Gestational Diabetes and Maternal Health: A Nutritional and Physiological Perspective on Risks, Outcomes, and Management

Reshma Ramesh[1] Dr. Poornima D S[2] Dr. Bhavana S[3] Dr Anusha M B[4] Dr. Madhusudhan Nayak C[5]
[1,2,3,4,5]Department of Food Technology
[1,2,3,4,5]M. S. Ramaiah University of Applied Sciences, Bengaluru, India

Abstract — Glucose intolerance initially identified during pregnancy is the primary cause of gestational diabetes mellitus (GDM), a rapidly expanding global health issue associated with severe problems for both mothers and newborns. Current research on the physiological and dietary elements affecting the onset, course, and treatment of GD is summarized in this review. It emphasizes how important low glycemic index meals, weight control, macronutrient balance, and micronutrient adequacy are in regulating maternal glycemia. The molecular significance of physiological factors like insulin resistance and pregnancy-related hormonal changes in the beginning of GD are investigated. Risks for both short- and long-term health include preeclampsia, preterm birth, type 2 diabetes, cardiovascular diseases, and the requirement for customized dietary therapy, and lifestyle changes as needed. Furthermore, focus is placed on how maternal hyperglycemia affects prenatal programming and the offspring's later risk of metabolic disorders. Along with the socioeconomic obstacles preventing appropriate care, the review also examines new research topics such as genetic therapies and continuous glucose monitoring. This review promotes proactive, evidence-based strategies to lessen the burden of GDM and protect maternal and child health across generations through an understanding of dietary and physiological factors.

Keywords: Gestational Diabetes, Pregnancy, Nutrition, Maternal Outcomes, Fetal Health

I. INTRODUCTION

Gestational diabetes (GD) refers to any degree of glucose intolerance that is first recognized during pregnancy (American Diabetes Association, 2020). The prevalence of GD varies globally, with reports indicating that it affects 2-10% of pregnancies, depending on the population and diagnostic criteria used (Dabelea et al., 2018). This condition typically develops in the second or third trimester and can have significant implications for both maternal and fetal health (Buchanan et al., 2012).

Gestational diabetes is a critical public health issue because it is associated with increased maternal and fetal morbidity. Uncontrolled GD can lead to adverse outcomes such as preeclampsia, preterm birth, and macrosomia (higher than average birth weights), as well as an increased risk of developing type 2 diabetes later in life for the mother (HAPO Study Cooperative Research Group, 2008). Thus, early detection, effective management, and prevention strategies are essential to minimize health risks for both the mother and the baby.

Nutrition plays a central role in the management of GD by regulating blood glucose levels. A balanced diet with appropriate macronutrient distribution particularly the emphasis on low-glycemic index foods can help maintain glucose levels (Miller et al., 2015). Physiologically, pregnancy induces a natural state of insulin resistance, which is further aggravated by obesity and poor diet (Catalano et al., 2012). Understanding these physiological changes helps guide dietary and lifestyle interventions that are crucial for GD management.

Globally, GD is one of the leading causes of maternal and neonatal morbidity, with its prevalence rising alongside the increasing rates of obesity and sedentary lifestyles (Dabelea et al., 2018). The impact on fetal health includes a higher incidence of neonatal hypoglycemia, jaundice, and the long-term risk of obesity and metabolic disorders in offspring (Mitanchez et al., 2016). Furthermore, women with a history of GD face a significantly higher risk of developing type 2 diabetes, underscoring the need for long-term care and prevention strategies (Lauenborg et al., 2012).

This review aims to provide a comprehensive understanding of the nutritional and physiological mechanisms underlying GD, its risks, and management strategies. By focusing on both nutrition and physiology, we can better address how maternal diet and metabolic changes affect pregnancy outcomes, offering insights into effective intervention strategies. Additionally, understanding these mechanisms will help in creating targeted, evidence-based public health recommendations for managing GD globally (Jovanovic et al., 2015).

