IDF-MENA Region Guidelines for
Management of Hyperglycaemia in Pregnancy

IDF-MENA Hyperglycaemia in Pregnancy Guidelines Collaborative Group
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Abstract

Hyperglycaemia in pregnancy (HIP) is the most common medical disorder complicating pregnancy. This includes women who have pre-existing Type 1 and Type 2 diabetes mellitus (DM) and those diagnosed to have gestational diabetes, with glucose intolerance identified for the first time in pregnancy. In the MENA region the prevalence of Diabetes Mellitus (DM) in women of reproductive age group is high and it varies widely between different regions due to variation in screening and diagnostic criteria for the identification of Gestational Diabetes Mellitus (GDM).

Universal blood glucose screening at first antenatal booking visit helps in identifying women with HIP. Women who are screen negative at first antenatal should subsequently be screened with a fasting Oral Glucose Tolerance Test (OGTT) around 24-28 weeks to identify GDM.

There is clear evidence that the identification and management of hyperglycaemia improves pregnancy outcomes. Women with pre-existing DM need to have education and counselling from the pre pregnancy period to ensure euglycaemia around conception. Medical Nutritional Therapy and exercise is the mainstay of management of HIP. When the glycaemic targets are not met, oral hypoglycaemic drugs and Insulin are initiated. Education and support of women are vital to ensure compliance.
Antenatal care involves more visits as these women are at higher risk of fetal malformations, preterm labour and stillbirth. Timing of delivery is based on glycaemic control, fetal wellbeing and presence of co morbidities.

Early initiation of breastfeeding and monitoring are important to reduce neonatal complications. Both women with GDM and their babies are at risk of long-term metabolic complications.

Postpartum blood glucose screening and annual follow up is vital to prevent subsequent T2DM. Focusing on HIP is a cost-effective strategy to improve maternal and child health and prevent diabetes in the future generations.

**Key Words:**

Gestational Diabetes, Guidelines, Hyperglycemia in pregnancy, Insulin techniques, Insulin storage, Ramadan fasting with hyperglycemia in pregnancy, Screening and diagnosis of GDM, Universal Blood Glucose Screening
Overview

The International Diabetes Federation (IDF) is an organization with about 230 national associations for diabetes spread across 170 countries globally. Its mission is to promote diabetes care, prevention and cure worldwide. IDF estimates that globally 463 million people of world population between ages of 20—79 years are living with diabetes.

IDF's national diabetes associations are divided into seven regions. The IDF-Middle East and North Africa (MENA) Region currently represents 29 diabetes organisations in 21 countries and territories. It covers a wide area in North Africa and West-Asia, extending from Pakistan in the east to Morocco in the west.

Among all IDF regions MENA Region has the highest age adjusted diabetes prevalence of 12.2%. The prevalence of hyperglycaemia in pregnancy (HIP) is very high in IDF-MENA region, it is 17.9% in women 20—29 years of age and 15.8% live births that is 1 in 6 births are affected by GDM. About 76 million women of reproductive age are suffering from some form of hyperglycaemia; 22 million women are coping with diabetes and 54 million women are living with pre-diabetes with likelihood to develop GDM if they become pregnant. There is a wide variation in the reported prevalence of HIP of 1—28%. This may be because of non-uniform screening and diagnostic criteria to detect HIP.

To address the diversity and non-uniformity of screening, diagnosis and management in HIP, Chair IDF-MENA Region, Prof. Jamal Belkhadir assigned the task of development of IDF-MENA HIP Guidelines under the Chairpersonship of Prof. Shabeen Naz Masood.

A guideline committee was formed in August 2020, which was comprised of members from different countries of MENA Region. These members are from discipline of Obstetrics & Gynecology, Endocrinology, Neonatology, Internal
Medicine and Diabetes Educationist with strong intellectual, clinical and research background having expertise and interest in diabetes in pregnancy. Different subsections to author HIP guidelines were distributed among 24 participating members. There were about 25 virtual meetings every weekend, each lasted 2-3 hours with active participation of the members. The first meeting started in September 2020 and after seven months the guidelines were completed and ready for publication.

Each member of the guideline team was assigned to author one or multiple subsections of hyperglycaemia in pregnancy guidelines. Sections were then reviewed by all members in these multiple weekly virtual meetings, and a consensus of expert opinion was achieved. Editing and internal review was done by a group of six members. Finally, the Chair of the guideline committee with the in depth research and intellectual input cooperation of team members has been able to produce pragmatic, evidence and practice-based guidelines on Hyperglycaemia in Pregnancy for MENA region.

There was no funding available and this work was completed on a purely voluntary basis.

The document was very kindly reviewed by Dr. V Mohan and was placed in special edition of Diabetes and Pregnancy issue of Journal of Diabetology (JOD) for publication. Keeping in view rapidly evolving developing medical evidence and updates, the guidelines are proposed to be updated after 2 years.

**International Diabetes Federation (IDF),
Middle East and North African (MENA) Region**
Executive Summary

Hyperglycaemia in pregnancy (HIP) is the commonest medical disorder in women worldwide. [1] Diabetes has become the fastest growing global public health challenge. Gestational diabetes mellitus (GDM) parallels and reflects the global rising epidemic trends of T2DM with 223 million women aged 20-70 living with T2DM. [1], [2] Among the 7 IDF regions, MENA region has the highest (12.2%) age adjusted prevalence of diabetes where 1 in 9 live births are to women affected by HIP. [1] More than 50% of the women in MENA are likely to become pregnant with either diabetes status undiagnosed or are improperly screened. [1], [3], [4] Arab countries have the highest prevalence of T2DM (3.9–18.3%) and GDM (5.1–37.7%) in the world. [1], [3], [4] The wide variation in prevalence of diabetes amongst MENA region countries is probably because of different screening strategies and diagnostic criteria, confusion and disagreement over uniform screening strategies and diagnostic criteria, among healthcare providers (HCP), and lack of agreed screening and diagnostic methodology globally. [2], [5], [6]

HIP is known to be associated with a higher maternal and perinatal morbidity. [1], [2], [5]-[8] Despite the known association with adverse maternal and perinatal outcomes, to date there has been confusion, disagreement and lack of consensus amongst international health organizations on screening and diagnostic criteria for HIP. [2], [5], [6] Given the known relationship between HIP and poor pregnancy outcomes and the role of in utero genetic imprinting in increasing the risk of future development of type 2 diabetes, obesity and cardiovascular disorders in the mother and offspring of HIP mothers, as well as increasing maternal vulnerability to future diabetes and cardio-metabolic disorders, there needs to be a greater focus on prevention, early identification (screening, diagnosis) and management of
HIP to improve pregnancy outcomes and reduce the future burden of non-communicable diseases. Pregnancy offers a unique opportunity not to be missed, for primary prevention of adverse consequences of hyperglycaemia.

