

GESTATIONAL DIABETES MELLITUS

- A Guidebook for pregnant women

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Abstract

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<p>Abstract</p> <p>Gestational diabetes mellitus (GDM) is defined as varying degrees of glucose intolerance that are first detected during pregnancy. GDM is diagnosed by oral glucose tolerance. It is usually tested at 24-28 weeks. If the risk factor for the disease is high, it needs to be tested at 12-16 weeks. Although GDM usually resolves following birth, it is associated with significant morbidity for the women and her child both perinatal and later in life.</p> <p>The purpose of this program is to provide the information to GDM high-risk population and GDM pregnant women helping them to know how to control and manage GDM as well as keeping them healthy during pregnancy.</p> <p>The aim of this thesis is to create a gestational diabetes guidebook, with which target population can get enough information about GDM, therefore paying their attention to GDM.</p> <p>This is a function framework thesis based on our practice-oriented research, as well as the up-to-date research data on GDM, communication and cooperation with the Maternal and Child Health Center. The thesis is written in English for Päijät-hämeen Mikkola Maternity Clinic.</p>		
Keywords Gestational diabetes mellitus, Body mass index, Gestational weight gain, Medical nutrition therapy, Oral glucose tolerance test, Macrosomia, Insulin therapy, type2		

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Tiivistelmä <p>Raskausdiabetes (GDM) määritellään vaihtelevaksi glukoosi-intoleranssiksi, joka havaitaan ensimmäisen kerran raskauden aikana. GDM diagnosoidaan suun kautta annettavan glukoositoleranssin avulla. Se testataan yleensä 24–28 viikossa. Jos äidillä on riskitekijöitä sairastua raskausdiabetekseen, tehdään testi 12-16 raskausviikolla. Vaikka GDM häviää yleensä synnytyksen jälkeen, se liittyy merkittävään sairastuvuusriskiin diabetekseen naisilla ja hänen lapsillaan sekä synnytyksen jälkeen että myöhemminkin.</p> <p>Opinnäytetyön tarkoituksena on antaa tietoa GDM:n riskin omaaville ja raskausdiabetekseen sairastuneille naisille ja auttaa heitä ennaltaehkäisemään ja hoitamaan raskausdiabetesta.</p> <p>Tämän opinnäytetyön tavoitteena on luoda englanninkielinen ohjekirja, jonka avulla kohdeväestö voi saada tietoa raskausdiabeteksestä. Ohjekirja on tarkoitettu naisille, jotka eivät osaa suomea ja eivät näin voi hyödyntää suomenkielistä ohjausmateriaalia.</p> <p>Tämä on projekti, joka perustuu käytännönläheiseen tutkimukseen sekä ajan tasalla olevaan tutkimustietoon GDM:stä ja tietoon potilasohjauksesta ja ohjausmateriaalin kriteereihin. Opinnäytetyön yhteistyökumppanina on toiminut Päijät-Hämeen Hyvinvointikuntayhtymän Mukkulan äitiysklinikka.</p>		
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1 INTRODUCTION

In recent years, hyperglycemia often occurs in pregnant women with a significant increase in the global prevalence of diabetes. This phenomenon provides a large amount of research data for studying the relationship between pregnancy and blood glucose. A systematic review shows that pregnant women with hyperglycemia during pregnancy have a higher risk of adverse pregnancy outcomes. Positive and correct treatment of gestational diabetes has a very large effect on reducing adverse birth outcomes. (WHO 2013a.)

Gestational diabetes is easily overlooked, but its complications and adverse effects on mothers and children are very serious. Nearly half of the women who have had GDM will develop type 2 diabetes within 5-10 years. (IDF 2017.)

This guidebook is for pregnant women who are not familiar with the situation and do not know how to care. When pregnant women are diagnosed with GDM, they need to have all the information and knowledge necessary to fully understand GDM, the importance of diet and exercise for GDM blood glucose control, and the impact of GDM on the fetus and childbirth. The guidebook is also available by helping healthcare professionals for those pregnant women who cannot understand Finnish and prefer English. Oral and written guidance supports each patient to successfully control GDM. The guide provides professional help to GDM pregnant women with clear, easy-to-understand vocabulary. The guide, based on the information collected in the paper, will be provided to Päijät-hämeen Makkula Maternity Clinic.

The purpose of this program is to provide the useful information to GDM high-risk population and GDM pregnant women, to help them to know how to control and manage GDM, as well as to keep them healthy during pregnancy.

The aim of this thesis is to create a gestational diabetes guidebook, through the guidebook, the target population can get enough information about GDM, attracting them to pay attention to GDM.

2 DEFINITION OF GDM

2.1 Gestational diabetes mellitus (GDM)

GDM is defined as a condition of hyperglycemia that has not occurred or was not detected before pregnancy. It develops into diabetes during pregnancy. During pregnancy, insulin secretion is resistant due to secretion of certain hormones in the body, or during pregnancy due to obesity, lack of exercise, Hypertension and hyperglycemia leads to the occurrence of hyperinsulinemia. GDM is a condition in which a pregnant woman is in a state of hyperglycemia, it is likely to cause adverse consequences if it is not well controlled. (Rev Obstet Gynecol 2008.)

In the middle and late stages of normal pregnancy, the placenta secretes glucocorticoids, estrogens, progesterone and other hormones, which can antagonize increased insulin and thus maintain normal blood sugar levels. GDM pregnant women with insulin resistance or beta cell function defects, leading to disorders of glucose metabolism. (Buchanan, Xiang 2005.) (Figure1)

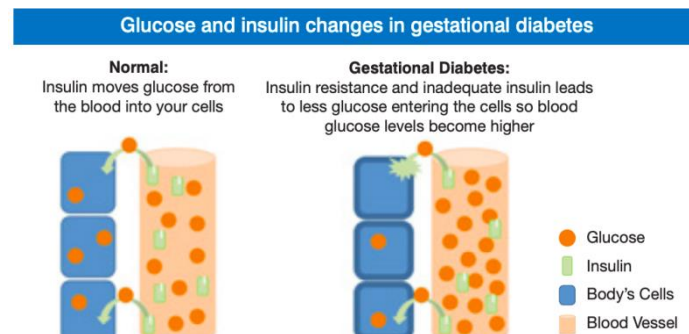


Figure1 Gestational diabetes: Caring for yourself and your baby. (DNSS 2017)

In the body of pregnant women, the volume of endocrine glands will increase too, so that the secretion of prolactin, thyrotropin and adrenaline from the pituitary increases, estrogen and progesterone also help to destroy the balance of glucose and insulin, so under the action of a variety of hormones, the function of islets is impeded, which in turn causes pregnant women to develop GDM. (Rev Obstet Gynecol 2008.)

2.2 Epidemiology and prevalence

The prevalence of gestational diabetes (GDM) worldwide is unclear, apparently has been steadily increasing with the increase in obesity and type 2 diabetes. It is estimated that GDM affects 1% to 4% of all pregnancies each year (DeSisto, Kim & Sharma 2014.) The incidence of GDM is more common during 24-28 weeks of gestation. (NIDDK2014.) It is closely related to genetic characteristics, living environment and area, screening and diagnostic criteria, and the incidence of type 2 diabetes. According to previous reports, the most common risk factors for GDM are pre-pregnancy overweight, family history of diabetes, infant macrosomia history, multiple pregnancies, age of pregnant women, and a history of GDM. (Erem, Kuzu & Can 2015). GDM affects 1% of pregnant women under 20 age 20 and 13% of pregnant women over 44 years old, depending on the distribution of residential areas, Indian descent, Asia, American Indians, Australian Aborigines and Pacific Islanders are at higher risk of developing GDM. (Donovan, McIntyre 2010.) In Europe, the incidence of GDM is reported as 2%-6% (Buckley, Harreiter & Damm 2011.)

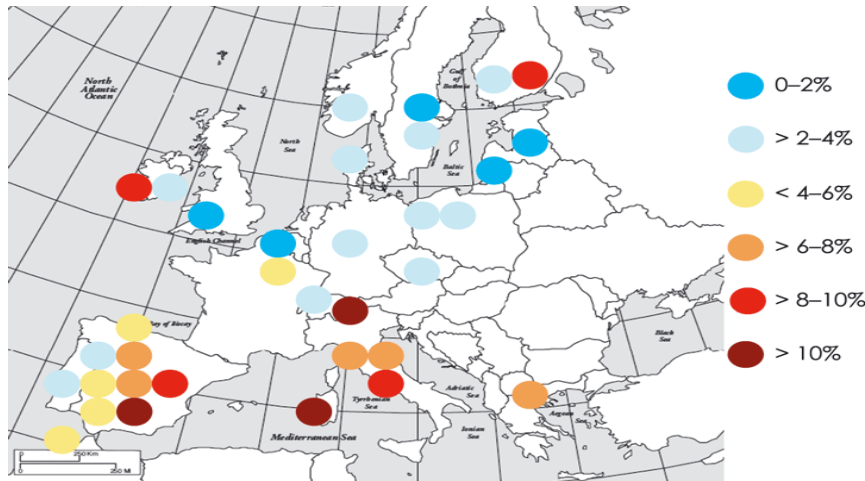


Figure 2 Reported prevalence of gestational diabetes in Europe. (Buckley, Harreiter & Damm 2011.)