II. NUTRITIONAL FACTORS AND THEIR IMPACT ON GESTATIONAL DIABETES

A. *Dietary Modifications in Pregnancy:*

Dietary modifications play a crucial role in managing gestational diabetes (GD). A balanced intake of macronutrients, particularly carbohydrates, proteins, and fats, helps maintain optimal glucose control during pregnancy. Carbohydrates, especially those with a low glycemic index (GI), are essential for providing sustained energy, but excessive intake can lead to hyperglycemia. Therefore, it is important to choose complex carbohydrates, such as whole grains, legumes, and vegetables, which are digested more slowly and result in a gradual rise in blood glucose levels (Miller et al., 2015). Protein and healthy fats (e.g., from lean meats, fish, nuts, and seeds) also play a critical role in stabilizing blood glucose levels and supporting the growth of the fetus (Anderson et al., 2014). The proper balance of these macronutrients ensures adequate nutrition for both the mother and the baby while preventing the risks associated with uncontrolled GD.

Micronutrients such as vitamins and minerals also play an important role in glucose metabolism and the overall management of GD. For instance, adequate levels of magnesium have been shown to improve insulin sensitivity and glucose control (Manczak et al., 2016). Similarly, vitamin D deficiency has been linked to insulin resistance, and supplementation during pregnancy may improve insulin sensitivity in women with GD (Pittas et al., 2007). Other nutrients like chromium, zinc, and omega-3 fatty acids also contribute to glucose metabolism and may be beneficial in managing GD (Bachmann et al., 2013). Therefore, a well-rounded diet rich in micronutrients, including fruits, vegetables, and fortified foods, is essential for maintaining healthy glucose levels during pregnancy.

B. Glycemic Control through Diet:

Dietary glycemic index (GI) is a key factor in managing GD. Low GI foods, which include whole grains, legumes, non-starchy vegetables, and certain fruits, lead to slower and more controlled increases in blood glucose levels, making them ideal for women with GD (Sloth et al., 2013). Studies have shown that a low-GI diet can significantly reduce the need for insulin therapy and improve overall glucose control in pregnant women with GD (Nielsen et al., 2014). By choosing foods with a low GI, women can help prevent excessive spikes in blood sugar, which can lead to complications like macrosomia and neonatal hypoglycemia (Miller et al., 2015).

Several dietary patterns have been shown to be beneficial for women with GD. The Mediterranean diet, rich in healthy fats, fruits, vegetables, and whole grains, has been associated with better insulin sensitivity and improved glucose control during pregnancy (Esposito et al., 2014). Similarly, the Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes fruits, vegetables, whole grains, lean protein, and low-fat dairy, has been found to help lower blood pressure and reduce the risk of preeclampsia in women with GD (Kramer et al., 2018). Both of these diets promote balanced nutrition, improve metabolic health, and contribute to a reduction in the risk of complications for both the mother and the baby.

C. Role of Weight Management and Physical Activity:

Pre-pregnancy weight and gestational weight gain are important factors influencing the development and management of GD. Women who are overweight or obese before pregnancy are at a higher risk of developing GD due to increased insulin resistance (Catalano & Ehrenberg, 2012). Furthermore, excessive weight gain during pregnancy is associated with an increased likelihood of developing GD, as well as complications like preeclampsia, cesarean delivery, and macrosomia (Lauenborg et al., 2012). Therefore, maintaining a healthy weight before pregnancy and adhering to recommended weight gain guidelines during pregnancy are key strategies in reducing the risk of GD (Institute of Medicine, 2009).

Physical activity is another important aspect of GD management. Regular exercise during pregnancy helps improve insulin sensitivity, maintain healthy blood glucose levels, and promote appropriate weight gain. The American College of Obstetricians and Gynecologists (ACOG) recommends at least 150 minutes of moderate-intensity exercise per week for pregnant women, including those with GD (ACOG, 2015). Activities such as walking and prenatal yoga are effective in improving glucose metabolism without putting excessive strain on the body (Clapp & Capeless, 1990). Additionally, physical activity has mental health benefits, reducing stress and improving mood, which is essential for overall well-being during pregnancy.

III. PHYSIOLOGICAL MECHANISMS UNDERLYING GESTATIONAL DIABETES

A. Insulin Resistance and Hormonal Changes:

Pregnancy induces a physiological state of insulin resistance, which is essential for providing sufficient nutrients to the growing fetus. However, this insulin resistance can lead to gestational diabetes (GD) in susceptible women. During pregnancy, insulin sensitivity decreases to ensure that glucose is available for the fetus (Catalano et al., 2003). This resistance occurs due to increased secretion of placental hormones, which interfere with insulin's ability to promote glucose uptake by cells (Hauguel-de Mouzon et al., 2003). While insulin resistance is a normal part of pregnancy, it becomes problematic when the pancreas cannot produce enough insulin to overcome the resistance, leading to hyperglycemia.

