Review Article

Management of Hyperglycemia during Pregnancy in Primary Care Settings, Review Article

Najlaa M. Alsudairy[1],Rawan A. Shwaiheen[2], wejdan A. Albalawi[3], Alaa A. Darraj[4], Khalid M. Alotaibi[5], shroog K. alshammari[4], Dalal A. Mulaysi[4], Huda O. Alanazi[4], Ahmed S. Alotaibi[4], Suad Z. Alyousef[6], Reem K. almuhaidib[7], Razan K. almuhaidib[7], Amina A. Maraj[4].

[1]Assistant Consultant FM,National Guard Hospital,King Abdulaziz Medical City, SCOHS, Jeddah, KSA. [2]Medical student, KSA. [3]University of Tabuk, KSA. [4]General practitioner, KSA. [5]Resident, KSA. [6]University of Hail, KSA. [7]King fahad specialist hospital, KSA.

ABSTRACT

Pregnancy-related diabetes carries dangers for both the mother and her growing foetus. Pre-conception care, screening, diagnosis, prenatal care, and postpartum care are all included in the management of the condition at the level of primary care. Its overall care requires a multidisciplinary approach. At the primary care level, there are many approaches to managing diabetes during pregnancy. The following clinical practice guidelines (CPG) on this topic were created to give healthcare clinicians a thorough, evidence-based management guidance to help them deliver high-quality care.

Keyword: diabetes, pregnancy, screening, management, diagnosis.

Introduction

Gestational diabetes mellitus (GDM) is a type of diabetes that can develop during pregnancy in women who don't already have diabetes [1]. GDM is responsible for about 84% of cases of hyperglycemia during pregnancy, whereas type 1 or type 2 diabetes, are responsible for the remaining 16% of cases. According to the International Diabetes Federation, 1 in 6 babies are delivered to moms who experienced some kind of pregnancy-related hyperglycemia [2]. A growing body of research has revealed that hyperglycemia during pregnancy promotes disease manifestation later in life as well as moms and children's prenatal morbidity and mortality [2].

For instance, preeclampsia (PE), caesarean births, and birth trauma are more common in GDM-affected women. Their babies are more prone to be premature, larger- age-for-gestation, with congenital malformations as well as neonatal respiratory distress syndrome. Additionally, both the mother and the child have an increased chance of acquiring type 2 diabetes with the metabolic syndrome (T2DM), and obesity later in life. Insulin resistance and hyperinsulinemia, which are brought on by excessive levels of circulating maternal glucose, lipids, and amino acids, are the key pathophysiological characteristics [3]. Hyperglycemia and adverse pregnancy outcomes (HAPO) study found

Access this article online	
Quick Response Code:	Website: www.smh-j.com
	DOI: 10.54293/smhj.v3i1.55

Address for correspondence: Najlaa Mohammad Alsudairy, Assistant Consultant FM,National Guard Hospital,King Abdulaziz Medical City, SCOHS, Jeddah, KSA.
E-mail: Najlaa.Alsudairy@gmail.com

Received: 2 November 2022 **Received in revised form:** 18 November 2022
Accepted: 28 November 2022

Please cite this article as: Mohammad Alsudairy N, abdullah shwaiheen R, Abdullah albalawi wejdan, Ahmed Darraj A, Mohammed Alotaibi K, khashman alshammari shroog, Ali Mulaysi D, Owaid Hudmul Alanazi H, Saleh Alotaibi A, Zaki Alyousef S, khalid almuhaidib R, khalid almuhaidib R, Abduljalil Maraj A. Management of Hyperglycemia during Pregnancy in Primary Care Settings, Review Article. SMHJ [Internet]. 2022;3(1):1-6.

SMHJ
Saudi Medical Horizons Journal

A direct correlation between the dangers of unfavourable results and maternal blood sugar levels. Mild hyperglycemia during pregnancy has been linked to adverse pregnancy outcomes [4]. Older age, a family history of diabetes, being overweight or obese, gaining too much weight while pregnant women with a poor track record and those from high-risk ethnic groupings are all risk factors for GDM [5]. A previous study showed that among Chinese women with a history of GDM, pre-pregnancy obesity and substantial post-delivery weight gain elevated the risk for developing T2D and prediabetes at 1–5 years after delivery [6]. Cost-effectiveness estimations are significantly impacted by GDM screening and therapy. Numerous studies have demonstrated that prenatal and, most likely, long-term illness risks can be decreased by implementing screening and management for GDM. As a result, significant financial savings can be made in terms of expenses related to maternal and newborn morbidities thanks to the high costs of GDM diagnosis and extensive treatment. Therefore, it is crucial to concentrate on GDM prevention, screening, early diagnosis, and management [7, 8].