An online survey about knowledge and practices of GDM amongst HCPs was recently carried out in MENA region revealed wide variation in screening and diagnostic practices for HIP. (approved for print in J Diabetol) This stimulated the idea for the MENA region HIP guideline. Multidisciplinary guideline group of international experts developed pragmatic, consensus, evidenced based key recommendations taking the local context into account, to address screening & diagnosis, management and care of women with HIP regardless of resource setting.

The overall objective of the MENA region HIP guideline is to equip all health care professionals to manage women with HIP, improve clinical practice and prevent progression to T2DM by continued postpartum BG monitoring and follow up. [2]

Preconception care is recommended for all women with pre-existing diabetes, to optimize glycaemic control, improve general health advise to reduce weight, assess for complications, review medications, and add folic acid supplementation. Effective contraception is advised until HbA1c of <6% is achieved.

The MENA region guideline recommends early universal screening for HIP in all pregnant women at booking using one step 75gm 2-hour OGTT. Diagnostic criteria given by WHO 2013 & IADPSG 2010 are used for the diagnosis of GDM.

Sequential Blood Glucose (BG) screening in second and third trimester is done if initial screen is negative. Idea is not to miss an opportunity to identify women with hyperglycaemia in pregnancy.

Antenatal management begins with counseling and education of pregnant women with HIP along with their families. The focus is on optimizing BG control initially by
lifestyle modification including exercise and medical nutrition therapy (MNT). Metformin alone or with insulin is added if glycaemic targets are not achieved. SMBG is encouraged. Glycaemic targets to be explained to the pregnant woman. Frequent antenatal follow ups for review of glycaemic control and obstetric care are recommended.

HbA1c testing is recommended at booking, to determine the level of risk for the pregnancy, and again in the second and third trimester for women who are nonadherent with SMBG, testing insufficiently, or if confirmation is needed to see that targets are being achieved.

The guideline recommends all HCPs to have a high index of clinical suspicion so as to recognize diabetic complications like Hypoglycaemia, severe hyperglycaemia and DKA early and manage with multidisciplinary team.

Timing of delivery depends upon glycaemic control, associated complications, and fetal condition. The optimal time of delivery for women with GDM well controlled on MNT is within 39-40 weeks; well controlled uncomplicated pre gestational T1DM and T2DM between 37-38 weeks of gestation. Timing of delivery is earlier and individualized for poorly controlled diabetes or with complications. Pregnancy with diabetes should not go beyond 40 weeks of gestation. BG is monitored closely in labor. Maternal BG levels are kept between 72 mg/dL-126 mg/dL (4.0-7.0 mmol/L) to reduce neonatal hypoglycaemia.

Vaginal delivery is encouraged. Elective caesarian section is recommended if estimated fetal weight is > 4 kg or for obstetric reasons. Neonates of mothers with HIP are at risk of hypoglycaemia. BG checks soon after birth and early feeding is recommended.
Postpartum risk of hypoglycaemia in mother is high, as insulin requirements falls with the delivery of the placenta. Insulin is adjusted/ titrated immediately after delivery. Maternal BG is monitored frequently to achieve optimum glycaemic control. All women to be encouraged to breast-feed, since this may reduce obesity in the offspring. Metformin and Insulin are safe while breast feeding.

Every pregnancy in a woman with diabetes needs to be planned. Effective long acting reversible contraception is recommended.

Postpartum the woman is advised to continue the lifestyle modification and regular follow up in order to reduce development of subsequent T2DM. Screening at six weeks postpartum by 2-hour 75g OGTT using WHO non pregnant criteria and lifelong screening for T2DM /Pre-diabetes by fasting BG every 1 to 3 years is recommended.

Women with HIP are to be counseled to report in Preconception clinic when planning pregnancy subsequently to optimize pregnancy outcomes.

MENA region has a predominant Muslim population. Women with HIP even well controlled on MNT/ Metformin are recommended against fasting. If decide to fast, then require close glycaemic monitoring and need to be educated regarding frequent SMBG and when to break the fast.

Guideline developing methodology is given along with the strengths and limitations of the evidence-based consensus document.

Future research recommendations have been made to better understand HIP in women of MENA region and to find the impact/change in clinical practice by the implementation of MENA region guidelines in member countries.
Strengths and Limitations

Strengths

1. This is the first comprehensive evidence based, locally tailored guideline from MENA region where the burden of disease estimated by IDF is the highest in the world; authored by a multidisciplinary group of HCPs with expertise in managing diabetes in pregnancy.

2. It suggests a uniform strategy for screening and diagnosis of HIP which will enable MENA Region to determine prevalence of HIP and compare the burden of disease amongst different countries of the Region. Previous sporadic studies have given a wide variation in prevalence of HIP (1-28%) due to use of different screening strategies and varied diagnostic criteria.

3. The format is clear, user friendly, offers clear recommendations for clinical practice. The writing group recommends that this guideline be translated and adapted into local health care policies and care pathways, considering all relevant local and cultural factors.

4. The guideline is practical and comprehensive addresses all aspects of care for pregnant women with hyperglycaemia both GDM and Pre-existing type 1 & type 2 DM. It not only covers preconception management, antenatal management (Glycaemic and obstetric), intrapartum care, post-partum management, neonatal care & breastfeeding, but also addresses contraception, care of women with foetal loss and management of complications of diabetes.

5. Additionally, the document includes clear instructions for Insulin administration, technique and storage guidelines.

6. Explains explicitly Medical Nutrition Therapy including calorie requirement, common food types of MENA region with their glycaemic index and the concept of food plate.

7. Gives clear recommendations for exercise including types and duration

8. Emphasizes preconception management as well as post-partum blood glucose monitoring and the need for continued BG follow up so as to reduce the future burden of T2DM.
Limitations

1. The guideline does not address routine pregnancy care. It addresses primarily the specific issues pertaining to gestational diabetes, pre-existing diabetes and pregnancy.

2. The relationship between social determinants of diabetes and diabetes management in pregnancy is beyond the scope of the guideline and has not been evaluated in the already lengthy clinical guideline.

3. The unique needs of women of different culture and strata of society have not been catered for. MENA region countries range from high income to low income group, each has not been addressed separately.

4. The relationship of clinical care for women with pre-existing diabetes and local healthcare systems of different countries has not been evaluated. The writing group acknowledges that in different systems, there are different care providers, different levels of care, processes and funding models.

5. Women-centred care & culturally safe care, in a particular country and other geographical nuances have not been addressed. We recommend that all HCPs should provide women-centred and culturally safe care for women with Hyperglycaemia in Pregnancy.