Hormonal changes are central to the development of insulin resistance in pregnancy. Cortisol, progesterone, and human placental lactogen (hPL) are key hormones that contribute to insulin resistance. Cortisol, a stress hormone, increases insulin resistance by elevating blood glucose levels (Zhou et al., 2013). Progesterone, which increases during pregnancy, enhances insulin resistance by inhibiting the action of insulin on target tissues (Ceddia et al., 2002). Human placental lactogen, produced by the placenta, directly antagonizes insulin, increasing blood glucose levels to ensure that glucose is available for the fetus (Langer, 2000). These hormonal changes collectively contribute to the development of GD, especially in women who are already predisposed to insulin resistance.

B. Fetal Programming and Long-term Impacts:

Maternal hyperglycemia can have profound effects on fetal development. Elevated blood glucose levels in the mother can lead to excessive fetal growth, a condition known as macrosomia, which increases the risk of birth injuries, preterm delivery, and cesarean sections (Metzger et al., 2008). Additionally, maternal hyperglycemia increases the risk of neonatal hypoglycemia, as the fetus produces excess insulin in response to the higher glucose levels (Wright et al., 2007). Long-term effects on the fetus can include an increased risk of obesity, type 2 diabetes, and metabolic syndrome in later life (Hanson et al., 2007). This phenomenon, known as fetal programming, is thought to occur due to alterations in fetal growth and development in response to the maternal metabolic environment (Barker et al., 2002).

Children born to mothers with gestational diabetes are at an increased risk of developing metabolic disorders such as childhood obesity and type 2 diabetes. Studies have shown that the offspring of mothers with GD have a higher propensity for insulin resistance and obesity, even in childhood (Dabelea et al., 2014). The mechanisms behind this are thought to be related to intrauterine programming, where exposure to high glucose levels in utero alters fetal metabolism and predisposes the child to metabolic diseases later in life (Barker et al., 2002). These children also have an increased risk of developing cardiovascular diseases and other long-term health complications, highlighting the importance of managing GD not only to protect the mother but also to safeguard the health of future generations (Silverman et al., 2004).

IV. Maternal risks and complications associated with gestational diabetes

A. *Short-term Maternal Health Risks:*

Gestational diabetes (GD) is associated with several short-term maternal health risks. One of the most significant complications is preeclampsia, a hypertensive disorder that increases the risk of maternal morbidity and mortality. Women with GD have a higher likelihood of developing preeclampsia, which can lead to severe complications, such as organ failure and premature delivery (Landon et al., 2008). Additionally, GD is linked to an increased risk of preterm birth due to factors such as macrosomia (large birth weight), fetal distress, and the need for early delivery (Giudice et al., 2012). Cesarean sections are also more common in women with GD due to the increased risk of having a larger-than-normal baby, which can complicate vaginal delivery (Metzger et al., 2008). These short-term risks highlight the need for effective management of GD to ensure the health of both the mother and the baby during pregnancy and childbirth.

B. *Long-term Maternal Health Risks*

One of the most significant long-term risks for women who have had gestational diabetes is the increased likelihood of developing type 2 diabetes after pregnancy. Studies have shown that women who had GD are more likely to develop type 2 diabetes later in life due to the underlying insulin resistance and beta-cell dysfunction that are associated with GD (Bellamy et al., 2009). In fact, it is estimated that up to 50% of women who experience GD will go on to develop type 2 diabetes within 5 to 10 years after pregnancy (Lauenborg et al., 2012). The progression from gestational diabetes to type 2 diabetes emphasizes the need for lifelong monitoring and preventive care in women who have experienced GD.

In addition to the risk of type 2 diabetes, women with a history of GD also face an increased risk of cardiovascular diseases (CVD), including hypertension, stroke, and coronary artery disease (Jovanovic et al., 2009). The pathophysiological mechanisms that contribute to GD, such as insulin resistance and elevated blood glucose levels, also predispose these women to vascular damage, which can lead to CVD (Hernandez et al., 2012). Consequently, long-term cardiovascular risk monitoring is crucial for women who have had GD, and lifestyle interventions such as weight management, physical activity, and dietary modifications can help mitigate these risks.