2.3 Screening and diagnosis of GDM

Screening and diagnosis of gestational diabetes mellitus (GDM) remains a controversial issue. A lack of consensus on GDM screening and diagnostic criteria means that different groups of women will be identified as GDMs with different standards. The International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria for GDM have been widely accepted. ADPSG suggested a single step 75g OGTT taking in all pregnant women between 24-28 weeks of gestation. The guidelines of 2013 both the WHO and the Endocrine Society informed that the IASPPSG criteria should be used for GDM diagnose. (Bhavadarini, Uma, Saravanan, Mohan, 2016.)

According to the ADA, the risk assessment of GDM needs to be carried out during the first pregnancy test of pregnant women. (ADA 2003a.)

If a pregnant woman has all of the low GDM risks (age <25, normal weight, no history of diabetes and family history, no adverse results of childbirth history, no abnormal glucose tolerance history) she does not need to be tested (Rev ObstetGynecol2008).

In Europe, different countries use also the different criteria. In Ireland, France and part of Belgium, a 75g OGTT of IADPSG criteria has been used to diagnose GDM for high-risk pregnancies. In German, they use the two-step screen. Some countries use WHO criteria, ACOG screen strategy or risk-factor-based screen and so on. The European Board & College of Obstetrics and Gynecology (EBCOG) suggested using the new WHO diagnostic criteria for GDM at 24-28 weeks of pregnancy. (Benhalima, Mathieu, Damm, et al. 2015).

In Finland, GDM is diagnosed by performing oral glucose tolerance test (OGTT) on pregnant women. The diagnostic thresholds used in Finland are: (75g 2h OGTT) fasting plasma glucose $\geq 5.3\text{mmol/l}$, 1h post load $\geq 10.0\text{mmol/l}$, 2h post load $\geq 8.6\text{mmol/l}$. If the value of OGTT meets the diagnostic criteria, GDM can still be diagnosed even if the blood glucose returns to normal after the test. (Käypähoito 2013.)

According to the diagnosis of diabetes by the ADA (American Diabetes Association) and WHO, it is useful to determine HbA1c levels if diabetes is suspected in early pregnancy, and HbA1C \geq 6.5% can be diagnosed as diabetes (WHO 2006).

3 PREVENTION AND MANAGEMENT OF GDM

3.1 Prevention of GDM

A series of studies have shown that if women do not have high risk factors for GDM before pregnancy and can maintain good eating habits and physical exercise, the incidence of GDM after pregnancy is minimal (NICHD 2014).

Gestational diabetes must be paid attention to prevent pre-pregnancy. Maintaining normal weight before pregnancy and timely weight loss can reduce the prevalence of GDM (Morisset, St-Yves & Veillette 2010). Ingesting large amounts of red meat, animal fat, cholesterol and blood products before pregnancy can increase the risk of GDM (Bowers, Yeung & Williams 2011).

During pregnancy, obesity and overweight will significantly increase or decrease the risk of GDM. Effective nutrition management through a nutritious diet can reduce the risk of GDM. Reducing dietary fat and carbohydrate intake can reduce the increase in body weight during pregnancy. (Morisset, St-Yves & Veillette 2010.)

3.2 Management of GDM

- Dietary

Dietary has been shown to play an important role in the management of GDM, with higher fat, cholesterol and serum iron intake increasing the risk of developing GDM. High fiber, beans, nuts, fishes and cereals help to reduce the risk of GDM. (ADA 2016.) According to the article by medical doctor Neda Dolatkhah, it has been proved that the appropriate dietary plan can help GDM pregnant women to effectively control blood sugar, and can also improve the growth rate of the fetus, while the reasonable addition of dietary supplements can improve the probability of fetal defects and the metabolism of GDM pregnant women. (Dolatkhah, Hajifaraji & Shakouri 2018.)

Dietary therapy is the first line of defense for GDM women to manage their disease. If diet therapy fails, it means more treatment management will be accepted. Poor pregnancy results will also increase the patient's pain and treatment costs. (Hernandez, Anderson 2014.)

In Finland, it recommended to eat a small amount of meals, and divide the food that should be ingested every day into 5-6 meals. In particular, avoid dinner and the breakfast time is too long. (Käypähoito 2013.) Eating a high-fiber diet can help reduce the risk of diabetes during pregnancy (NICHD 2003.). High fiber carbohydrates are preferred. It is recommended to take at least 500 grams of vegetables, fruits and berries per day. (Käypähoito 2013.) It can delay the rise of blood sugar, help control blood sugar, and feel full, but never eat in unlimited quantities fruit. (NICHD 2003.)

- Physical activity

Exercise has been proven to be an effective glucose control tool to prevent, reduce or delay the need for insulin. Exercise is also conducive to future delivery of gestational diabetes, infant feeding and postpartum lifestyle changes. (Prather, Spitznagle 2012.) In six studies including 322 women with DM2 46 it was shown that the dietary advice plus exercise group was more weight loss and HbA1c decreased more (Moore, Summerbell, Hooper, et al.2004).

Studies showed that lots of exercises from low forces to high forces such as Yoga, aerobic exercise and jogging which can be safe for mother and fetus. The most effective aerobic exercise is the exercise of large muscle groups to complete continuous or intermittent movements. It mainly includes walking, jogging, fixed bicycles, swimming, boating, skipping, and climbing stairs. Among them, walking is the most commonly used (Matthew, David, Johannes, et al. 2012).

However, suitable and practical aerobic exercise model should be chosen by clinical judgment. If the intensity should be strictly controlled, that is especially important in the first stage of exercise program.

Resistance strength training and flexibility exercise are also suitable and safe for pregnant women and fetus (Matthew, David, Johannes, et al. 2012). The Royal College of Obstetrician and Gynecologists (RCOG), the American Congress of Obstetricians and Gynecologists (ACOG) and the Society of Obstetricians and Gynecologists of Canada (SOGC) recommend the resistance strength practice for pregnant women. A 64 patients with GDM study showed that the resistance training can reduce the number of patients with GDM who

needed insulin. (de Barros, Lopes, Francisco, et al. 2010.) Combined resistance exercise and aerobic exercises are more effective in blood management. Resistance exercise can increase the amount of muscles which can improve the blood glucose uptake. The glucose of muscle is independent of insulin response. Aerobic exercise increases the response of insulin.

It is important to consider the history of physical activity, cardiovascular health and strength. After the early period of pregnancy, the discomfort of nausea and fatigue has been stabilized. It should be more suitable for women who have been sedentary for a long time. Women with small activities history can begin with aerobic exercise from 15 min, three times a week to 30 min four or more times a week. More than 45 min continuous exercise has the risk of increasing the fetus temperature. Exercise can improve the insulin action and glucose uptake for 48 hours, so the aerobic exercise interval is no more than 2 days. (Cliantha, Jeff 2015.)

Resistance training recommended limit is twice a week and ideally three times a week. Each training session should contain 5-10 exercises, which involve the upper body, lower body and core, the repetitions range is 8-15 times and includes 1-4 strength gains exercise. (Cliantha, Jeff 2015.)

Using a track record of exercise is a good practice. Record exercise minutes and styles per day or use a device which can count number steps and summarize weekly. Gradually increase the active time or steps every day. (International Diabetes Federation 2015.)

- Self-monitoring blood glucose

Gestational diabetes must be paid attention during the pregnancy, how to prevent it and blood sugar controlling are especially important. Self-monitoring blood glucose can provide important information for patients to control blood sugar. Through blood glucose monitoring, they can actively adjust your diet and exercise to make their blood sugar reach the standard. (IOSRPHR 2017).

GDM pregnant women are trained in educators who have experience in diabetes education to educate them about the effects of blood glucose testing, diet and exercise on blood sugar. (Queensland Clinical Guidelines 2015.)

Pregnant women need to take measurements one hour before and after breakfast, lunch and dinner every day. The measurement target is

- Below or equal to 5.5mmol/L before meals
- Less than or equal to 7.8mmol/L after meals
- 5-7 times measurements are taken every day. (Käypähoito 2013.)

The increase or decrease in the number of tests is based on the value of blood sugar in pregnant women and the progress of pregnancy. It is recommended that the blood glucose meter of the pregnant woman be used personally, and the blood glucose meter and the record book should be carried with them. (Queensland Clinical Guidelines 2015.)

- Pharmacology therapy

Insulin therapy

People with gestational diabetes can reduce blood sugar by injecting exogenous insulin when diet and exercise therapy are unable to control blood sugar. (International Diabetes Federation 2015.)