6. The recommendations of the Guideline though evidenced based have not been pilot tested. Future research will determine the impact on clinical practice and women health in the region.

7. The recommendation of early universal screening by 2-hour 75g OGTT at booking visit may increase the local laboratory workload along with requiring women to come fasting for the test. Perhaps the benefits outweigh the discomfort.

8. The guideline did not aim to meet the National Health/ Medical Council standard for guidelines.

9. Rating the quality of evidence or strength of each recommendation was out of scope.

10. Not all 22 member countries of MENA region were involved in guideline development.
Introduction

Hyperglycaemia in Pregnancy (HIP) is a major public health issue. It is a global concern being the commonest metabolic abnormality encountered in pregnancy. \cite{1, 2, 9, 10} According to International Diabetes Federation (IDF), globally 20.4 million women of reproductive age (16%) are affected by HIP, of which 83.6% have Gestational Diabetes Mellitus (GDM), 7.9% have pre-existing diabetes, and 8.5% have diabetes first detected during pregnancy.\cite{1} According to IDF estimates, MENA region has the highest age-adjusted prevalence of diabetes (12.2%), which is likely to double by the year 2045.\cite{1}

Due to similarities in genetics and pathogenesis, prevalence of GDM correlates and parallels with T2DM. \cite{2, 4} In MENA region, prevalence of T2DM varies from 3.9% (Yemen) to 18.3% (Saudi Arabia) and GDM from 5.1% (Yemen) to 37.7% (United Arab Emirates). \cite{2, 11} The vast variation amongst MENA countries is because of dissimilar screening strategies, non-uniform diagnostic criteria for GDM, and economic differences amongst the countries. \cite{2, 5, 6, 8} This makes accurate assessment and comparison of burden of HIP amongst the countries very challenging. \cite{5} The aim of the guidelines proposed here is to create a standardized pragmatic approach for screening, diagnosis and management of hyperglycaemia in pregnancy that is effective, simple and accessible to all healthcare providers. This will eventually assist to improve clinical practice and prevent long term health complications in the region.

MENA region has high prevalence of overweight (65.5%) and obesity (33.9%) among women ≥ 20 years, thereby increasing the burden of T2DM and GDM in the population. \cite{9, 11, 13} With increasing obesity, practice of consanguineous marriages, sedentary lifestyle, poor dietary habits, and lack of access to primary healthcare facilities in low- and middle-income countries, the likelihood of women presenting with undiagnosed DM in pregnancy is high. Nearly 45% of women of childbearing
age with T2DM remain undiagnosed. Undiagnosed, uncontrolled or inadequately treated HIP poses increased risk to the mother, developing foetus and newborn. It does not only increase short term maternal, foetal and newborn morbidity and mortality, but also increase long term health risks in both mother and baby. Specific complications threatening a diabetic pregnancy include miscarriage, pre-eclampsia, preterm labour, infections, worsening of diabetic retinopathy, and nephropathy. Foetal and newborn complications include stillbirth, congenital malformations, macrosomia, birth injury, respiratory distress, hypoglycaemia, hypocalcaemia and hypomagnesaemia.

Exposure to hyperglycaemia in utero affects foetal programming and predisposes the offspring to develop insulin resistance and impaired glucose tolerance as early as 10-14 years of age, with increased lifetime risk of developing T2DM, obesity, hypertension, cardiovascular and renal disease. Timely identification (screening and diagnosis) and intervention to control HIP will not only reduce short and long term maternal and neonatal morbidity and mortality, but also improve quality of life and prove cost-effective.

GDM has emerged as a marker for future T2DM, obesity & cardiovascular problems. Women who had prior GDM are at a 7.4-fold increased risk of developing T2DM within 3-6 years after index pregnancy compared to women with normoglycaemic pregnancy. Hence it is important for women with GDM to monitor their BG levels post-delivery to reduce the risk of T2DM. Despite being aware of adverse consequences, to date there is lack of consensus amongst international health organizations on screening and diagnostic criteria for HIP. Other areas of controversy include selective versus universal screening, timing of testing, choice of one-step or two-step approach, and postnatal screening method timing and criteria. A healthcare provider who embarks upon the care of
pregnant women with diabetes is confronted with various guidelines offering conflicting and confusing recommendations.\textsuperscript{17, 18} 
Pregnancy offers a unique opportunity for the prevention of adverse consequences of hyperglycaemia by patient education for lifestyle modification, continued BG monitoring practices, and follow up post-delivery.\textsuperscript{13} Early screening (through a uniform strategy), with strict glycaemic control during pregnancy and post-delivery BG surveillance are effective intervention strategies to reduce the future burden of T2DM and obesity. This will improve the health of women not only in the MENA region but globally as well.\textsuperscript{2, 9, 10, 16} 
This document serves as an evidence-based, consensus recommendations obtained from a multidisciplinary group of experts from the MENA region, for guiding healthcare providers manage HIP optimally following the latest available scientific evidence, keeping in view the unique challenges faced in the region.
1: Screening and Diagnosis

1.1: When to Test

- Blood Glucose (BG) Screening for HIP should be done at the first antenatal visit. [9]

- For women with normal glucose values on initial screening, a second test is recommended during 24th to 28th weeks of gestation. [17]

- A third trimester BG testing should be done if the first two trimesters screen was missed, especially for women belonging to a high-risk group (See: Table 1) or for women who develop clinical features suggestive of HIP (See, Tab 2). [2], [16], [19], [20]

1.2: Target Population

Universal screening of all pregnant women is recommended, irrespective of risk factors. [11], [13]

1.3: BG Screening Options

- The recommended gold standard test is one step 75 g two-hour OGTT (Oral Glucose Tolerance Test), using IADPSG criteria. [9], [10], [13]

- If the pregnant woman cannot fast for the test, then non-fasting 75 g two-hour OGTT Diabetes in Pregnancy Study Group of India (DIPSI) method may be used. [22]

- Fasting blood glucose (FBG), defined as no caloric intake for at least 8 hrs, should be done at the first antenatal visit or later in pregnancy [17] if the pregnant woman cannot tolerate the glucose load.