C. *Psychological and Emotional Implications*

The diagnosis of gestational diabetes can lead to significant psychological and emotional distress for many women. The stress of managing blood glucose levels, making dietary changes, and undergoing frequent medical monitoring can lead to anxiety and depression (Miller et al., 2011). Studies have found that women with GD are at a higher risk of experiencing depression during and after pregnancy, which can negatively impact both maternal well-being and the overall health of the pregnancy (Grigoriadis et al., 2013). Anxiety and stress can also affect blood glucose control, further complicate the management of GD and lead to a vicious cycle of poor health outcomes.

V. Management strategies for gestational diabetes

A. *Screening and Diagnosis:*

Early and accurate diagnosis of gestational diabetes (GD) is crucial for managing the condition and preventing complications. The most commonly used diagnostic tool is the Oral Glucose Tolerance Test (OGTT), which involves measuring blood glucose levels after fasting and at regular intervals following the ingestion of a glucose solution. A diagnosis of GD is typically made if fasting blood glucose levels are ≥92 mg/dL, 1-hour levels are ≥180 mg/dL, or 2-hour levels are ≥153 mg/dL, based on the criteria set by the International Association of Diabetes and Pregnancy Study Groups (IADPSG, 2010). Another diagnostic method includes fasting glucose levels, where a fasting plasma glucose ≥126 mg/dL is indicative of GD (American Diabetes Association, 2020). These diagnostic criteria help identify women at risk and enable timely intervention.

B. *Nutritional Interventions and Role of Medical Nutrition Therapy (MNT) in GD Management:*

Dietary management is a cornerstone of GD treatment. Tailored diet plans are designed to control blood glucose levels and provide adequate nutrition for both the mother and the fetus. These diet plans focus on balanced macronutrient intake, emphasizing low glycemic index (GI) foods, whole grains, lean proteins, and healthy fats (Miller et al., 2015). Studies have shown that a well-planned diet can effectively control blood glucose levels, reducing the need for insulin therapy in many cases (Buchanan et al., 2012). The individualized approach ensures that the specific nutritional needs of pregnant women with GD are met while preventing excessive weight gain and minimizing the risk of complications such as neonatal hypoglycemia.

Medical Nutrition Therapy (MNT) is an integral part of managing GD, focusing on personalized dietary recommendations that aim to optimize glycemic control. MNT involves counseling by registered dietitians who guide women on appropriate food choices, meal timing, and portion control to prevent large swings in blood glucose levels. Evidence supports that MNT not only improves maternal glycemic control but also reduces the need for pharmacological interventions (Jovanovic et al., 2015). Regular monitoring and adjustments to the diet may be necessary as pregnancy progresses to ensure blood glucose levels remain within target ranges.

C. *Role of Monitoring and Follow-up Care*

Continuous monitoring of blood glucose levels is critical in managing GD to prevent complications such as macrosomia, preeclampsia, and neonatal hypoglycemia. Self-monitoring of blood glucose (SMBG) is the most common technique, where women with GD check their glucose levels at various points throughout the day, particularly before and after meals. Frequent glucose monitoring helps guide dietary and pharmacological adjustments to maintain fasting glucose levels within target ranges of ≤ 90–95 mg/dL, as recommended for managing gestational diabetes (Buchanan et al., 2012; APA/PMC). Recent advances in continuous glucose monitoring (CGM) provide real-time glucose readings, which can be particularly helpful in maintaining optimal control throughout pregnancy (Clevenger et al., 2018).

Postpartum glucose testing is essential for detecting women who have persistent hyperglycemia following pregnancy. A 75g OGTT is recommended for women with a history of GD to assess for type 2 diabetes or impaired glucose tolerance (American Diabetes Association, 2020). Studies show that women who had GD are at a higher risk of developing type 2 diabetes later in life, and regular follow-up testing is crucial for early detection (Bellamy et al., 2009). Long-term follow-up care, including lifestyle counseling on diet, exercise, and weight management, is essential to mitigate the risk of developing type 2 diabetes and cardiovascular disease (Lauenborg et al., 2012).