Insulin is the only hormone in the body that can lower blood sugar. Insulin therapy is the safest during pregnancy. Insulin is a macromolecular protein that does not affect the fetus through the placenta, and nearly 27% of GDM pregnant women use this therapy. (Queensland Clinical Guidelines 2015.)

Because there are a lot of types of insulin available and various insulin dosage regimens can be used. Multiple injections in a day or continuous subcutaneous insulin infusion can be used. The best insulin treatment provides the appropriate basal requirement of insulin in 24 hours and keeps the correction blood glucose level and decrease the risk of hypoglycemia and hyperglycemia.

Metformin

Metformin as a kind of oral medicine for diabetes, metformin is more and more popular among pregnant women with GDM. (Queensland Clinical Guidelines 2015c.) Its mechanism of action is different from insulin. It can

promote insulin sensitivity and glucose tolerance, and there is no hypoglycemia or hyperinsulinemia side effect. It is an oral medication that can be safely used during pregnancy. (Reece, Parihar and Lo Bello 2014a.)

In patients with mild gestational diabetes, the use of metformin is clearly intended to reduce the incidence of macrosomia. However, metformin is not recommended as a primary drug because approximately 30% of patients require insulin. (Käypähoito 2013.) Some studies have shown that the incidence of adverse outcomes for insulin treatment is higher than metformin. Although insulin is still the main method of GDM treatment, metformin is a safe alternative therapy. (Reece, Parihar and Lo Bello 2014b.)

The starting dose is 500 mg once a day, for example 2-3 days after administration, after which the dose is gradually increased. Pregnant women rarely need a daily dose of more than 2 grams. Blood glucose levels were reviewed three days after the use of metformin. (Queensland Clinical Guidelines 2015.)

- Hypoglycemia

The fasting blood glucose of pregnant women during pregnancy has a tendency of decline, and blood glucose may be physiological or asymptomatic at 3.5mmol/L. The incidence of hypoglycemia is not high in non-drug treated GDM pregnant women. (Queensland Clinical Guidelines 2015.) However, treatment of diabetes with drugs (insulin, sulfonylureas) is the most common cause of hypoglycemia. (Yanai, Adachi & Katsuyama 2015.) Therefore, the incidence of hypoglycemia is increased in pregnant women who are treated with insulin therapy for GDM. Diabetes patients with a blood glucose level below 3.9 mmol/L can be diagnosed with hypoglycemia. (NIDDK 2016.)

4 DELIVERY

4.1 Planning for birth

The incidence of macrosomia in GDM patients is higher than normal pregnant women, because if the mother's blood sugar is at a high level during pregnancy, the fetus will produce more insulin to balance blood sugar, which the fetus will save more fat and tissue, so GDM pregnant women recommend giving birth with the support of a professional medical team.(Healthdirect 2017.)

The main target of GDM pregnant women's delivery time and mode of choice is to minimize the complications (hyperglycemia, shoulder dystocia and brachial plexus injuries) and risks associated with macrosomia and outdated labor and reduce the negative outcomes of maternal and neonatal. (Queensland Clinical Guidelines 2015.)

4.2 Date of delivery

GDM pregnant women who use diet therapy for glycemic control during pregnancy, blood glucose control is relatively stable and there are no complications associated with them, then they can wait for natural childbirth (Käypähoito 2013).

GDM pregnant women use medicine to control hyperglycemia during pregnancy. Because of the increased risk of fetal asphyxia after 38 weeks of gestation, their date of delivery is up to the calculated date of delivery (Käypähoito 562013.).

GDM pregnant women who are suspected of having a neonatal newborn or have other complications during pregnancy are considered to have delivered at 38-39 weeks. (Queensland Clinical Guidelines 2015.)

4.3 Mode of birth

If the estimated fetal weight is less than 4,000 g, normal delivery can usually be performed.

On the other hand, if the estimated fetal weight exceeds 4,500 g, caesarean section surgery is recommended as a method of delivery.

If the fetus weighs between 4,000 and 4,500 grams, the method of delivery is chosen individually, considering the course of previous labor, the extent of pelvic pain and the likelihood of errors associated with echoes, and the progression of birth. (Queensland Clinical Guidelines 2015.)

4.4 Insulin infusion

GDM pregnant women use high-dose insulin to control blood sugar during pregnancy, or during cesarean section, in order to control blood sugar levels, insulin infusion is used. (NDSS 2017.)

The goal is to maintain plasma glucose levels at 4-7 mmol / l during and after childbirth. (Queensland Clinical Guidelines 2015.)

Blood glucose levels were monitored at maternity hospitals every 1-2 hours. As long as the mother is eating normally, insulin therapy is continued at regular doses. When insulin is used after delivery, it is necessary to constantly monitor maternal blood glucose levels. After childbirth, blood glucose levels were monitored for 1-3 days in the morning and after meals. The goal is to know whether the mother still needs insulin therapy. (Käypähoito 2013.)

4.5 The importance of breastfeeding

Breastfeeding is the best source of nutrition for infants and young children. Pregnant women with GDM need to be given the right breastfeeding knowledge during pregnancy. Breastfeeding has long-term benefits for both mother and newborn. Breast milk contains antibodies that help children prevent pneumonia and diarrhea. Breastfeeding can lower mothers and Children are at risk of developing type 2diabetes in the future, and breastfeeding should be done one hour after birth. (Victora, Bahl & Barros 2016.)

Breastfeeding can help pregnant women consume calories during pregnancy and help women lose weight, thereby reducing the incidence of long-term diabetes. Many GDM pregnant women find that breastfeeding can maintain their fasting blood sugar at a lower state after childbirth. (NICHD 2003.)

5 POSTPARTUM CARE

5.1 5.1 Postpartum blood glucose level (BGL) monitoring

After GDM mothers give birth, their bodies are in a state of recovery. In a short period of time, blood sugar will be controlled within a good range, especially in pregnant women who are treated with diet and exercise therapy during pregnancy. Hyperglycemia will disappear immediately; blood sugar in this period is in a state of volatility. (ADA 2013.) So within 24 hours after giving birth, the mother who use the pharmacological therapy during the pregnancy needs to check blood sugar regularly to find out how much insulin the body needs, the goal of postpartum blood glucose in all pregnant women is less than or equal to 7 mmol/L. (Queensland Clinical Guidelines 2015.)

5.2 Newborn care

Newborns in GDM pregnant women will have no diabetes. (International Diabetes Federation 2015.) GDM pregnant women use insulin therapy during pregnancy to increase the incidence of neonatal hypoglycemia. (Queensland Clinical Guidelines 2015.) So, after the birth, the newborn will be carefully detected 24-48 hours, including heart rate, breathing, color, blood sugar. (NDSS 2017.) Newborns should be kept warm, mothers should contact the baby's skin as soon as possible, breastfeeding should be given as soon as possible, and the frequency of feeding should be increased. If breastfeeding fails, the neonatal indicators should be monitored. (Queensland Clinical Guidelines 2015.)

5.3 Mother's follow-up and Mother's long-term prediction

- Glucose

The oral glucose tolerance test (OGTT) was retested after each gestational diabetes patient was produced. OGTT can be retested for insulin pregnant diabetics 6 to 12 weeks after childbirth. If the results are normal, check them again before they are not regularly checked or before the next pregnancy. (Ian Blumer, Eran Hadar, David & R. Hadden, et al. 2013.)

- Blood pressure, blood lipids, etc.

Patients with gestational diabetes mellitus are associated with hypertension, it is recommended to be treated with an ACE inhibitor or an ATR inhibitor. Monitor body weight, waist circumference, and blood pressure and blood lipid levels in all gestational diabetes patients every 1 to 3 years. It is important to find people with metabolic syndrome and to guide their treatment. (ADA 2007.)

- Subsequent pregnancy

Women who previously had GDM can get pregnant again, but the risk of developing GDM is triple than normal. (Kjos, Peters & Xiang 1998.) So, before pregnancy, they need to monitor blood sugar, maintain a good lifestyle, get in touch with the doctor in the early stages of pregnancy, and tell the doctor that they have had GDM before, and the doctor will help the pregnant woman to develop the next health plan. (IDF 2015.)

6 GDM-RELATED ADVERSE CONSEQUENCES

There are clear GDM-related adverse consequences to mother and fetus from some studies. These adverse consequences associate with mild glucose level, but are independent of other factors during pregnancy, e.g. increasing weight and BMI. (Metzger, Contreras, Sacks, et al. 2008.)

6.1 Maternal comorbidities

- Lifestyle interventions

GDM has the short- and long-term adverse effects for mothers and babies. The lifestyle management is basic strategy for the GDM treatment. Lifestyle interventions include education, diet, exercises and self-monitoring of blood glucose. Under the lifestyle interventions, more women reached their weight goals after baby born and the risk of postpartum depression decreased. (Alwan, West, Brown, et al. 2017.)