- Glycated haemoglobin (HbA1c) in the first trimester only. [23]
1.4: Screening Methodology

OGTT: Take venous blood sample, following 8 hours of fasting. Dissolve 75gm glucose load in 250ml of water and advise to drink over 3-5 min to avoid nausea and vomiting.[24] During OGTT, if women have a FBG over 126mg/dL, withhold the OGTT test, as this indicates pre-existing diabetes.[24]

- DIPSI Method: (Non-Fasting Oral Glucose Tolerance Test): Dissolve 75gm glucose in 250ml of water, ask woman to drink over 3-5 minutes, irrespective of time of the last meal.[9], [23]
  - If the laboratory facilities are not available, a plasma standardized glucometer may be used to evaluate blood glucose. [9], [25], [26]
- If the 75 g glucose load is not tolerated or the test is unavailable, then an 8-hour FBG with or without an HbA1c could be used along with another confirmatory FBG. [27]

1.5: Diagnostic Criteria

- **Pre-existing DM:** Diagnosis when one or more blood glucose values are above cut offs based on WHO[13] and ADA[26] criteria:
  - FBG ≥ 126 mg/dl (≥ 7 mmol/L).
  - RBG (random blood glucose) ≥ 200 mg/dL (≥ 11.1 mmol/L)
  - Two-hour BG ≥ 200 mg/dl following 75g fasting OGTT.
  - HbA1c ≥ 6.5%. [23]

- **Gestational diabetes mellitus:** Diagnosis depends on the blood glucose values, in accordance with the values see Table: 3.
Diabetes in Pregnancy Study Group India (DIPSI) Criteria:
- If non-fasting 75 OGTT test is used to diagnose GDM, then the cut-off value for two-hour postprandial (2h pp) of ≥ 140 mg/dl (7.8 mmol/L) is diagnostic. \cite{28}, \cite{29}
- If fasting BG is between 92 and 125 mg/dL (5.1–6.9 mmol/L), women will be considered as GDM. \cite{17}

HbA1c test: HbA1c test is performed during the first trimester to identify women with pre-existing diabetes \cite{8} and to assess the risk to pregnancy. \cite{31}
- HbA1c value ≥ 6.5% is diagnostic of pre-existing diabetes. \cite{31}
- HbA1c is not recommended for screening and diagnosis of GDM. It is not a reliable test during the second or the third trimesters since physiological changes in pregnancy lower HbA1c levels. \cite{23}

2: Preconception Management
Background
All women with T1DM, T2DM, past history of GDM must be counselled to plan pregnancies and attend pre-pregnancy care. Maternal assessment and interventions to optimize health prior to conception improves pregnancy outcomes. \cite{2}, \cite{9}, \cite{30}

2.1: Preconception management for women with high risk for HIP
2.1.1: Offer women who are at high risk for HIP (see section 1 on screening for HIP) two-hour 75gm OGTT to identify undiagnosed pre-existing diabetes (use Non pregnant WHO diagnostic criteria, 2019). \cite{2}
2.1.2: Give advice regarding physical activity and weight reduction to women with BMI > 25 kg/m² prior to pregnancy. Referral to a registered dietician may be helpful. [30]

2.2: Preconception care for women with pre-existing diabetes

2.2.1: Educate and counsel about importance of euglycaemia at conception and throughout pregnancy. [2], [8]

2.2.2: Advise to avoid unplanned pregnancy and use effective contraception (see section 14) until good glycaemic control is achieved. Ensure HbA1c to be < 6- 6.5% 2 months before conception and throughout pregnancy, to minimize risk of congenital malformations. [2], [8]

2.2.3: Emphasize the importance of regular antenatal care and need for frequent antenatal visits.

2.2.4: Advocate healthy eating.

2.2.5: Set SMBG frequency, charting and SMBG targets. Preferred are pre-meal <5.5 mmol/L (<99mg/dL) and post-meal <7.8 mmol/L (140mg/dL) [2], [8], [9]

2.2.6: Warn about hypoglycaemia risks, recognition and management. [8]

Inform about nausea and vomiting in pregnancy and its effect on blood glucose control. [8]

2.2.7: Optimize medications: Discontinue oral hypoglycaemic drugs (OHD) except Metformin. Switch to Insulin and/or Metformin. [2], [8]

2.3: Review Medications

2.3.1: Provide folic acid (5 mg/day) at least 2 months prior to planned pregnancy until 12 weeks of gestation to reduce the risk of foetal neural tube defect. [2], [8], [9], [30]
2.3.2: Discontinue medications e.g; angiotensin- converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARBs), thiazide diuretics and switch to safer anti- hypertensive drugs e.g. Labetalol, Nifedipine Hydralazine and Methyldopa. [8], [30]

2.3.3: Stop statins and fibrates as soon as the pregnancy is confirmed. [8], [30]

2.4: Screen for Co-morbidities and Chronic diabetes complications

2.4.1: Screen for Hypertension, thyroid disease (test thyroid-stimulating hormone (TSH) and thyroid peroxidase (TPO) autoantibodies for type 1 diabetes.

2.4.2: Assess for medical complications related to diabetes e.g. ischemic heart disease, renal insufficiency, retinopathy and neuropathy. Get professional medical consultation to assess her ability to cope with pregnancy. [8], [34]-[37]

2.4.3: Offer a dilated retinal assessment (unless it was performed in the last 6 months). Consider laser photocoagulation if required to stabilize retinal status before pregnancy. [8], [38], [39]

2.4.4: Advise women with retinopathy to avoid rapid optimization of blood glucose control until treatment have been completed. [8], [35]

2.4.5: Offer a renal assessment, if serum creatinine is abnormal (≥120micromol/litre), or urinary albumin/creatinine ratio is high (>30mg/mmol) referral to a nephrologist should be considered before conception. [8], [33], [38]
3: Antenatal Management

Medical management for pregnant women with diabetes: Good glycaemic control is the key for improving pregnancy outcomes. In addition to routine pregnancy care, the following are the additional recommendations:

3.1: Educate and counsel pregnant woman

3.1.1: Explain key role of glycaemic control in reducing maternal, foetal and neonatal complications.

3.1.2: Counsel about glycaemic targets in pregnancy.\(^2\)

3.1.3: Emphasize the role of diet and exercise in achieving glycaemic control (see section on exercise).\(^{40},^{41}\)

3.1.4: Educate pregnant women on insulin (T1DM), how to avoid hypoglycaemia and ketoacidosis.\(^{30},^{42}\)

3.1.5: Individualize food plan based on personal and cultural eating habits throughout pregnancy to optimize glycaemic control.\(^{39}\) (See section 7.1)

3.1.6: Commence aspirin 100–150mg daily with evening meal from 12th week of gestation and stop at 36 weeks.\(^{30},^{43}\)

3.1.7: Commence calcium supplementation from 12 weeks of gestation.

3.1.8: Check blood pressure (BP) and urinalysis at each visit to identify preeclampsia early.