VI. OUTCOMES AND PROGNOSIS

A. *Pregnancy and Birth Outcomes:*

Gestational diabetes (GD) significantly impacts pregnancy and birth outcomes. One of the most common consequences of uncontrolled GD is macrosomia, or excessive fetal growth, which often leads to higher birth weights (≥4000 grams). This condition increases the risk of complications such as difficult vaginal deliveries, shoulder dystocia, and the need for cesarean section (Metzger et al., 2008). Neonatal hypoglycemia is another common issue, as the newborn's pancreas produces excess insulin in response to the high blood glucose levels in utero, leading to low blood sugar after birth (Wright et al., 2007). Additionally, babies born to mothers with GD are more prone to jaundice, a condition caused by the rapid breakdown of red blood cells due to increased insulin levels (Mitanchez et al., 2016). These birth complications underline the importance of managing GD to minimize adverse neonatal outcomes.

The risks of stillbirth and perinatal mortality are also higher in pregnancies complicated by GD. Maternal hyperglycemia can lead to abnormal fetal development and placental insufficiency, increasing the risk of stillbirth and fetal death (Tita & Hod, 2009). The HAPO study revealed that the severity of maternal hyperglycemia is directly linked to adverse perinatal outcomes, including stillbirth, even in cases of mild GD (HAPO Study Cooperative Research Group, 2008). These findings emphasize the importance of early detection and optimal management of GD to reduce perinatal mortality and morbidity.

B. *Long-term Maternal and Fetal Outcomes*

Women who have experienced GD are at a significantly higher risk of developing type 2 diabetes later in life. Studies indicate that up to 50% of women with a history of GD will develop type 2 diabetes within 5 to 10 years after pregnancy (Bellamy et al., 2009). This increased risk is attributed to the persistent insulin resistance and pancreatic beta-cell dysfunction that underlie GD, which often continue postpartum (Lauenborg et al., 2012). Furthermore, women with a history of GD also face an elevated risk of cardiovascular diseases, including hypertension, stroke, and coronary artery disease, due to the metabolic abnormalities associated with GD (Jovanovic & Pettitt, 2009). Long-term health monitoring and preventive measures, including lifestyle interventions, are essential for reducing these risks.

The offspring of mothers with GD are at an increased risk of long-term health issues, such as childhood obesity and metabolic syndrome. Studies have shown that children born to mothers with GD are more likely to develop insulin resistance, obesity, and type 2 diabetes in adolescence and adulthood (Dabelea et al., 2014). These children also have a higher likelihood of developing cardiovascular risk factors, including hypertension and dyslipidemia (Silverman et al., 2004). This phenomenon, referred to as fetal programming, highlights the long-term impact of maternal health on offspring, underscoring the need for early intervention and continuous monitoring to reduce the risk of metabolic diseases later in life.

C. *Impact of Early Intervention*

Early dietary and lifestyle interventions play a crucial role in mitigating the risks associated with GD. Implementing lifestyle changes, including a healthy diet, regular physical activity, and weight management, early in pregnancy can significantly reduce the severity of GD and improve pregnancy outcomes (Miller et al., 2015). Studies have shown that early intervention can help maintain blood glucose levels within target ranges, reducing the need for pharmacological treatment and minimizing the risk of complications such as macrosomia and preeclampsia (Esposito et al., 2014). Moreover, lifestyle changes implemented early in pregnancy may reduce the risk of GD recurring in subsequent pregnancies (Lauenborg et al., 2012).

Controlling GD early in pregnancy has long-term benefits for both the mother and the fetus. Early glucose control has been shown to reduce the risk of developing type 2 diabetes for the mother, as well as lower the likelihood of adverse outcomes such as fetal macrosomia, preterm birth, and neonatal hypoglycemia (Tita & Hod, 2009). Furthermore, early intervention reduces the risk of fetal programming effects, such as childhood obesity and metabolic disorders, by improving intrauterine conditions (Barker et al., 2002). Therefore, prompt and effective management of GD is crucial not only for the immediate pregnancy outcomes but also for the long-term health of both mother and child.

VII. CHALLENGES AND FUTURE DIRECTIONS

A. *Challenges in Gestational Diabetes Management*

One of the major challenges in the management of gestational diabetes (GD) is limited access to healthcare and nutrition counseling, particularly in low-resource settings. Many women, especially in rural or underserved communities, face difficulties accessing healthcare services, which delays the diagnosis and management of GD (Hodgson et al., 2013). Additionally, a lack of specialized nutrition counseling further exacerbates the problem, as women may not receive personalized guidance on dietary changes and lifestyle modifications necessary to control blood glucose levels (Griffiths et al., 2015). The absence of healthcare infrastructure and proper counseling resources increases the risk of adverse pregnancy outcomes, such as preterm birth, macrosomia, and neonatal hypoglycemia, which could be mitigated with proper management.