- Long-term metabolic comorbidities in mothers

If the women with GDM in untreated hyperglycemia status can increase the risk of developing T2DM in the future life. A recent meta-analysis showed that women with GDM had 7.43 times chance of suffering T2DM than the women without GDM. (Bellamy, Casas, Hingorani, et al. 2009.)

Kim et al demonstrated that different ethnic groups women with GDM has a similar rate to develop T2DM. During the first 5 years after delivery, the cumulative incidence of T2DM increase significantly and after 10 years, it shows a plateau. The Most risk factors related to the future T2DM is the fasting blood glucose level during pregnancy. (Kim, Newton, Knopp 2002.)

GDM increases the risk of developing type 2 diabetes, the incidence of type 2 diabetes in patients with GDM is 50%. Because gestational diabetes is prone to recurrence, it is important to have a good lifestyle in the future or before the next pregnancy, especially in weight control and physical exercise. (NDSS 2017.)

- Hypertensive disorders

Pregnancy hypertensive disorders include: preeclampsia, chronic hypertension and gestational hypertension. The research showed that GDM women with highest BMI are 8 times to develop preeclampsia than the GDM women with lowest BMI (Metzger, Contreras, Sacks, et al. 2008). Barden et al (2004) study showed that GDM women with more serious insulin resistance and metabolic syndrome are easier to development preeclampsia.

- Preterm birth

Preterm birth means that the baby born before pregnancy 37 weeks. The preterm rate is 6.9% and neonates had less demand for NICU (8.0%). The birth weight is more than 90%. The glucose levels after OGTT are significant association with preterm born. The fasting blood glucose levels are not related. (Metzger, Contreras, Sacks, et al. 2008.)

- Shoulder dystocia

Large infant can cause women with GDM problems of surgical procedures and vulvar incision. Even if infant weight less than 4 kg, shoulder dystocia maybe requires surgical procedures. Shoulder dystocia was associated with the glucose level after OGTT and fasting glucose levels. (Dirar, Doupis 2017.)

- Caesarean delivery

In the study showed that Caesarean delivery is about 16.0% of the total participants and 7% of them are repeated Caesarean delivery. This result is related to the glucose level after OGTT and fasting glucose levels (Metzger, Contreras, Sacks, et al., 2008.). Infant macrosomia of pregnant women without treated GDM was a mediating factor which due to Caesarean delivery. Even if the treated GDM women have the normal baby birth weight, the Caesarean delivery rate is still higher than the normoglycemia pregnant women. (Naylor, Sermer, Chen, et al. 1996.)

6.2 Neonatal comorbidities

GDM with high glucose level results in neonatal exposure to hyperinsulinemia that leads to neonatal hypoglycemia. (Kim, Newton, Knopp 2002) Neonates were delivered by GDM women with insulin and without insulin have no

significant differences in hypoglycemia. The glucose level after OGTT of GDM women are related with neonatal hypoglycemia. (Dirar, Doupis 2017.)

Hyperbilirubinemia may be associated with increased fetal red blood cell as a result of maternal hyperglycemia and fetal hyperinsulinemia. Macrosomia was related with maternal glucose levels. Neonatal hypocalcemia happened infrequent and the clinical significance is not very well. Respiratory distress syndrome may be related with hyperinsulinemia which can affect the produce of surfactant synthesis, in contrast, one study showed that there is no difference in neonates of GDM women and normoglycemia women. (Dirar, Doupis 2017.)

Children born with the GDM women had 8-fold risk of T2DM / prediabetes at 19-27 years old than with the normoglycemia women. (Damm 2009.)

7 ROLES OF NURSE IN THE MANAGEMENT OF GDM

Apolonia et al. (2003) research showed that the women with GDM, who were guided by endocrinologist and nurse in metabolic management, were no difference in the insulin treatment and perinatal outcome. Nurse can play an important role in the management of women with GDM.

Nurses are better educators, spend more time with patients and know more about patients than physicians. Nurses promote patient appointment keeping and educate the patient about self-management and medication management. (Sminerio, et al. 2007.)

Selfcare management plays an important role in effective management and the decrease of GDM. Through medical nutrition therapy to achieve a balanced diet is the main basis for management of GDM. The Nurse plays an important role in counseling and education GDM women. (Nanyunja, Immaculate, et al. 2018.) Health-related quality of GDM women can be effectively improved through health education. (Mani, Zahra, Mohammad, Soheila, Mandana, 2017)

Community follow-up care can promptly correct risk factors and help gestational diabetes patients monitor post-natal blood glucose status and whether they have type 2 diabetes. Community care is very important in the GDM management. (Bernadette, Neil, 2015.)

One study showed that in the management of GDM, the nurse-led model is feasible. Through improving information provision, support and care coordination, the adverse outcomes of neonates are significantly reduced. (Giuliana, Penny, Tania, 2013.)

8 PURPOSES AND AIM OF THESIS

This progress has permission from division head of Päijät-Hämeen family and social services, and family services for children. Our cooperator is Päijät-hämeen Mukkula Maternity Clinic. The public nurse is better educator who can educate and support the woman with GDM about self-management and medication management. Now our cooperator Mukkula maternity clinic can provide Finnish education, but through this guidebook, the healthcare professionals can easily educate and support the GDM women who cannot understand Finnish and prefer English.

The purpose of this program is to provide the information to GDM high-risk population and GDM pregnant women, to help them to know how to control and manage GDM, to keep them healthy during pregnancy.

The aim of this thesis is to create a gestational diabetes guidebook. Through the guidebook, the target population can get enough information about GDM, causing their attention to GDM.

9 CREATE A GOOD CLIENT BOOK

A good guidebook must be clear and easy to read as readers can only remember 3-5 keywords at a time. The content must be brief and accurate. Plain language is easier to remember and understand than the medical jargon. Information structure is according to the needs of readers with the arrangement of the priority level. A patient-centered model is focused on the problem and the solution- what to do and how to do. To split the information into small pieces and important information is written in the front. Use titles and subtitles can be easily to skip into the interested section. Images and other graphic elements are used in the text, which support the text directly or indirectly and readers can be easier to get the key points. Color text for titles, subtitles and images enhance key points and information structure. (Deatrlick, et al. 2010.)

Plain language is not a non-professional writing and has a correct grammar, complete sentence structure and rightly word usage. Plain language is easy to read and understand, tell the reader the information he needed, and improve the effect of communication. Clear communication can improve the reader response to the information provided. Plain language communication can decrease the barriers between the writer and the reader. (NIH a, 2019.)

Display content clearly can use images, white space, suitable fold and meaningful headings. Images can facilitate learning. Images with text can help read, understand and communicate health information. In the main section use white space break information to pieces that can less distract. Light background and black text are the easiest to read. The 12-point type font is a familiar type. A small font size is difficult to read, especially for person with limited read ability. (Health, 2010.)

10 METHODOLOGY OF GUIDEBOOK ABOUT THE GESTATIONAL DIABETES MELLITUS

10.1 Data search, review and collection

This is a functional, practice-based thesis. Due to the limitations of the author's use of Finnish, the Finnish language research data collection in the bookstore is relatively insufficient. Its data collection mainly comes from the network, masto-finna can be used for our partly data collection, we also searched for different high-quality research data from different web pages, including käypähoito, WHO, American diabetes association, NICHD, NIH, Queensland clinical guidelines and so on.

Keywords related to the topic are used for data search:

- Gestational diabetes mellitus
- Body mass index
- Gestational weight gain
- Medical nutrition therapy
- Oral glucose tolerance test
- Macrosomia
- Insulin therapy
- Type 2 diabetes

10.2 Functional framework thesis

Functional thesis is used to solve practical, real-world problems by designing and developing new products or knowledge to improve the current situation. In the thesis, we found that with the increase of the Finnish immigrant population, it is difficult for immigrants to read the Finnish language guidance series, which leads to a situation where they are not aware of GDM problem. However, the adverse effects of GDM are serious, as such. We wish to publish an English GDM guidebook.

10.3 Thesis ethical and reliability

We have read carefully about the “A practical model of self-regulation academic integrity: A Chinese-English edition of the code of conduct for research integrity in Finland”. This set of guidelines promotes responsible research methods to prevent academic misconduct in all research institutions and organizations. It gives guidelines on ethics and integrity in our thesis.

We strictly follow with the requirements in the guidelines, data collection to reliable websites, in line with scientific standards and ethical standards. We respect other people's research results, appropriate reference to other people's papers. We conduct research and thesis write-up in accordance with the principle of ethics and integrity. However, due to the limitations of our Finnish language, some Finnish materials are difficult to adopt, which may lead to the limitations of our thesis content.

10.4 Development and feedback of guidebook

There are many important elements of considering when writing a guidebook. We need to follow the natural laws of the development of things logically, so that readers can gradually accept and understand the content of the guidance, choose the order of importance from the reader's point of view, and tell by title and subtitle. The content of the reader's text, and prompt readers to guide the importance of them, because pregnant women are the main readers of the guidebook, suggesting the impact of GDM on the fetus, prompting them to follow the guidance. (Hyvärinen 2015.)