Screening and Diagnosis

The following factors put a woman potentially having BMI greater than 27 kg/m^2, a history of GDM, and a first-degree relative who has diabetes (DM), newborn weight greater than 4 kg (in the past); negative obstetric history including shoulder dystocia, congenital malformations (such as neural tube problems and heart defects), unexplained intrauterine mortality, glycosuria greater than 2+ twice, present-day obstetric issues (the usage of steroids currently, polyhydramnios, pregnancy-induced hypertension, and essential hypertension) [8]. Using this 75-gram oral glucose tolerance test (OGTT): expecting mothers who are at pregnancy-related risk and pregnant women with type 1 diabetes should be considered checked when making a reservation (OGTT). When a woman is between 24 and 28 weeks pregnant, test should be redone if it comes out negative. Women who are 25 years of age or older and do not have any other risk factors should be examined between 24- and 28-weeks' gestation [9, 10]. Overt pregnancy-related diabetes has no one accepted definition. Early diagnosis is recommended because the illness may indicate that diabetes existed before becoming pregnant. If the test results show overt diabetes, pre-existing diabetes treatment and follow-up procedures should be followed [9]. To determine if GDM, is present a standard OGTT should be performed with 75g anhydrous glucose in 250-300ml of water after overnight fasting of 8-14 hours. Plasma glucose is measured, fasting and after two hours, pregnant women who meet the criteria for DM or Impaired Glucose Tolerance (IGT) are classified as having GDM. These women should have 75g OGTT at 6 weeks or more after delivery. A venous plasma glucose cut off of ≥140 mg/dl (7.8mmol/l) at 2-hour are classified as having GDM. It became popular particularly in developing countries as it is simpler than two step procedure [10, 11]. DIP should be identified at any stage of pregnancy [11]. FIGO recommends that in order to assure very affordable GDM screening and testing methodologies, all nations must take resource settings into account and implement and promote practical solutions [2]. Chinese government agency for family planning and health produced recommendations for GDM testing and diagnosis in 2014 that were comparable to FIGO recommendations. However, China is a huge nation with an uneven distribution of medical resources. For low-resource rural locations, the two-step screening method that involves an FPG level and a 75-g OGTT is advised in order to lessen the clinical cost burden. First, the 24th to 28th gestational week should be used for FPG level screening. 4.4 mmol/L (80 mg/dl) of FPG is the desired level or lower. Without a 75-g OGTT, GDM can be identified if the FPG level falls above 5.1 mmol/L (92 mg/dl) [5]. This approach may make it possible to avoid about 50% of China's standard 75-g OGTTs [12]. Results of another Chinese study demonstrated that GDM could not be diagnosed with FPG levels in the first trimester of less than 5.1 mmol/L (92 mg/dl). The first trimester of pregnancy, with FPG values corresponding to concentrations of 5.10–5.59, 5.60–6.09, and 6.10–6.99 mmol/L, only 37.0%, 52.7%, and 66.2% of the women reported GDM. Therefore, to rule out GDM, it is necessary to perform the 75-g OGTT between weeks 24 and 28 of pregnancy. Ladies with FPG during the initial prenatal appointment readings of 6.10 mmol/L or greater are assumed to have GDM and need to change their diet and workout regimen. Women should be regarded to be at a high risk of developing GDM and should receive the appropriate nutrition and exercise advice if their FPG levels are between 5.10 mmol/L and 6.09 mmol/L [13].

Management with prevention of GDM

Prior to becoming pregnant, plan and prepare. Diabetes is very common in China, and women are getting T2DM at earlier ages. Additionally, most women of reproductive age don't know their blood

sugar levels or get regular physicals. As a result, hyperglycemia can infrequently exist before fertilisation. The risk of spontaneous miscarriages and congenital malformations can be greatly increased by hyperglycemia during organogenesis, according to studies, even if good glycemic management can reduce these risks [1]. Pregnancy planning and counselling should begin as soon as possible for all women, but especially for those who have decreased glucose tolerance, diabetes, or low fasting blood sugar. Additionally, they should have their blood glucose levels examined as soon as it is practicable to assess their glucose metabolism circumstances. If pregnancy is unavoidable, at the very least, the assessment should take place at the initial prenatal visit. All expecting mothers are advised to develop healthy eating and lifestyle habits, but those who are underweight, overweight, or obese are urged to do so more strongly. Body mass index (BMI) is an important indicator of a woman's health before conception, and both low and bad pregnancy outcomes are significantly correlated with high BMIs [15]. Changes can be made to these risk factors, though to decrease risk. According to Zhang et al., a low incidence of gestational diabetes is associated with keeping a risk-free way of life before becoming pregnant (healthy body weight, nutritious diet, consistent activity, and no smoking) [16].