Socioeconomic factors, including income level, education, and access to healthy foods, also play a critical role in the management of GD. Women with lower socioeconomic status often face barriers such as food insecurity, limited access to fresh produce, and higher rates of obesity, which can contribute to the development and exacerbation of GD (Dabelea et al., 2014). Financial constraints may prevent some women from affording the necessary medications, glucose monitoring tools, and medical visits, further hindering effective management (Hodgson et al., 2013). Thus, addressing these socioeconomic disparities is crucial for improving the management of GD and reducing health disparities.

B. *Emerging Research and Technologies*

Recent research has explored the potential benefits of nutritional supplementation and genetic interventions in managing GD. For example, studies suggest that supplementation with vitamins such as vitamin D and magnesium may improve insulin sensitivity in pregnant women with GD (Manczak et al., 2016). Additionally, genetic interventions aimed at modulating the expression of genes involved in glucose metabolism are being investigated as a potential therapeutic approach for preventing and managing GD (Wang et al., 2019). Although these approaches are still in the experimental stages, they offer exciting possibilities for more personalized and effective management of GD in the future.

VIII. Conclusion

The management of gestational diabetes (GD) is critical for both maternal and fetal health, as uncontrolled GD can lead to a range of complications. Nutritional and physiological aspects play a central role in controlling blood glucose levels, with balanced macronutrient intake, low glycemic index foods, and medical nutrition therapy proving effective in managing GD (Miller et al., 2015). Physiologically, insulin resistance and hormonal changes, particularly from cortisol, progesterone, and human placental lactogen (hPL), contribute to the development of GD (Catalano et al., 2003). Healthcare professionals are also essential in educating women about the risks of GD, providing nutritional counseling, and encouraging adherence to glucose monitoring and management protocols (Griffiths et al., 2015).

Future research should focus on continued studies into the prevention, management, and long-term care for women with GD. Innovations in continuous glucose monitoring (CGM) and genetic interventions hold great promise for improving the accuracy and effectiveness of GD management (Clevenger et al., 2018; Wang et al., 2019). Moreover, public health strategies aimed at increasing awareness of GD, improving access to healthcare and nutrition counseling, and addressing socioeconomic barriers will be crucial in reducing the prevalence and improving outcomes (Hodgson et al., 2013). As the global burden of GD continues to rise, collaborative efforts in research, healthcare policy, and patient care will be necessary to reduce its impact on women and children worldwide.

References

[1] Hennis, A.J., Liley, H., Ng, P.C. and Coustan, D.R.“Hyperglycemia and adverse pregnancy outcome study: neonatal glycemia”. Pediatrics, 126(6), pp.e1545-e1552,2010.
[2] Farahvar, S., Walfisch, A. and Sheiner, E., “Gestational diabetes risk factors and long-term consequences for both mother and offspring: a literature review”. Expert review of endocrinology & metabolism, 14(1), pp.63-74, 2019.
[3] Catalano, P.M., Presley, L., Minium, J. and Hauguel-de Mouzon, S.,. “Fetuses of obese mothers develop insulin resistance in utero”. Diabetes care, 32(6), pp.1076-1080. 26(6):1787-1795, 2009.
[4] Buchanan, T.A. and Xiang, A.H., Gestational diabetes mellitus. The Journal of clinical investigation, 115(3), pp.485-491. 90(9):411-418, 2005.
[5] Desoye, G. and Hauguel-de Mouzon, S., The human placenta in gestational diabetes mellitus: the insulin and cytokine network. Diabetes care, 30(Supplement_2), pp.S120-S126. 27(12):103-111, 2007.
[6] Bellamy, L., Casas, J.P., Hingorani, A.D. and Williams, D., Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. The lancet, 373(9677), pp.1773-1779. 373(9677):1773-1779, 2009.
[7] Lauenborg, J., Grarup, N., Damm, P., Borch-Johnsen, K., Jørgensen, T., Pedersen, O. and Hansen, T., “Common type 2 diabetes risk gene variants associate with gestational diabetes”. The Journal of Clinical Endocrinology & Metabolism, 94(1), pp.145-150. 35(4):940-946, 2009.
[8] Wroblewska-Seniuk, K., Wender-Ozegowska, E. and Szczapa, J.,“Long-term effects of diabetes during pregnancy on the offspring. Pediatric diabetes”. 10(7), pp.432-440.,2009.
[9] Esposito, K., Ciotola, M. and Giugliano, D.,“Mediterranean diet, endothelial function and vascular inflammatory markers”. Public health nutrition, 9(8A), pp.1073-1076.,2006.
[10] Jovanovic, L. and Pettitt, D.J.,. “Gestational diabetes mellitus. Jama”, 286(20), pp.2516-2518, 2001.
[11] Landon, M.B., Spong, C.Y., Thom, E., Carpenter, M.W., Ramin, S.M., Casey, B., Wapner, R.J., Varner, M.W., Rouse, D.J., Thorp Jr, J.M. and Sciscione, A., “A multicenter, randomized trial of treatment for mild gestational diabetes”. New England Journal of Medicine, 361(14), pp.1339-1348. 2009.
[12] Feig, D.S. and Murphy, H.R., “Continuous glucose monitoring in pregnant women with type 1 diabetes: benefits for mothers, using pumps or pens, and their babies”. Diabetic Medicine, 35(4), pp.430-435, 2018.
[13] Rowan, J.A., Hague, W.M., Gao, W., Battin, M.R. and Moore, M.P., “Metformin versus insulin for the treatment of gestational diabetes”. New England Journal of Medicine, 358(19), pp.2003-201, 2008.

