes, obesity before pregnancy and at the moment of reporting, ethnical group predisposing to the occurrence of diabetes, next pregnancy complicated with diabetes, weight gain, abnormal values of the selected parameters of the lipid economy, high-fat and high-carbohydrate diet, and not too active lifestyle [44]. Diagnosis of diabetes in the first half of pregnancy is connected with the smaller glycaemia control of diabetes, with the increased demand for insulin in pregnancy, as well as the increased risk of developing type 2 diabetes [45-47]. So, the high glucose concentrations on an empty stomach and in glucose tolerance tests, abnormal diabetes control in pregnancy and the necessity to include the insulin therapy, suggest the necessity of special observation. Moreover, predictors may include the presence of immunological markers of pancreatic damage, fetal macrosomia or early pregnancy completion [43]. Diagnosing the wrong glucose tolerance in the period of postpartum or directly after its completion is also considered one of the most important factors, which predispose the revealing of the diabetes in the future [48]. Accurate assessment of the risk of the occurrence of diabetes after GDM has significant clinical significance and may constitute an important element of the strategy preventing diabetes.

The primary treatment goal of GDM is achieving the potentially full normoglycemia and the full compensation of other metabolic disorders during pregnancy. Hypoglycemic therapy is based on the classic triad: diet, proper to the period and state of pregnancy physical activity and medicine therapy. In pregnancy complicated with gestational pregnancy in 40-60% cases, we can achieve the diabetes control, at least for the predominant part of pregnancy, using diet and physical exercises. Among hypoglycemic drugs in pregnant women, there is used insulin [49]. In the ACHOIS test in women with gestational diabetes intensive care, including the self-control of glycaemia, nutritional counseling and, if necessary, insulin therapy, in comparison to the standard care, the risk of serious perinatal complications of newborns, macrosomia and the risk of hypertension caused by pregnancy and depression after the pregnancy decreased [50].

Some doctors may not be aware of the important in the social scale dealing with the problem of gestational diabetes. For example, the survey conducted by American College of Obstetrics and Gynecology in 1998 showed that only 62% of its members considered important the fact that women after GDM are in the group of the increased risk of developing type 2 diabetes [15].

Every woman with gestational diabetes should be informed about the risk of occurring abnormal carbohydrates tolerance and its adverse consequences in the future. It is important to breastfeed for a long time, as it has been shown that lactation may have a beneficial effect on the glucose metabolism and sensitivity to insulin, which may reduce the risk of diabetes after GDM pregnancy [51,52]. It is important to provide information about the recommended pregnancy planning and the birth control measures [53,54]. Before the next pregnancy there applies the evaluation of the carbohy-drate status.

Around the GDM problem there is an ongoing and lively, international debate. On this occasion, there is a need to improve the knowledge about the disease, educational and awareness actions addressed to women and doctors. Probably there is needed more evidence for the effectiveness of the postnatal behavioral intervention in preventing diabetes in women with gestational diabetes, to increase the knowledge of doctors about the role of advice for women with GDM. It is important to strive to create the optimal strategy of the evaluation of carbohydrate economy after birth and the strategy of the more strict supervision. There are needed more coordinated efforts to change the current trends in GDM and to prevent the chronic diabetes in patients with GDM and their offspring.

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