Altering one's way of life

Adjusting one's lifestyle, which also involves receiving nutrition advice and engaging in physical activity, is the first line of defence against and therapy for GDM. It should be used at all stages of pregnancy, including conception, labour, delivery, and postpartum. Nutritional treatment is a customised eating regimen that restricts carbohydrate intake while providing enough nutrition to support healthy weight gain. Therefore, nutritional counselling should focus on the type, amount, and distribution of carbohydrates in the diet. Further, physical activity has beneficial effects on glucose and insulin levels and it can contribute to a better glycaemic control. This is especially important for individuals with GDM risk factors [16]. Women who are educated about nutrition can understand the kinds and quantities of food they need. The daily dietary energy recommendations for carbs, protein, and fat are, respectively, 50–60%, 15%–25%, and 25–30% [17]. A Mediterranean diet, fruit, green leafy vegetables, chicken, fish, nuts, and fibre are a few possible dietary elements that could be beneficial [18]. The recommended daily caloric intake is between 1800 and 2000 calories, not less than 1500 calories, as this raises the risk of ketonemia and interferes with the nervous system development of the unborn child. The recommended daily fibre intake is 28 g [2]. Additionally, food's glycemic index (GI) merits consideration. Foods having a low GI may lessen the need for frequent insulin injections, birth weight, and postmeal glycemic excursion. High GI foods may have greater postprandial values [19]. Exercise has been shown to increase insulin sensitivity, which helps to improve glucose homeostasis and decrease weight gain. A recent meta-analysis exercise interventions in a study on physical activity and GDM from 1966 to 2014, showed that physical exercise decreased the incidence of GDM by 28% [20]. Additionally, Halse et al. demonstrated women on regulated diets GDM may benefit from exercising during pregnancy to maintain daily postprandial normoglycemia. However, there isn't a single, distinct recommendation for exercise during pregnancy [21]. Weekly modest exercise of 150 minutes (or 30 minutes per day) is recommended. Before commencing exercise therapy, pregnant women must go through a complete medical examination and get specialised instruction [22]. Exercises for the principal muscle groups and aerobic activity are advised. They should avoid participating in any contact, injury, or collision-prone sports. Women should check to ensure the safety of exercise and avoid hypoglycemia. People should check their blood sugar levels before and after exercise. After having delivery, healthy food and exercise routines should be maintained [23].

Medical treatment

Drug therapy is required when lifestyle changes are insufficient for maintaining normoglycemia in women with GDM. Currently available medications for hyperglycemia during pregnancy include oral antidiabetic drugs (OADs) and insulin therapy. The conventional, secure, and efficient drug treatment for GDM is insulin. There are numerous types of insulin formulations available. The three types of insulin are long-acting, intermediate-acting, and rapid-acting (for example, ordinary human insulin and neutral protamine hagedorn) (e.g., insulin detemir). Rapid-acting insulin often begins to function 30 minutes or one hour after subcutaneous injection, peaks between two and four hours later, and the impact can linger for up to six to eight hours. After subcutaneous injection, intermediate insulin begins to operate after 1-2 hours, reaches its maximal efficiency between 4 and 8 hours, and its effects can extend for up to 12 to 18 hours. The effects of long-acting insulin extend for up to 20 hours after subcutaneous injection, peaking between 8 and