3.1.9: Continue folic acid 5 mg daily up to the end of the first trimester.\(^8\)

3.1.10: Screen for complications: Offer heart, renal and retinal assessment in those pregnant women with pre-existing diabetes, if it has not been undertaken in the preceding 6 months.\(^8,^{30},^{34}\)
3.2: Glycaemic Control

3.2.1: Set glycaemic targets:

- Fasting and pre-prandial 72-95 mg/dl (4–5.3 mmol/L)
- 1 hour after meal <140 mg/dl (7.8 mmol/L)
- 2 hour after meal < 120 mg/dl (6.7 mmol/L) [8], [9], [30]
- HbA1c level of < 6 % [8]

3.2.2: BG monitoring:

- Recommend BG monitoring by SMBG by 4–7 daily measurements [8], [9] depending upon the glycaemic control. Once the glycaemic control is achieved reduce the frequency of SMBGs by 2-3/day.
- Review SMBG and/or CGM at each antenatal visit.
- HbA1c at booking may be repeated once in each trimester. [8]
- Test for ketonaemia to exclude ketoacidosis if pregnant woman on insulin presents with hyperglycaemia, hyperemesis or is unwell. [8], [30]

3.2.3: BG control strategy:

- Begin treatment with lifestyle modification and diet.
- Add pharmacological drugs; Metformin & Insulin, if BG targets are not achieved within 1-2 weeks.
- Review medication and stop drugs harmful to foetus (refer to pre-conception counselling).

3.3: Antenatal Organisation of care for women with HIP

3.3.1: Booking antenatal visit (Up to 12 weeks)

- Fasting and pre-prandial 72-95 mg/dl (4–5.3 mmol/L)
- Review past obstetric history
• Review history of diabetes including type of diabetes, duration, treatment, history of DKA, episodes of hypoglycaemia and associated obstetrics and medical disorders.

• Ask for complete blood count, blood grouping and Rh factor, urine analysis, renal function test, thyroid profile and screening for viral hepatitis.

• Do ultrasound to confirm foetal viability, gestational age, and multi foetal gestation at 7-9 weeks.\textsuperscript{[8]}

• Arrange early anomaly ultrasound scan (USG) and measure nuchal Thickness at 12 weeks of gestation.

• Recommend 1-2 weekly antenatal visits.\textsuperscript{[44]}

3.3.2: At each antenatal visit:

• Monitor maternal weight gain.

• Do regular assessment for foetal growth and well-being.

• Serial foetal growth scans every 2–4 weeks from 28 weeks of gestation.

• Weekly Cardiotocography (CTG) from 34 weeks of gestation.

3.3.3: 18-23 weeks Antenatal visit:

• Recommend detailed anomaly ultrasound scan at 18-24 weeks for detection of foetal structural anomalies.\textsuperscript{[34]}

3.3.4: 22-26 weeks Antenatal visit:
• Do foetal echocardiogram at 24-26 weeks in women with pre-existing diabetes with high HbA1c at booking visit, or GDM with abnormal 4 chamber view on anomaly scan.\textsuperscript{[2],[45],[46]}

• Offer ultrasound monitoring of foetal growth and amniotic fluid volume at 28 weeks.\textsuperscript{[8]}

3.3.5: 32-34 weeks Antenatal visit:
• Offer ultrasound monitoring of foetal growth and amniotic fluid volume assessment.\textsuperscript{[8]}

3.3.6: 34-36 weeks Antenatal visit:
• Assess ultrasound foetal growth, abdominal circumference and amniotic fluid volume.\textsuperscript{[2],[8]}

• Offer umbilical artery doppler velocimetry if there is evidence of foetal growth restrictions.\textsuperscript{[2]}

• Provide information, discuss and advice about timing and mode of delivery to woman and family.

• Create and document a plan of delivery.

• Carry out cardiotocography if the woman reports reduced foetal movements.\textsuperscript{[47]}

3.3.7: 37-40 weeks Antenatal visit:
• Individualize timing and mode of delivery. (see section 4.1)

• In uncomplicated GDM on diet control or Metformin, await spontaneous labour and offer induction of labour at 39-40 weeks
• Consider delivery at 37-38 weeks for woman with metabolic or obstetric complications.\cite{2,8}

• Aim for vaginal birth unless there are obstetric or medical contraindications or suspected foetal weight > 4000gm.\cite{9}

4: Intrapartum Management

Plan and discuss for time and mode of birth during the third trimester.\cite{48} Women with diabetes are at increased risk of stillbirth in late pregnancy with the risk increases exponentially after 40 weeks of gestation.\cite{49} No diabetic pregnancy to go beyond 40 weeks.

Maintain good glycaemic control during labour, since maternal hyperglycaemia increases the risk of foetal acidaemia and neonatal hypoglycaemia.\cite{50}

4.1: Timing of delivery

4.1.1: The optimal timing of delivery in pregnancies complicated by hyperglycaemia depends on glycaemic control, associated metabolic and obstetric complications.\cite{50}

4.1.2: Deliver women with well-controlled and uncomplicated pregnancy, at 37-39 weeks.

4.1.3: In case of associated complications deliver around 37 weeks gestation. \cite{5}

4.2: Mode of delivery

4.2.1: Aim for vaginal birth and recommend Caesarean section for obstetric reasons only.\cite{50}
4.2.2: Consider Elective caesarean section if estimated foetal weight is greater than 4 kg to reduce maternal and perinatal morbidity and mortality.\[51], \[52]\n
4.2.3: Offer Induction of labour for obstetric reasons.

4.2.4: Diabetes by itself is not a contraindication to vaginal birth after caesarean section.\[8]\n
4.2.5: Use partogram/ Labour care guide to monitor labour.

4.2.6: Anticipate shoulder dystocia at birth especially if progress of labour is slow or if instrumental delivery is required or senior and skilled staff to be present in labour ward.

4.3: Glycaemic management during labour:

4.3.1: Avoid maternal hyperglycaemia to optimize pregnancy outcomes. Maternal hyperglycaemia during labour increases the risk of neonatal hypoglycaemia and adverse neonatal outcome. Intrapartum glucose levels > 10.0mmol/L (180 mg/dL) have been associated with neonatal hypoglycaemia and an increased risk of maternal ketoacidosis in type 1 diabetes \[50]\n
4.3.2: Recommended Intrapartum target BG are between 72 to 126 mg/dL (4 to 7 mmol/L).\[53]\n
4.3.3: Intrapartum glucose monitoring:

- Consider, 4 hourly BG monitoring in women with HIP on MNT.\[12], \[17], \[18]\n
- Women on insulin should have BG monitoring every 1 to 2-hours.\[2]\n
- Monitoring frequency can be decreased in women with glucose values consistently within the target range.\[54]\n
4.4: Glycaemic control during labour and delivery: [2], [55]

- Usual dose of intermediate-acting or long-acting insulin is given at bedtime.
- On the morning of induction, the morning dose of insulin is withheld.
- Omit morning dose of Insulin for elective C-Section and schedule as first case on the operative list. [55], [56]