The text should be easy for the reader to understand comprehensively, because we are targeting ordinary pregnant women or patients, so the content is be edited scientifically and accurately, therefore the reader can be given the most common and concise language, vocabulary and sentences to minimize the use of medical vocabulary. (Hyvärinen 2015).

In the structure of the text, we use the chronological order, so that readers can also get the information they want to know along the regular development of pregnancy time. In editing, the sentences are as concise and clear as possible, and the spelling is correct, avoiding the reader's understanding

difficulties due to sentence structure and spelling mistakes. Considering the location of the guide, because our guide is mainly based on paper printing, the proper appearance and page layout support the structure of the information and enhance the readability. (Hyvärinen 2015).

Based on the theoretical how to make a good client guidebook and the data we found about how to manage GDM, we have created a guidebook as the final product of our study project. We showed our guidebook to our cooperation partner Mukkula Maternity Clinic and collected the feedback from their nurses after their evaluation process. This is an open feedback. We evaluated the content, structure and language of this guidebook.

Feedback from Mukkula Maternity Clinic team is positive. The guidebook contains accurate and necessary information. The guidebook is easy to understand and useful. And the question style directly shows main points and immediately attracts the readers' interest. The language is friendly and plain, the readers can easily understand the information about GDM. They also provide some advice regarding to self-monitor of glucose monitor and hypoglycemia. The nurses of Mukkula Maternity Clinic believe that the guidebook was very useful to them.

11 DISCUSSION

GDM is caused by pregnancy, resulting in a persistent hyperglycemia condition. Insulin resistance or beta cell function defects can be due to disorders of glucose metabolism. Changes in estrogen, progesterone and other hormone levels during pregnancy are also a contributing factor in gestational diabetes. OGTT test is used to diagnose gestational GDM between 24-28 weeks of pregnancy.

GDM can be prevented pre-pregnancy. Dietary and physical activity guidance is effective glucose control tools to manage the glucose level. Rich in vitamins, high dietary fibers, moderate amounts of carbohydrates and eating more times with a little amount are recommended. Aerobic exercises and resistance strength exercises are suitable for GDM women. Self-monitoring blood glucose can keep the blood glucose level to reach the standard. When diet and exercise therapy cannot control blood sugar, metformin and insulin are the popular medicine among pregnant women with GDM.

The delivery mode, time and type of pregnant women with GDM are associated with the fetal weight and the glucose level after OGTT. Hypertensive disorders, preterm birth, shoulder dystocia and Cesarean section delivery are related to GDM. The pregnant women with GDM can increase the risk of developing T2DM. Neonates born with the GDM women have high risks of neonatal hypoglycemia and 8-fold risk of T2DM/prediabetes at age of 19-27.

The nurse play an important role in the management of women with GDM. Nurses spend more time with patients and know more about patient than physician. Nurses can provide effective counseling and education to improve health-related life quality of GDM women.

Feedback from Mukkula Maternity Clinic team is positive. The guidebook contains accurate and necessary information. The guidebook is easy to understand and useful. And the question style directly shows main points and immediately attracts the readers' interest. The language is friendly and plain, the readers can easily understand the information about GDM. They also provide some advice regarding to self-monitor of glucose monitor and hypoglycemia.

The nurses of Mukkula Maternity Clinic believe that the guidebook was very useful to them.

Now in Päijät-Häme Mukkula Maternity Clinic, the high risk GDM women can get the guide on how to manage the GDM, but the materials are only Finnish. The GDM women are difficult to sufficiently understand the information provided. In the future, the maternity clinic nurses can educate the high risk GDM women who speak English through this guidebook. In this way, the GDM women can get more information about GDM and help them to effectively manage the GDM.

REFERENCES

American Diabetes Association. 2003a. Diabetes Care: gestational diabetes.

Diabetes Care 2003 Jan; 26(suppl 1): s103-s105. Available at:

http://care.diabetesjournals.org/content/26/suppl_1/s103

American Diabetes Association. 2007. Diagnosis and classification of diabetes mellitus. [referenced 06.05.2019]. Diabetes Care 2007;30 Suppl 1: S42-7

ADEA. 2009. Clinical guiding principles for subcutaneous injection technique.

[referenced 25.04.2019]. Available at: [https://www.adea.com.au/wpcon-](https://www.adea.com.au/wp-content/uploads/2009/10/Injection-Technique-FINAL_170815.docx-1.pdf)

[tent/uploads/2009/10/Injection-Technique-FINAL_170815.docx-1.pdf](https://www.adea.com.au/wp-content/uploads/2009/10/Injection-Technique-FINAL_170815.docx-1.pdf)

American diabetes association. 2013. After delivery. [referenced 13.05.2019].

Available at: [http://diabetes.org/livingwithdiabetes/complications/pregnancy/after-deliv-](http://diabetes.org/livingwithdiabetes/complications/pregnancy/after-delivery.html)
[erly.html](http://diabetes.org/livingwithdiabetes/complications/pregnancy/after-deliv-ery.html)

American Diabetes Association. 2014. Insulin storage and syringe safety. [ref-

erenced 13.05.2019]. Available at: [http://www.diabetes.org/living-with-diabe-](http://www.diabetes.org/living-with-diabetes/treatment-and-care/medication/insulin/insulin-storage-and-syringe-safety.html)

[tes/treatment-and-care/medication/insulin/insulin-storage-and-syringe-](http://www.diabetes.org/living-with-diabetes/treatment-and-care/medication/insulin/insulin-storage-and-syringe-safety.html)
[safety.html](http://www.diabetes.org/living-with-diabetes/treatment-and-care/medication/insulin/insulin-storage-and-syringe-safety.html)

ADA. 2016. Patterns in the Development of Gestational Diabetes Mellitus: A

Systematic Review of Observational Studies. [referenced 13.05.2019]. Availa-

ble at: <http://care.diabetesjournals.org/content/39/1/16.long>

Nisreen A., West J., Brown S. et al., 2017. Lifestyle interventions for the treat-

ment of women with gestational diabetes. Cochrane Database Syst

Rev. 2017(5). [referenced 10.05.2019]. Available at: [https://www.ncbi.nlm.nih](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6481373/)

[.gov/pmc/articles/PMC6481373/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6481373/)

American Association of Diabetes Educators. 2019. Pro tips (and tricks) for

easier and better insulin injections. [referenced 10.05.2019]. Available at:

[https://www.diabeteseducator.org/docs/default-source/legacy-docs/_re-](https://www.diabeteseducator.org/docs/default-source/legacy-docs/_resources/pdf/general/Insulin_Injection_Pro_Tips_AADE.pdf)
[sources/pdf/general/Insulin_Injection_Pro_Tips_AADE.pdf](https://www.diabeteseducator.org/docs/default-source/legacy-docs/_resources/pdf/general/Insulin_Injection_Pro_Tips_AADE.pdf)

American Association of Diabetes Educators. 2019. Living with diabetes - monitoring. [referenced 10.05.2019]. Available at: <https://www.diabeteseducator.org/living-with-diabetes/aade7-self-care-behaviors/aade7-self-care-behaviors-monitoring>

Apolonia G., et al. 2003. Nurse-based management in patients with gestational diabetes. *Diabetes care*. 26(4): 998-1001. <http://care.diabetesjournals.org/content/26/4/998.short>

Barden A., Singh R., Walters B.N., et al. 2004. Factors predisposing to pre-eclampsia in women with gestational diabetes. *Journal of Hypertension*, Volume 22. Issue 12:2371-2378 [referenced 25.04.2019]. Available at: https://journals.lww.com/jhypertension/Abstract/2004/12000/Factors_predisposing_to_pre_eclampsia_in_women.20.aspx

Bellamy L., Casas J.P., Hingorani A.D., et al. 2009. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. *The Lancet*. Volume 373, Issue 9677, 1773-1779 [referenced 25.04.2019]. Available at: [https://www.sciencedirect.com/science/article/pii/S014067](https://www.sciencedirect.com/science/article/pii/S0140673609607315)

3609607315

Benhalima K., Mathieu C., Damm P., et al. 2015. A proposal for the use of uniform diagnostic criteria for gestational diabetes in Europe: an opinion paper by the European Board & College of Obstetrics and Gynecology (EBCOG). *Diabetology*, Volume 58, Issue 7:1422-1429 [referenced 12.08.2019]. Available at: <https://link.springer.com/article/10.1007%2Fs00125-015-3615-7>

Bernadette L., Neil M., 2015 Gestational diabetes in primary care. *Nursing in Practice*. [referenced 19.08.2019]. Available at: <https://www.nursinginpractice.com/gestational-diabetes-primary-care>

Bhavadharini B., Uma R., Saravanan P., Mohan V., 2016 Screening and Diagnosis of Gestational Diabetes Mellitus- Relevance to Low- and Middle-Income Countries. *Clinical Diabetes and Endocrinology*. Article number: 13(2016) [referenced 12.08.2019]. Available at: <https://clindiabetesendo.biomedcentral.com/articles/10.1186/s40842-016-0031-y>

Buchanan TA, Xiang AH. 2005. Gestational diabetes mellitus. [referenced 10.05.2019]. *The Journal of Clinical Investigation* 2005 Mar 1;115 (3):485-491. Available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC1052018/

Bowers K, Yeung E, Williams MA ym. A prospective study of pre-pregnancy dietary iron intake and risk for gestational diabetes mellitus. *Diabetes Care* 2011; 34:1557-63. [referenced 10.05.2019]. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/21709294>

B. S. Buckley, J. Harreiter & P. Damm.2011. Gestational diabetes mellitus in Europe: prevalence, current screening practice and barriers to screening. A review. [referenced30.05.2019]. Available at: <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1464-5491.2011.03541.x>Carla L. DeSisto, Shin Y. Kim & Andrea J. Sharma. 2014.