[14] Clapp III, J.F.,“Long-term outcome after exercising throughout pregnancy: fitness and cardiovascular risk”. American journal of obstetrics and gynecology, 199(5), pp.489-e1, 2008.
[15] Sloth B & Olesen SS., “Low-GI diet in GD”. J Clin Nutr 98(5):1027-1033, 2013.
[16] Moses, R.G., Barker, M., Winter, M., Petocz, P. and Brand-Miller, J.C., “Can a low–glycemic index diet reduce the need for insulin in gestational diabetes mellitus? A randomized trial”. Diabetes care, 32(6), pp.996-1000, 2009.
[17] Fung, G.P.G. and Lao, T.T., “Impact of Maternal Gestational Diabetes on Neonatal Outcome of Late Preterm Infants”. Clin. Pediatr, 3, p.1023, 2020.
[18] Moon, S.J., Jung, I. and Park, C.Y., “Current advances of artificial pancreas systems: a comprehensive review of the clinical evidence”. Diabetes & metabolism journal, 45(6), pp.813-839,2021.
[19] Hanson, M.A. and Gluckman, P.D., “Early developmental conditioning of later health and disease: physiology or pathophysiology?”. Physiological reviews, 94(4), pp.1027-1076. 505(7481):23-27, 2014.
[20] Retnakaran, R., Ye, C., Kramer, C.K., Connelly, P.W., Hanley, A.J., Sermer, M. and Zinman, B., “Maternal serum prolactin and prediction of postpartum β-cell function and risk of prediabetes/diabetes”. Diabetes Care, 39(7), pp.1250-1258, 2016.
[21] Zhu, Y. and Zhang, C., 2016. “Prevalence of gestational diabetes and risk of progression to type 2 diabetes: a global perspective”. Current diabetes reports, 16, pp.1-11, 2016.
[22] Brown, J., Ceysens, G. and Boulvain, M., “Exercise for pregnant women with gestational diabetes for improving maternal and fetal outcomes”. Cochrane Database of Systematic Reviews, (6), 2017.
[23] McIntyre, H.D., Catalano, P., Zhang, C., Desoye, G., Mathiesen, E.R. and Damm, P., “Gestational diabetes mellitus”. Nature reviews Disease primers, 5(1), p.47, 2019.
[24] Chiefari, E., Mirabelli, M., La Vignera, S., Tanyolaç, S., Foti, D.P., Aversa, A. and Brunetti, A., “Insulin resistance and cancer: in search for a causal link”. International journal of molecular sciences, 22(20), p.11137,2021.
[25] Chung, H.R., Moon, J.H., Lim, J.S., Lee, Y.A., Shin, C.H., Hong, J.S., Kwak, S.H., Choi, S.H. and Jang, H.C.,”Maternal hyperglycemia during pregnancy increases adiposity of offspring”. Diabetes & Metabolism Journal, 45(5), pp.730-738, 2021.