- Two simultaneous intravenous infusions are used:
  - (A) insulin infusion (50 units of regular insulin in 50 mL normal saline at 1.0 unit/h to maintain BG between 4-7 mmol/L (72-126mg/dL) given through a syringe pump; The insulin infusion rates are titrated according to the blood glucose level, checked hourly, using a bedside glucometer.
  - (B) 5% dextrose 1000ml with Regular insulin 12 units to cater for metabolic needs at a fixed rate of 125ml/hour [2]. [8], [55]. If BG is > 7mmol/L (126 mg/dL), the infusion is changed from 5% dextrose to normal saline.
  - Keep IV-line infusion separate from the infusion which is given for induction/augmentation of labour. [8]

4.5: Consider Continuous Electronic Foetal Heart rate monitoring: [50, 57]

5: Preterm Labour

5.1: Management of preterm labour in women with HIP:
Preterm birth is associated with significant perinatal morbidity and mortality.\textsuperscript{[58]} The rate of prematurity doubles in women with HIP.\textsuperscript{[32], [59]} This could be either due to spontaneous preterm birth or induced due to complications of HIP.

5.2: Administer a single course of corticosteroids to women at risk of preterm delivery between 24+0 and 35+6 weeks of gestation to accelerate foetal lung maturation.\textsuperscript{[48]}

- Monitor BG values and adjust the insulin doses accordingly (see recommendation 9.6)
- Repeat course: If steroids were given before 28 weeks, a repeat single dose course can be considered.\textsuperscript{[48]}
- Avoid multiple courses of antenatal steroids as it may cause foetal growth restriction and affect neurological development.\textsuperscript{[60] - [62]}
- Medications: Both Betamethasone and Dexamethasone are effective.\textsuperscript{[63], [64]}
- Dosage and route of administration:
  - Betamethasone is given as two intramuscular doses, 12 mg each and 24 hours apart.\textsuperscript{[63], [64]}
  - Dexamethasone is given as four intramuscular doses 6 mg each, 12 hours apart.\textsuperscript{[63], [64]}

5.3: Tocolytics

Tocolysis enable pregnancy prolongation for at least short term and thus provide time for further in utero maturation and interventions that may improve neonatal outcome.\textsuperscript{[48]}

- Indications:
  - Women with suspected preterm labour with uncomplicated pregnancy
- For in utero transfer of mother to tertiary care
- For full course of corticosteroids

- Contraindication:
  - Established labour (4 cm dilatation with regular contraction)
  - Maternal hemorrhage, pre-eclampsia and intraamniotic infection
  - Severe intrauterine growth restriction
  - Maternal contraindication to tocolytic drugs

- Duration - 48 hours after administration of first corticosteroid dose
  - Drugs of choice: Summarized in Table: 4.

5.4: Magnesium Sulphate for neuroprotection: [48], [68]

- Dose of Magnesium sulphate as tocolytics is higher than for neuroprotection
- Women in established preterm labour or planned for preterm delivery should receive magnesium sulphate for foetal neuroprotection 24 hours prior to birth. The usual loading dose is 4gm IV over a median 25 minutes. The median maintenance dose is 1 gm/h IV for 7.4 hours. [67]
- If delivery is no longer imminent, Magnesium Sulphate should be discontinued.
- Do not delay delivery to administer antenatal MgSo4 for foetal neuroprotection if there are maternal and/or foetal indications for emergency delivery. (For dose of Magnesium Sulphate see table 4)
- Monitor clinical signs of magnesium toxicity every 2-4 hours
  - Decreased deep tendon (patellar) reflexes
  - Respiratory rate < 12/min
- Urine Output < 30ml/hour

- If a woman has or develops oliguria or other signs of renal failure
  - Monitor more frequently for Magnesium toxicity
  - Reduce the dose of Magnesium Sulphate.

- Antidote for Magnesium Sulphate toxicity: Give intravenous infusion of calcium gluconate 1 gm (10 ml of 10% solution) slowly over 10 minutes

6: Postpartum Management

The postpartum period is crucial, in terms of addressing the immediate perinatal problems, and for early preventive health of both mother and child, who are at risk for future obesity, metabolic syndrome, diabetes, hypertension, and cardiovascular disorders. [9]

6.1: Women with pre-existing diabetes:

6.1.1: Encourage breastfeeding immediately after delivery and support it for the sake of maternal and child benefits. [70]

6.1.2: Inform women who are breastfeeding for the potential increased risk of hypoglycaemia, especially during nighttime. [70]

6.1.3: Provide women with a post-delivery plan to reduce pre pregnancy insulin pump dosages settings or readjust anti hyperglycaemic drugs and record this in birth plan document. [70]

6.1.4: Screen women with T1DM for thyroid hormone abnormalities during pregnancy and at approximately 1-3 months post-partum. [71], [72] Since, these mothers have higher risk for autoimmune thyroid disease and postpartum thyroid dysfunction. [73]
6.1.5: Provide appropriate hygiene, antibiotics and proper glycaemic control\(^2\) in order to detect early signs of infection for the breast, genitourinary tract, and surgical site infections\(^9\).

6.1.6: Advise women for effective contraception\(^70\).  
6.1.7: Advice for preconception management prior to subsequent pregnancy\(^2\).

**6.2: Gestational Diabetes Mellitus:**

6.2.1: Encourage women for breastfeeding since it protective against the occurrence of infant and maternal complications\(^70\).

6.2.2: Counsel, women with the diagnosis of GDM for the high rate of recurrence for GDM\(^74,75\).

6.2.3: Inform women with previous GDM with their families about the increased risk for the development of T2DM\(^76\) and advice for lifelong screening\(^20\).

6.2.4: Offer lifestyle advice as weight control, diet and exercise and/or Metformin to prevent or delay progression to T2DM\(^2,20,77-80\) which is about 50–70% in the coming 5-10 years if mothers are not compliant\(^2,76\).

6.2.5: Encourage obstetricians to establish connections with family physicians, internist, paediatricians, and health care providers to support postpartum follow up for those mothers and connect it to regular follow up and vaccination program of the child to ensure continued engagement of the mothers with their children\(^9\).