Prevalence Estimates of Gestational Diabetes Mellitus in the United States, Pregnancy Risk Assessment Monitoring System (PRAMS), 2007–2010. [referenced 30.05.2019]. Available at: https://www.cdc.gov/pcd/issues/2014/13_0415.htm

Cliantha P., Jeff C.2015.Exercise guidelines for gestational diabetes mellitus. *World Journal of Diabetes*.6(8):1033-1044 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4515443/#B75>

Cihangir Erem, Ufuk B. Kuzu & Orhan Deger. 2015. Prevalence of gestational diabetes mellitus and associated risk factors in Turkish women: the Trabzon GDM Study. [referenced30.05.2019]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4548030/>

C. Victora, R. Bahl, A Barros, G.V.A Franca, S. Horton, J. Krasevec, S. Murch, M. J. Sankar, N. Walker, and N.C. Rollins.2016."Breastfeeding in the 21st Century: Epidemiology, Mechanisms and Lifelong Effect." *The Lancet* 387 (10017):475-490. [referenced 12.05.2019]. Available at: <https://www.who.int/features/factfiles/breastfeeding/en/>

Centers for disease Control and Prevention (CDC).2017. About Adult BMI. [referenced 08 .05.2019]. Available at: https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html#Definition

Davies GA, Wolfe LA, Mottola MF, et al. 2003. Joint SOGC/CSEP clinical practice guideline: exercise in pregnancy and the postpartum period. *Can J Appl Physiol.* 28(3):330-41. <https://www.ncbi.nlm.nih.gov/pubmed/12955862/>

Damm P.2009.Future risk of diabetes in mother and child after gestational diabetes mellitus. *International Journal of Gynecology & Obstetrics.* Volume 104, Supplement [referenced 16 .05.2019]. Available at: <https://obgyn.onlinelibrary.wiley.com/doi/abs/10.1016/j.ijgo.2008.11.025>

[Yn.onlinelibrary.wiley.com/doi/abs/10.1016/j.ijgo.2008.11.025](https://obgyn.onlinelibrary.wiley.com/doi/abs/10.1016/j.ijgo.2008.11.025)

de Barros MC., Lopes MA., Francisco RP., et al. 2010.Resistance exercise and glycemic control in women with gestational diabetes mellitus. *Am J obstetrics Gynecol.* 203(6):556. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/20864072/>

Deatrck D., et al. 2010. A guide to creating and evaluating patient materials, 2010) [referenced 30.05.2019]. Available at:

<https://mainehealth.org/-/media/community-education-program-cep/health-literacy/mh-print-guidelines.pdf?la=en>

Dirar A.M., Doupis J., 2017.Gestational diabetes from A to Z. *World J Diabetes.* 8(12): 489-511 [referenced 15 .05.2019]. Available at:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5740094/>

Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD). 2003b. Managing Gestational Diabetes: A Patient's Guide to a Healthy Pregnancy. [referenced 08.05.2019]. Available at:

https://www.nichd.nih.gov/sites/default/files/publications/pubs/Documents/managing_gestational_diabetes.pdf

Emily Shepherd, Philippa Middleton & Caroline A Crowther, et al.2017.Dietary advice interventions in pregnancy for preventing gestational diabetes mellitus. [referenced 15.05. 2019. Published online 2017 Jan 3. Doi :

10.1002/14651858.CD006674.pub3. Available at:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6464792/>

Giuliana O., Penny A., Tania J.,2013. Maternal and neonatal health outcomes following the implementation of an innovative model of nurse practitioner-led care for diabetes in pregnancy. *Journal of Advanced Nursing*. Volume 70, Issue 5. [referenced 19.08.2019]. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1111/jan.12277>

Health, 2010. Office of disease prevention and health promotion health literacy online. [referenced 03.06.2019]. Available at: <https://health.gov/health-literacyonline/2010/index.htm>

Hordern M.D., Dunstan D.W., Prins J. B., et al.2012.Exercise prescription for patients with type 2 diabetes and pre-diabetes: A position statement from exercise and sports science Australia. *Journal of Science and Medicine in Sport*, Volume 15, Issue 1, 25-31. Available at: [https://www.jsams.org/article/S1440-2440\(11\)00080-6/fulltext](https://www.jsams.org/article/S1440-2440(11)00080-6/fulltext)

Hidekatsu Yanai, Hiroki Adachi & isayuki Katsuyama, et al.2015.Causative anti-diabetic drugs and the underlying clinical factors for hypoglycemia in patients with diabetes. [referenced 19.05.2019]. Available at:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4317315/>

Hyvärinen. 2015.Millainen on toimiva potilasohje? [referenced 19.08.2019]. Available at: <https://www.terveyskirjasto.fi/xmedia/duo/duo95167.pdf>

Health direct. 2017.pregnancy birth & baby - gestational diabetes. [referenced 11.05.2019]. Available at: <https://www.pregnancybirthbaby.org.au/gestational-diabetes>

Ian Blumer, Eran Hadar, David & R. Hadden, et al.2013.Diabetes and Pregnancy: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*, Volume98, Issue11, Pages 4227– 4249. [referenced 15.05.2019]. Available at: <https://doi.org/10.1210/jc.2013-2465>

International Diabetes Federation. 2015.Having a baby? Now is the time to learn more about gestational diabetes. [referenced 20 .03.2019]. Available at:

<https://www.idf.org/component/attachments/attachments.html?id=858&task=download>

Kjos SL, Peters RK & Xiang A. 1998. Diabetes Care: Hormonal choices after gestational diabetes. Subsequent pregnancy, contraception, and hormone replacement. *Diabetes Care*. 21 Suppl 2: B 50-7. [referenced 18.05.2019]. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/9704227/>

Kim C., Newton M., Knopp R.H., 2002 Gestational diabetes and the incidence of Type 2 Diabetes. *Diabetes Care*. 25(10):1862-1868 [referenced 17.05.2019]. Available at: <http://care.diabetesjournals.org/content/25/10/1862.short>

Käypä hoito. 2013. Raskausdiabetes. [referenced 06.05.2019]. Available at: <http://www.kaypahoito.fi/web/kh/suosituksset/suositus?id=hoi50068>

Langer O., Yogev Y., Most O., et al. 2005. Gestational diabetes: The consequences of not treating. *American Journal of Obstetrics & Gynecology*, Volume 192, Issue 4:989-997. [https://www.ajog.org/article/S0002-9378\(04\)01997-0/fulltext](https://www.ajog.org/article/S0002-9378(04)01997-0/fulltext)

Mani M., Zahra M.T., Mohammad A.J., Soheila M.H., Mandana H., 2017. Health education in gestational diabetes mellitus and quality of life. *Journal of Midwife & Reproductive Health*. 5(4):1066-1074 [referenced 17.05.2019]. Available at: http://jmrh.mums.ac.ir/article_9256_fa93a50c13055516448deb733e4059c8.pdf

Moore H., Summerbell C., Hooper L, et al. 2004, Dietary advice for treatment of type 2 diabetes mellitus in adults. *Cochrane Databases of systematic reviews*. [referenced 10.05.2019]. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/15266517>

Metzger B.E., Contreras M., Sacks D. A., et al. 2008. Hyperglycemia and adverse pregnancy outcomes. *New England Journal of Medicine*, 358(19), 1991-2002. [referenced 10.05.2019]. Available at: <https://www.scholars.northwestern.edu/en/publications/hyperglycemia-and-adverse-pregnancy-outcomes>

Morriset AS1, St-Yves A & Veillette J, et al.2010.Prevention of gestational diabetes mellitus: a review of studies on weight management. [referenced 16.05.2019.]. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/19943327>

Metzger BE, Gabbe SG et al.2010.International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. *Diabetes Care*; 33:676-82. [referenced 11.05.2019]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2827530/>