10 hours later. In order to mimic the daily physiological release of insulin, it is advantageous to combine these insulin formulations. Insulin dosage should be started at a low level and progressively both the insulin kind with dosage have to increase. Schedules ought to be customized [18]. OAD use during pregnancy was formerly discouraged due to worries regarding teratogenic effects. However, a lot of organisations now advise using them as a GDM adjunct therapy. OADs are now the first choice for treating hyperglycemia during pregnancy with medication in the US. Metformin and glyburide are two more frequently used medications. However, there were discrepancies between trials on the outcomes of insulin and OAD therapy. For instance, several research revealed that there were no appreciable variations in the incidence rates of unfavourable controlling the blood sugar levels of women after fasting and after eating Utilizing glyburide for GDM, metformin, with insulin was compared for maternal and neonatal outcomes [24–28]. Though the sample size was limited, according to a recent randomized controlled trial (RCT), failure rates for the GDM therapies metformin and glyburide were 25% and 23.8%, respectively. According to a different study, metformin medication increases the likelihood of premature birth, whereas glyburide therapy may raise the risk of newborn hypoglycemia and macrosomia. The FIGO further notes the paucity of data about OADs' long-term security [29, 30]. OADs are suggested by the FIGO due to their low cost and simple management. OADs could therefore be used as a substitute for insulin for expectant women who object to using it or in locations with inadequate supplies of the drug. However, there were no glyburide or metformin-containing medications approved for the treatment of GDM in China, and no medical research using solid evidence was carried out to assess the effects that OADs have on management among pregnant Chinese women who have GDM. Therefore, Chinese women were advised to use OADs if they refused to take insulin when pregnant [2].

Postpartum follow-up

Another essential time frame for the management of GDM is the postpartum period. Given the future obesity, T2DM, hypertension, and metabolic syndrome are now more likely to occur in both the mother and the child, it is crucial to address intrapartum issues and start an intervention at this time. It is advised to schedule the initial postpartum check-up 6 to 12 weeks following giving birth. The 75-g OGTT is required for all pregnant women who have hyperglycemia in order to measure their blood sugar levels. They should be recommended to see an endocrinologist and schedule follow-up appointments every one to three years if, at this time, based on diagnostic standards, they have diabetes or pre-diabetes. Moreover, females having A GDM background should spend the intrapartum interval of at least a year before trying to conceive. Additionally, they must take the 75-g OGTT before or at least throughout the first trimester of the subsequent pregnancy [15, 20]. The most crucial and effective postpartum care strategy is lifestyle intervention. In hyperglycemic pregnant women, metformin has also been demonstrated to be successful in avoiding diabetes. 350 newly diagnosed GDM patients were randomised to receive metformin medication, a standard lifestyle intervention, a placebo, or lifestyle intervention [31]. They found that compared to conventional lifestyle and placebo, metformin medication and lifestyle modification can both lower the incidence of diabetes by around 50% in the fourth year after delivery. Additionally, the likelihood that a woman with GDM may acquire type 2 diabetes can be reduced by nursing. Studying lactation and the incidence of diabetes two years after a GDM pregnancy was the goal of a cohort study of mothers having a history of the condition [32]. According to their research, the adjusted hazard ratios for primarily formula or inconsistent/mixed, primarily breastfeeding, and only breastfeeding compared to purely consuming formula were 0.64, 0.54, and 0.46, respectively. They discovered a negative correlation between the intensity of lactation and the prevalence of diabetes following GDM pregnancy (P for trend = 0.016). With time spent nursing, the likelihood of contracting diabetes in the two years following a GDM pregnancy declines. Furthermore, a substantial study by Bider-Canfield et al., using a clinical cohort, revealed a relationship between breastfeeding for fewer than 6 months and a reduced risk of childhood obesity at 2 years old [33]. Unfortunately, a postpartum check-up rates are poor all across the world, largely because health professionals lack professional expertise, self-efficacy, and social support. In order to provide postpartum follow-up, collaboration between obstetricians with internists, paediatricians, and other healthcare providers is necessary [34].

Conclusion

In summary, GDM is linked to an increased risk of negative maternal and foetal health results in both immediately with later on life. Consequently, setting

priorities is essential for GDM prevention and control throughout the whole pregnancy, including before conception, during the actual pregnancy, and after delivery. The two main and most important strategies should be nutrition guidance and exercise. OADs and insulin should be taken into consideration; if lifestyle changes alone are ineffective at maintaining normoglycemia. The importance of postpartum care in preventing future chronic non-communicable diseases should not be understated.