6.2.6: Screen women with a recent history of GDM with 75 gm OGTT after 4-12 weeks post-partum using WHO criteria\(^81,82\) followed by 6 months postpartum\(^68\) if possible, then one year later, followed by every 1-3 years\(^20,83-86\). Offer FBG or HbA1C if OGTT is not possible\(^2\).
6.2.7: Screen all components of the metabolic syndrome, because it is more prevalent in these women.\textsuperscript{[87]} - \textsuperscript{[89]}

6.2.8: Advise women for proper contraceptive methods.\textsuperscript{[9]}

6.2.9: Counselling women to attend preconception management clinics before planning for next pregnancy.\textsuperscript{[2]}

6.2.10: Psychosocial assessment and support for self-care should be included\textsuperscript{[2]} to enable women and her family to carry out diabetes care tasks.\textsuperscript{[90]}

6.3: Adjustment of pharmacological treatment:

6.3.1: Women with pre-existing diabetes:

6.3.1.1: Continue BG monitoring in women who were on Metformin or on low-dose insulin (<0.5 units/kg/day) by FBG and 2-hr post prandial for the next 48–72 h, then adjust the frequency of SMBG monitoring according to glycemic status.\textsuperscript{[70]}

6.3.1.2: In women with pre-existing T1DM with insulin requirement of >1 unit/kg/day, Insulin dose may be reduced to 50% post-partum, however those on 0.5–1 unit; the dose need to individualized according to SMBG levels.\textsuperscript{[70]}

6.3.1.3: Resume and or continue medications (Metformin /insulin) in women with pre-existing T2DM after birth according to SMBG values.\textsuperscript{[70]}

6.3.1.4: Advise women with pre-existing diabetes to see their primary care physician postnatal for further management of diabetes.\textsuperscript{[70]}
6.3.2: Women with GDM:
Women with GDM usually go back to normoglycaemia. Stop or modify pharmacological treatment. [2] Postpartum target FBG should <5.5 mmol/L (<99mg/dL), same as non-pregnant women. [2], [8], [9], [78]

6.3.2.1: SBGM may be stopped after birth in women on non-pharmacotherapy. [78]

6.3.2.2: Re-adjust the medications for women on pharmacotherapy. [78]

6.3.2.3: Stop pharmacological therapy (Metformin and insulin) immediately after birth (vaginal or CS). [78]
- Continue SBGM monitoring four times per day for 24 hours (pre-prandial and before bed). [78]
- Stop monitoring 24 hours after birth if all pre-prandial SMBGs are between 4.0 - 7.0 mmol/L (72-126 mg/dL). [76]
- BG monitoring may continue every 4–6 hourly till oral food is allowed and thereafter 2 hrs post prandial according to BGL in the immediate postoperative period in case of CS. [2]
- Stop IV fluids early if diet is tolerated. [78]
- Seek medical review if diet is not tolerated or SBGM < 4.0 mmol/L (72mg/dL); however, consider 4% Dextrose/0.18% Sodium Chloride or Hartmann’s/Dextrose IL IV, 12-hourly. [83]
• Seek medical review and continue SBGM if persistent pre-prandial BG is >7.0 mmol/L (126 mg/dL). [83]
• Prescribe lower dose of insulin (if required) than during pregnancy. [83]

7: Management of Hyperglycaemia in Pregnancy

a. Non-Pharmacological Treatment (NPT)

b. Pharmacological management (PT)

a. Non-Pharmacological Management:

It consists of medical nutrition therapy (MNT), exercise and physical activity.

7.1: Medical Nutrition Therapy

Introduction:

It is a customized dietary plan for diabetes and hyperglycaemia in pregnancy for optimum glycaemic control and long term foetal and maternal well-being. [33]

Goals

Recommended gestational weight gain and caloric requirements:

• Women with HIP should take adequate calories and gain weight as recommended.
• Weight gain in first trimester should be 0.5 – 2 kg.
• No increase in caloric intake is recommended in the first trimester.
• An additional 340 kcal/day are recommended during the second trimester.
• An additional 452 kcal/day for the third trimester.
• In women with Polycystic ovarian disease (PCOS), weight monitoring should be fortnightly as they are likely to gain excessive weight.  

7.1.1: Glycaemic index

• Select the foods that have lower Glycaemic index to avoid postprandial glucose spikes. \[92\]
  - Low GI (55 or less) .......... Choose most often
  - Medium GI (56 to 69) .......... Choose more often
  - High GI (70 or more) .......... Choose less often

7.1.2: Macronutrient and Micronutrient requirement

Take into consideration, multiple factors like BMI, glycaemic control, personal and socio-cultural preferences, patterns of eating and financial constraints while planning meals/snacks.

7.1.3: Carbohydrates:

• Minimum requirement of carbohydrates is approximately 175g /day. 35-45% of total calories should come from carbohydrates.
• Spread carbohydrate containing foods throughout the day.
• Balance protein with carbohydrates as pure protein meal may cause hypoglycaemia in people taking insulin. \[93\]
• Avoid severe caloric restriction in pregnancy especially in type-I DM as it may promote ketosis which is associated with adverse effects on foetal brain and nervous system. \[94\]
7.1.4: Oils and Fats:
25-35% calories per day should come from fats. Do not exceed >40% of total calories.

- Following proportion of fats should be used in meal:
  - Animal sources: \[^{[95]}\] (Saturated) should be < 7% (butter, clarified butter, egg yolk, meat & fats)
  - Plant sources: \[^{[96]}\] (Unsaturated fat)
    - 90% should be monounsaturated fat (Olive oil, Canola oil)
    - 10% should be polyunsaturated fats (Sunflower oil, Corn oil, Soya oil)

- Prefer cooking oils with high smoke point instead of low smoke point to decrease trans-fat formation and AGEs

- Additional saturated fat should not be consumed (like clarified butter, butter, cream) because daily intake of eggs, dairy & meat fulfil the recommended amount of saturated fat (<7%) per day.

7.1.5: Protein:

- Daily requirement index (DRI) in pregnancy is minimum 71 gram of proteins daily. At least 20% of the calories should come from proteins.

- Chicken, fish, eggs white, low /no fat dairy, beans, lentils and nuts are healthy sources of protein and should be evenly distributed in the meal plan. \[^{[30]}\]

- Protein supplements do not improve pregnancy outcomes. \[^{[100]}\]

7.1.6: Fibre:
• Encourage fibre in diet to control glycaemic spikes

7.1.7: Fluid Requirements:
• Minimum fluid requirement is 2.3 L per day (10 cups of beverages to keep adequate hydration). [101]
• Increase fluid intake while staying active and in hot environment
• Alcohol, Sugar sweetened, sugar free fizzy drinks and coffee should be avoided. [102], [103]

7.1.8: Daily Meal Planning:
1. Distribute the meal in 3 main courses and 3 snacks given at a fixed time of the day
2. Space meals/snacks at 2 to 3 hours intervals, breakfast before 8 am and dinner before 8pm.
3. Advise bedtime snack to avoid nocturnal hypoglycemia. Bedtime snack and breakfast should not be more than 10 hours apart.
4. Avoid skipping meals/snacks. In case a meal is skipped, monitor blood sugar and judiciously compensate it with appropriate food.
5. Monitor blood sugar to avoid hypoglycemia for any unscheduled exercise or physical activity.
6. Plan daily meals and snacks. For convenience, food is categorized into 7 groups. Group 7 consist of food items to be avoided (indicated in red colour). Food groups along with number and serving size are given below.
7. Tobacco and smoking are prohibited in pregnancy.