Morriset AS, St-Yves A, Veillette J ym. 2010. Prevention of gestational diabetes mellitus: a review of studies on weight management. *Diabetes Metab Res Rev*; 26:17-25. [referenced 10.05.2019]. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/19943327>

MedlinePlus. 2017.Diabetes diet - gestational. [referenced 09.05.2019]. Available at: <https://medlineplus.gov/ency/article/007430.htm>

Nanyunja, Immaculate, et al. 2018. Nursing interventions in the management of gestational diabetes in prenatal care patients. Available at: https://www.theseus.fi/bitstream/handle/10024/140885/Thesis1_%20.pdf?sequence=1&isAllowed=y

Naylor D.C., Sermer M., Chen E., et al. 1996.Cesarean delivery in relation to birth weight and gestational glucose tolerance pathophysiology or practice style. *JAMA*. 275(15):1165-1170 [referenced 16.05.2019]. Available at: <https://jamanetwork.com/journals/jama/article-abstract/400472>

NICHHD. 2014.Healthy Pre-Pregnancy Diet and Exercise May Reduce Risk of Gestational Diabetes. [referenced 07.05.2019]. Available at: <https://www.nichd.nih.gov/newsroom/resources/spotlight/082114-pregnancy-GDM>

NIDDK. 2014.Gestational Diabetes: What is the gestational diabetes? [referenced 30.05.2019]. Available at: <https://web.archive.org/web/20160816190744/https://www.niddk.nih.gov/healthinformation/diabetes/types/gestational>

NIH a, 2019. Plain language at NIH. [referenced 03.06.2019]. Available at: <https://www.nih.gov/institutes-nih/nih-office-director/office-communications-public-liaison/clear-communication/plain-language>

National Institute of Diabetes and Digestive and Kidney Disease. 2016. Low Blood Glucose (Hypoglycemia). [referenced 19.05.2019]. Available at: <https://www.niddk.nih.gov/health-information/diabetes/overview/preventing-problems/low-blood-glucose-hypoglycemia?dkrd=hispt0031>

National diabetes services scheme (NDSS). 2017. Diabetes-caring for yourself and your baby. [referenced 12.05.2019]. Available at: <https://static.diabetesaustralia.com.au/s/fileassets/diabetes-australia/9a6615de-20d7-4b09-b98d-b661b3bebb88.pdf>

Peter J Donovan, H David McIntyre. 2010. Drugs for gestational diabetes. *Australian Prescriber*. 33 (5): 141–144. doi:10.18773/austprescr.2010.066. [referenced 30.05.2019]. Available at: <https://www.nps.org.au/australian-prescriber/articles/drugs-for-gestational-diabetes>

Prather H, Spitznagle T., 2012. Hunt D. Benefits of exercise during pregnancy. *PM R*. 2012; 4:845–850

Queensland Clinical Guidelines. 2015. Gestational diabetes mellitus. [referenced 09.05.2019]. Available at: https://www.health.qld.gov.au/__data/assets/pdf_file/0023/140099/g-gdm.pdf

Rev Obstet Gynecol. 2008. Gestational Diabetes Mellitus; 1(3):129-134. [referenced 06.05.2019]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2582643/>

Radiana Staynova Importance of Self-Monitoring of Blood Glucose in Gestational Diabetes: Pharmacists' Role in Improving Patient's Compliance - Pilot Study." *IOSR Journal of Pharmacy (IOSRPHR)*, vol. 7, no. 10, 2017, pp. 78-82.

Sara Wilson Reece, Harish S. Parihar, and Christina Lo Bello. 2014. Metformin in Gestational Diabetes Mellitus. Published online 2014 Nov 13. doi: 10.2337/

diaspect.27.4.289. [referenced 11.05.2019]. Available at:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4231930/>

Nanyunja, Immaculate, et al. 2018. Nursing interventions in the management of gestational diabetes in prenatal care patients. Available at: https://www.the-seus.fi/bitstream/handle/10024/140885/Thesis1_%20.pdf?sequence=1&isAllowed=y

Thomas A. Buchanan, Anny H. Xiang. 2005. Gestational diabetes mellitus. [referenced 11.05.2019]. The Journal of Clinical Investigation.2005 Mar 1;115(3):481-491. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1052018/>

Teri L. Hernandez, Molly A. Anderson, Catherine Chartier-Logan, Jacob E. Friedman and Linda A. Barbour. 2014. Strategies in the Nutritional Management of Gestational Diabetes. Clin Obstet Gynecol. 2013 Dec; 56(4): 803–815. [referenced 08.05.2019]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3921177/>

World Health Organization (WHO). 2006.Report of a WHO/IDF consultation. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia. [referenced: 11.05.2019] ISBN: 978 92 4 159493 6

World Health Organization (WHO). 2013a. Diagnostic criteria and classification of hyperglycemia first detected in pregnancy; p. 3. WHO reference number: WHO/NMH/MND/13.2 [referenced 02. 05. 2019]. Available at: <https://www.paho.org/hq/dmdocuments/2015/guide-who-hyperglycaemia-pregnancy.pdf>

World Health Organization (WHO). 2013b. Diagnostic criteria and classification of hyperglycemia first detected in pregnancy; p. 3.WHO reference number: WHO/NMH/MND/13.2. [referenced 02.05.2019]. Available at: <https://www.paho.org/hq/dmdocuments/2015/guide-who-hyperglycaemia-pregnancy.pdf>

APPENDICES

Guidebook for pregnant women

Gestational Diabetes Mellitus (GDM)

a guidebook for pregnant women



Picture1. from babycenter.com

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1. Introduction of GDM

- Gestational Diabetes Mellitus (GDM) is the most common effects 1% to 4% of all pregnancies each year.
- Diseases occur in pregnancy.
- GDM complicating pregnancy is associated with adverse maternal and perinatal outcomes. It is also associated with the risk of developing type 2 diabetes in mothers and children in the future.
- The good news is there are some things that can control its occurrence and development.
- The guidebook provides the information to you, who have high risks of GDM and the population who have been diagnosed GDM, helping you to have a health pregnancy.

2. What is Gestational Diabetes Mellitus?

GDM means there is too much sugar in your blood during pregnancy. It may be harmful to you and your baby. If a woman is in a state of hyperglycemia, it is likely to cause adverse consequences if it is not well controlled.

3. What is gestational diabetes true reason?

In the middle and late stages of normal pregnancy, the placenta secretes glucocorticoids, estrogens, progesterone and other hormones, which can antagonize increased insulin and thus maintain normal blood sugar levels. GDM pregnant women with insulin resistance or beta cell function defects, leading to disorders of glucose metabolism.

In the body of pregnant women, the volume of endocrine glands will increase too, so that the secretion of prolactin, thyrotropin and adrenaline from the pituitary increases, estrogen and progesterone also help to destroy the balance of glucose and insulin, so Under the action of a variety of hormones, the function of islets is impeded, which in turn causes pregnant women to develop GDM.

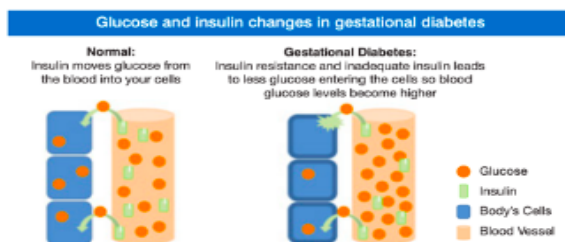


Figure1 gestational diabetes: caring for yourself and your baby (DNSS 2017)

4. Do I have high risks of gestational diabetes?

Yes, if you have one of the following:

- ★ If your age is over 40.
- ★ If you have type 2 diabetes family history or your mother or sister has had GDM.
- ★ If you are over the normal weight range.
- ★ If you are from (Asian, Indian subcontinent, Aboriginal, Torres Strait Islander, Pacific Islander, Maori, Middle Eastern, non-white African)
- ★ If you have had GDM in a previous pregnancy.
- ★ If you have had a large baby whose weight is over 4.5kg.
- ★ If you have polycystic ovary syndrome.
- ★ If you are taking some types of antipsychotic or steroid medications.
- ★ If you gained weight too rapidly in the early pregnancy.

5. How can gestational diabetes be diagnosed?

Oral glucose tolerance test is used for the diagnosis of GDM.

resistance and metabolic syndrome is easier to development preeclampsia.

The diagnostic thresholds used in Finland are:

- ◆ Fasting ≥ 5.3 mmol / l
- ◆ 1h ≥ 10.0 mmol / l
- ◆ 2h ≥ 8.6 mmol / l

6. Is the management of GDM important to me?

Yes, because

- When your blood glucose always in a high level, that will pass the glucose to your baby, then she/he will grow bigger than normal, this will make you difficult to give birth, Shoulder dystocia rate increased, C-section rate increased too.
- Untreated GDM can easily to develop high blood pressure to you, with more serious insulin

7. How can I manage GDM?

Balanced and healthy eating

At the beginning of pregnancy, you should make a healthy eating plan and follow it, which can help you to:

- ◆ Keep your blood glucose within target range.
- ◆ Ensure that you and your baby have adequate nutrition.
- ◆ Make your weight increase evenly.