Conflict of Interest

None

Funding

None

References

1. Standards of Medical Care in Diabetes-2016: Summary of revisions. Diabetes Care. 2016;39 Suppl 1:S4-S5. doi:10.2337/dc16-S003

2. Hod M, Kapur A, Sacks DA, Hadar E, Agarwal M, Roura LC, et al. The International Federation of Gynecology and Obstetrics (FIGO) Initiative on gestational diabetes mellitus: A pragmatic guide for diagnosis, management, and care. Int J Gynaecol Obstet. 2015;131 Suppl 3:S173-S211. doi:10.1016/S0020-7292(15)30033-3

3. Mitanchez D, Yzydorczyk C, Siddeek B, Boubred F, Benahmed M, Simeoni U. The offspring of the diabetic mother--short- and long-term implications. Best Pract Res Clin Obstet Gynaecol. 2015;29(2):256-269. doi:10.1016/j.bpobgyn.2014.08.004

4. Metzger BE. Long-term outcomes in mothers diagnosed with gestational diabetes mellitus and their offspring. Clin Obstet Gynecol. 2007;50(4):972-979. doi:10.1097/GRF.0b013e31815a61d6

5. HAPO Study Cooperative Research Group, Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, et al. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008;358(19):1991-2002. doi:10.1056/NEJMoa0707943

6. Kitzmiller, J. L., Elixhauser, A., Carr, S., et al. Assessment of costs and benefits of management of gestational diabetes mellitus. Diabetes Care. 1998;21 Suppl 2:B123-B130.

7. Ohno MS, Sparks TN, Cheng YW, Caughey AB. Treating mild gestational diabetes mellitus: a cost-effectiveness analysis. Am J Obstet Gynecol. 2011;205(3):282.e1-282.e2827. doi:10.1016/j.ajog.2011.06.051

8. Capula C, Chiefari E, Borelli M, Oliverio R, Vero A, Foti D, et al. A new predictive tool for the early risk assessment of gestational diabetes mellitus. Prim Care Diabetes. 2016;10(5):315-323. doi:10.1016/j.pcd.2016.05.004

9. Di Cianni G, Volpe L, Casadidio I, Bottone P, Marselli L, Lencioni C , et al. Universal screening and intensive metabolic management of gestational diabetes: cost-effectiveness in Italy. Acta Diabetol. 2002;39(2):69-73. doi:10.1007/s005920200016

10. International Association of Diabetes and Pregnancy Study Groups Consensus Panel, Metzger, B. E., Gabbe, S. G., Persson, et al. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care. 2010;33(3):676-682. doi:10.2337/dc09-1848

11. Lindsay RS, Mackin ST, Nelson SM. Gestational diabetes mellitus-right person, right treatment, right time? BMC Med. 2017;15(1):163. doi:10.1186/s12916-017-0925-2

12. Zhu WW, Yang HX, Kapur A, Kong L-Y, Wang Z-L, Hu Y-L, et al. Fasting plasma glucose at 24-28 weeks to screen for gestational diabetes mellitus: new evidence from China. Diabetes Care. 2014;37(8): 2246–2252. doi:10.2337/dc13-2246

13. Zhu WW, Yang HX, Wei YM, Yan J, Wang ZL, Li X-L, et al. Evaluation of the value of fasting plasma glucose in the first prenatal visit to diagnose gestational diabetes mellitus in China. Diabetes Care. 2013;36(3):586-590. doi:10.2337/dc12-1157

14. Wang C, Yang HX. Diagnosis, prevention and management of gestational diabetes mellitus. Chronic Dis Transl Med. 2016;2(4):199-203. doi:10.1016/j.cdtm.2016.11.004

15. Hanson MA, Bardsley A, De-Regil LM, Moore SE, Oken E, Poston L, et al. The International Federation of Gynecology and Obstetrics (FIGO) recommendations on adolescent, preconception, and maternal nutrition: "Think Nutrition First". Int J Gynaecol Obstet. 2015;131 Suppl 4:S213-S253. doi:10.1016/S0020-7292(15)30034-5

16. Zhang C, Tobias DK, Chavarro JE, Bao W, Wang D, Ley SH, et al. Adherence to healthy lifestyle and risk of gestational diabetes mellitus: prospective cohort study. BMJ. 2014;349:g5450. doi:10.1136/bmj.g5450

17. He Z, Xie H, Liang S, Tang Y, Ding W, Wu Y, et al. Influence of different diagnostic criteria on gestational diabetes mellitus incidence and medical expenditures in China. J Diabetes Investig. 2019;10(5):1347-1357. doi:10.1111/jdi.13008