The principle of the eating plan:

- ★ Regular meals.
- ★ Eat small dose often (5-6 meals/day).
- ★ Satisfy hunger and maintain healthy weight.
- ★ Make sure that every meal has a certain amount of carbohydrates.

During the pregnancy, in order to keep you and your baby healthy, you should choose varied food that contains rich vitamins and nutritious.

You are recommended to eat :

- Low in fat and high in fiber , like vegetables and fruits.
- Quality protein, such as egg whites, fish, chicken, beans.
- A good source of carbohydrate (grains, cereals, fruit, pasta, rice).

Higher demand nutrients during pregnancy

- Calcium (milk, yogurt, cheese nuts...)
- Iron (red meat, fish, tofu...)
- folic acid 0.4-0.9/day (dark green leafy vegetables)

Your plate contains every day :



Figure2 international diabetes federation: GDM-having a baby?

How much should I eat?

- If possible, you can see a dietitian, she will give you an exact calorie level to follow.

- If you are not able to see a dietitian, you can eat for the first 3 month as usual.
- Later about 4 months, you should know the calories of food, and add about 350 calories a day.
- If your BMI equal or over 25 before pregnant, You should reduce the amount of increase.
- If your BMI less than 18.5, you should eat even more.

Of course, during the whole pregnancy, you should minimize sugars and artificial sweeteners, avoid alcohol and tobacco in all forms, avoid saccharin and cyclamate!

Physical activity

As pregnant women with GDM, from low forces to high forces exercises are safe to you and your fetus and help you to manage blood glucose, except there are special obstetric or medical conditions.

Recommend exercise:

walking, jogging, fixed bicycles, swimming, boating, skipping, climbing stairs, Yoga, cleaning the house,

working in the garden etc. Women with small activities history can begin with aerobic exercise from 15 min, three times a week to 30 min four or more times a week.

Strength training and flexibility exercise are also recommended.

International Diabetes Federation 2015 recommended flexibility exercise are showed below, try to slowly do each one six times every day and stop if you feel pain or discomfort.

Upper-back stretch

Cat stretch

Heel cord and hamstring stretch

Pelvic tilt done standing beginning with the 4th month of pregnancy

Pelvic tilt done on your back up to the 4th month of pregnancy

Maternal age	Heart rate target zone (beats/min)	Heart rate target zone (beats/10s)	Heart rate target zone (beats/min) (SQwt/SQb)
<20	140-155	23-26	-
20-29	135-150	22-25	102-124
30-39	130-145	21-24	101-120
>=40	125-140	20-30	-

SQwt: Sedentary overweight; SQb: Sedentary obese.

Track of exercise:

You can use a track record or device which can count number steps, which can help you know the amount of exercise every day. Gradually you can increase the active time or steps.

Table2: Here's a fully featured spreadsheet for tracking

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Ave
WK01								
WK02								
WK03								
...								

Table3: General guidelines for physical activity

Do	Don't
Complete moderate and regular physical activity unless your health care provider tells you not to.	Get too tired while working out or doing physical activity.
Choose activities like swimming, that don't require a lot of standing or balance.	Do any activity while lying on your back when you are in your 2nd or 3rd trimester of pregnancy.

wear loose, light clothing that won't make you sweat too much or get too hot.	Perform activity in very hot weather.
Drink a lot of water before, during and after your activity.	Perform activities that may bump or hurt your belly, or that may cause you to lose your balance.
Eat a healthy diet and gain the right amount of weight.	Fast (skip meals) or do physical activity when you are hungry.
Watch your level of exertion (Can you talk easily?).	Over-exert yourself.

NICHD: Managing gestational diabetes - A patient's guide to a health pregnancy

Self-monitoring blood glucose

Blood glucose measurement

<https://www.youtube.com/watch?v=6Wp7iEsBdM4>

Self-monitoring blood glucose can provide important information for you to control blood sugar. Through blood glucose monitoring, you can actively adjust your diet and exercise to make your blood sugar reach the standard.

In the first week, blood sugar is measured daily, if the values are normal, then you can measure the blood sugar twice a week until the baby born, if the values are elevated, you should measure the blood sugar every day, if necessary you need to send the values to the maternity clinic for an initial medication evaluation.

You need to take measurements one hour before and after breakfast, lunch and dinner every day. The measurement target is

- Before meals: below or equal to 5.5mmol/L.
- After meals: less or equal to 7.8mmol/L.
- 4-7 times measurements are taken every day.

The increase or decrease in the number of tests is based on the value of blood sugar of you and the progress of pregnancy.

Pharmacology therapy (If needed)

Insulin

If you are pregnant with GDM, your body may not produce enough insulin as the baby grows and the insulin may not work well. If wise diet choice + enough exercise + fit able weight still can help you keep the blood sugar aim, insulin will be necessary. Insulin will be safe to you and your baby. 27% women with GDM use it.

If you use insulin, the unused insulin should be stored in the refrigerator; the using bottle can be put at the room temperature approximately 1 month.

If you are interested in how to inject insulin, you can get a guide from the follow website.

<https://www.youtube.com/watch?v=cHmdBMJe1Pg>

Metformin

Metformin as a kind of oral medicine for diabetes, metformin is more and more popular among pregnant women with GDM.

Its mechanism of action is different from insulin. It can promote insulin sensitivity and glucose tolerance, and there is no hypoglycemia or hyperinsulinemia side effect. It is an oral medication that can be safely used during pregnancy.

In patients with mild gestational diabetes, the use of metformin is clearly intended to reduce the incidence of macrosomia.

Hypoglycemia

Treatment of diabetes with drugs (insulin, sulfonylureas) is the most common cause of hypoglycemia. Diabetes patients with a blood glucose level below 3.9 mmol/L can be diagnosed with hypoglycemia.

When you feel:

- Shaky
- Sweating
- Heart pounding
- Hungry
- Dizzy

If you feel any of these, you should take 15 grams of fast-reacting carbohydrates immediately:

-5-7 glucose jelly beans.

- glass of soft juice.
- tablespoon of sugar, honey, or corn syrup.

- 2 tablespoons of raisins

after 15 minutes, if the level of blood glucose is still low of 4 mmol/L, repeat to eat 15g carbohydrate, do the same thing until the blood glucose level to normal.

8. Will the baby be hurt by GDM?

The GDM will increase some risks of your baby. Elevated blood glucose may be harmful to the fetus. Due to GDM, the fetus may grow larger than normal and the development of fetal organ function may be slower. At the first couple days, your newborn baby may have a risk of hypoglycemia and hyperbilirubinemia. In the future, the baby will have more risk of types 2 diabetes.

9. Delivery

When will the baby be born?

- If you control your blood sugar with diet and exercise therapy, your blood sugar is also relatively stable, then you can wait for natural childbirth.

- If you use medicine to control hyperglycemia during pregnancy. Because of the increased risk of fetal asphyxia after 38 weeks of gestation, your date of delivery is up to the calculated date of delivery.
- If you are suspected of having a neonatal newborn or have other complications during pregnancy are considered to have delivered at 38-39 weeks.

-Why is breastfeeding important?

Breastfeeding is the best source of nutrition for you and your baby.

Breastfeeding can lower mothers and Children are at risk of developing type 2 diabetes in the future

Breastfeeding can help you lose weight, many GDM pregnant women find that breastfeeding can maintain their fasting blood sugar at a lower state after childbirth.

10. What should I do after my baby is born?

Your healthcare provider will check your blood sugar level in two months after your baby is born. Most of women with

GDM, blood sugar level quickly returns to normal after delivery. Six weeks after delivery, you should have a glucose tolerance test. According to the results of test, you should follow one of three categories.

AFTER PREGNANCY TEST CATEGORIES

If your category is ...	You should ...
Normal	Do blood glucose monitoring every three years
Impaired Glucose Tolerance	Do blood glucose monitoring every year.
Diabetic	Treatment your diabetes.

(Table 4) NICHD: Managing gestational diabetes - A patient's guide to a health pregnancy delivery.

Yes, you can have another baby, but you are three times more likely to have GDM than normal women. Before your next pregnancy, you should monitor your blood sugar, keep a good lifestyle, especially in weight control and

physical exercise and get in touch with the doctor in the early stages of pregnancy. The doctor will help you to develop the next health plan.

If you are interested to know more about GDM, there are some useful link:

[file:///Users/tangshuhua/Downloads/GDM-having-a-baby-2015%20\(2\).pdf](file:///Users/tangshuhua/Downloads/GDM-having-a-baby-2015%20(2).pdf)

<file:///Users/tangshuhua/Downloads/GDM-model-of-care-2015.pdf>

<https://static.diabetesaustralia.com.au/s/fileassets/diabetes-australia/6d398ea2-5d33-4369-94e3-413437a151d3.pdf>