18. Zhang C, Rawal S, Chong YS. Risk factors for gestational diabetes: is prevention possible?

Diabetologia. 2016;59(7):1385-1390. doi:10.1007/s00125-016-3979-3
19. Brand-Miller J, Hayne S, Petocz P, Colagiuri S. Low-glycemic index diets in the management of diabetes: a meta-analysis of randomized controlled trials. Diabetes Care. 2003;26(8):2261-2267. doi:10.2337/diacare.26.8.2261
20. Keshel TE, Coker RH. Exercise training and insulin resistance: A current review. J Obes Weight Loss Ther. 2015;5(Suppl 5):S5-003. doi:10.4172/2165-7904.S5-003
21. Halse RE, Wallman KE, Newnham JP, Guelfi KJ. Home-based exercise training improves capillary glucose profile in women with gestational diabetes. Med Sci Sports Exerc. 2014;46(9):1702-1709. doi:10.1249/MSS.0000000000000302
22. Evenson KR, Barakat R, Brown WJ, Molina PD, Haruna M, Mikkelsen EM, et al. Guidelines for physical activity during pregnancy: Comparisons from around the world. Am J Lifestyle Med. 2014;8(2):102-121. doi:10.1177/1559827613498204
23. ACOG Committee Opinion No. 650: Physical activity and exercise during pregnancy and the postpartum period. Obstet Gynecol. 2015;126(6):e135-e142. doi:10.1097/AOG.0000000000001214
24. Practice Bulletin No. 137: Gestational diabetes mellitus. Obstet Gynecol. 2013;122(2 Pt 1):406-416. doi:10.1097/01.AOG.0000433006.09219.f1.
25. Metzger BE, Buchanan TA, Coustan DR, Leiva AD, Dunger DB, Hadden DR, et al. Summary and recommendations of the Fifth International Workshop-Conference on Gestational Diabetes Mellitus [published correction appears in Diabetes Care. 2007 Dec;30(12):3154]. Diabetes Care. 2007;30 Suppl 2:S251-S260. doi:10.2337/dc07-s225
26. Hunt KJ, Schuller KL. The increasing prevalence of diabetes in pregnancy. Obstet Gynecol Clin North Am. 2007;34(2):173-vii. doi:10.1016/j.ogc.2007.03.002
27. Langer O, Conway DL, Berkus MD, Xenakis EM, Gonzales O. A comparison of glyburide and insulin in women with gestational diabetes mellitus. N Engl J Med. 2000;343(16):1134-1138. doi:10.1056/NEJM200010193431601
28. Rowan JA, Hague WM, Gao W, Battin MR, Moore MP; MiG Trial Investigators. Metformin versus insulin for the treatment of gestational diabetes [published correction appears in N Engl J Med. 2008 Jul 3;359(1):106]. N Engl J Med. 2008;358(19):2003-2015. doi:10.1056/NEJMoa0707193
29. Silva JC, Pacheco C, Bizato J, de Souza BV, Ribeiro TE, Bertini AM. Metformin compared with glyburide for the management of gestational diabetes. Int J Gynaecol Obstet. 2010;111(1):37-40. doi:10.1016/j.ijgo.2010.04.028
30. Balsells M, García-Patterson A, Solà I, Roqué M, Gich I, Corcoy R. Glibenclamide, metformin, and insulin for the treatment of gestational diabetes: a systematic review and meta-analysis. BMJ. 2015;350:h102. doi:10.1136/bmj.h102
31. Ratner RE, Christophi CA, Metzger BE, Dabelea D, Bennett PH, Fowler S, et al. Prevention of diabetes in women with a history of gestational diabetes: effects of metformin and lifestyle interventions. J Clin Endocrinol Metab. 2008;93(12):4774-4779. doi:10.1210/jc.2008-0772
32. Gunderson EP, Hurston SR, Ning X, Lo JC, Crites Y, Walton D, et al. Lactation and progression to type 2 diabetes mellitus after gestational diabetes mellitus: A prospective cohort study. Ann Intern Med. 2015;163(12):889-898. doi:10.7326/M15-0807
33. Bider-Canfield, Z., Martinez, M. P., Wang, X., et al. Maternal obesity, gestational diabetes, breastfeeding and childhood overweight at age 2 years. Pediatr Obes. 2017;12(2):171-178. doi:10.1111/ijpo.12125
34. Gomes D, von Kries R, Delius M, Mansmann U, Nast M, Stubert M, et al. Late-pregnancy dysglycemia in obese pregnancies after negative testing for gestational diabetes and risk of future childhood overweight: An interim analysis from a longitudinal mother-child cohort study. PLoS Med. 2018;15(10):e1002681. doi:10.1371/journal.pmed.1002681