7.1.9: Smart Plate (to plan a given meal)
Learn to make a smart plate for a given meal.

- Principles to make a customized food plate according to dietary habits, job, daily workout and lifestyle.

- Size of plate ------- 9 inches (See Figure1: Smart Plate)

- Proportion of nutrients to be filled in plate:
  a) **Half plate** – Non-starchy vegetables
  b) **One quarter plate** – Proteins e.g., Lean Meat or skinless poultry or fish & food or egg white or peanut butter or Soya beans & products
  c) **One quarter plate** – Grains, Vegetables (Starchy), beans and lentils.
  d) In addition to contents in plate, following can be used for a healthy meal planning:
     - **Outside plate contents** – dairy (<1% fat) and fruits

**8: Exercise and Physical Activity**

Pregnancy provides a unique opportunity to motivate women for exercise. It facilitates glucose entry into muscles,\[104\] improves glycaemic control and reduces excessive weight gain during pregnancy and in postpartum period.\[105\] Evaluate for obstetric and medical complications before advising exercise.

**8.1: Recommendations for exercise in HIP**

Advise women to:

8.1.1: Tailor exercise according to physical endurance and increase the intensity of exercise gradually if there are no obstetrics or medical contraindications.
8.1.2: Continue exercise through post-partum period and thereafter.
8.1.3: Stop exercise and immediately contact healthcare provider if there is any obstetrical/ medical complications: [106]

- Vaginal bleeding
- Abdominal pain with or without nausea
- Regular painful contractions
- Amniotic fluid leakage
- New dyspnoea before exertion
- Dizziness, syncope
- Headache
- Chest pain
- Muscle weakness affecting balance
- Calf pain or swelling

8.1.4: Exercise should be done for 30-60 minutes [107] daily (at least 3-5 days/week) with correct posture.

8.1.5: Exercise time should be split preferably 10 minutes intervals.

8.1.6: Exercise preferably post meal, if not tolerated, shift to pre meal.

8.1.7: Exercise intensity must be gauged, and exercise capacity must not exceed.

8.1.8: Exercises in pregnancy can be done using following tools:

- Talk test [108] As long as woman can talk during exercise [talkative conversation]. This is an indication of not over exerting
- Less than 60-80% of age predicted maximum maternal heart rate [109] (usually not exceeding 140bpm) (Annexure 1)
- Self-reporting intensity Borg scale [110] moderate 12-14 (Annexure 2)
8.1.9: Exercise should be done in a smoke free well-ventilated temperature-controlled area. Prolonged exposure to heat/extreme cold should be avoided.

8.1.10: Wear air filled joggers, cotton socks.

8.1.11: Under guidance and supervision, may be modified in Medical and obstetric contraindications / complications according to physicians’ recommendations.

8.1.12: With caution and the possibility of hypoglycaemia with unscheduled exercise should be taken into consideration.

8.1.15: Resume strenuous exercise 3 months after C-Section.\textsuperscript{[111]}

8.1.16: Women should be advised safe form of exercises in pregnancy.\textsuperscript{[112]}

- Aerobics
- Brisk Walking
- Stationary cycling
- Swimming (diving is contraindicated)
- Modified Yoga
- Pelvic exercises (Kegel’s Exercises)
- Strength training (under supervision)
- Jogging (only in previously active women)

8.1.17: Advise against strenuous exercise and/or sports with a risk of fall e.g., Contact sports.

- High-intensity (>90% HRmax) strenuous exercise
- Long-distance running
- Exercises with risk of falls or impact of the body against the ground or hard surfaces (e.g., downhill snow skiing, water skiing, surfing, off-road cycling, gymnastics and horseback riding)
• Contact sports (e.g., hockey, ice hockey, wrestling, kabaddi (a form of Pakistani/Indian wrestling), boxing, rugby, soccer and basketball etc.)
• Physiological danger (e.g., diving)
• Scuba diving
• Sky diving
• "Hot yoga" or "hot Pilates"

8.2: Contraindications to exercise during pregnancy[^112]

8.2.1: Absolute contraindications
• Haemodynamically significant heart disease.
• Restrictive lung disease.
• Cervical incompetence.
• Multiple gestation at risk of preterm labor.
• Persistent second- or third-trimester vaginal bleeding.
• Placenta previa after 26 weeks of gestation.
• Threatened preterm labor during the current pregnancy.
• Ruptured membranes.
• Preeclampsia or pregnancy-induced hypertension.
• Severe anemia.

8.2.2: Relative contraindications
• Moderate to severe anemia.
• Unevaluated maternal cardiac arrhythmias.
• Chronic bronchitis.
• Poorly controlled type 1 diabetes.
• Morbid obesity
• Extreme underweight (BMI less than 12).
• Intrauterine growth restriction in current pregnancy.
• Poorly controlled hypertension.
• Orthopedic limitations.
• Poorly controlled seizure disorders.
• Poorly controlled hyperthyroidism.
• Heavy smokers.

8.3: Exercise in Special Situations:
8.3.1: Women on bed rest should be advised following exercises:
• Lie on left lateral position (she should not exercise while lying supine or in right lateral position). Fig 2: A & B
• Perform full flexion at ankle joint and toes and hold for 10 seconds followed by full extension of ankle and toe and hold for 10 seconds. Fig 3: A & B
  Alternate this movement 10 times/hour whilst awake
• Do alternate flexion and extension of both legs at knee and hip joints 10 times/hour whilst awake. Fig 4: A
• Combination of movements of the arms at the shoulder joint with the exercises of the lower limbs (as detailed above) will help in glycaemic control and prevention of DVT.

8.3.2: Women with orthopedic limitations of knee and hip joints should avoid weight bearing exercises. Following exercises can be recommended to them:
• Cycling, swimming can be continued.

• Walk while sitting in chair (Sitting Walk)

• Steps to be followed: Fig IV: A & B
  - Sit in a highchair with feet dangling above ground.
  - Posture should be upright.

• Combined paddling movements of legs with circular movements of arms.

8.3.3: Competitive athletes can continue training under supervision throughout pregnancy if there are no maternal or foetal contraindications:

• Heavy lifting (10 to 20 kg more than 20 times/week) should be avoided during pregnancy. [69],[114],[115]

• Avoid dehydration especially during prolonged training sessions in hot and humid weather.

• Following heart rate can be used as reference: (Note: for non-athlete women, recommendations are different. [116]-[118] See section on recommendation for exercise in HIP)
  - Age 20 to 29 years – 145 to 160 beats/minute
  - Age 30 to 39 years – 140 to 156 beats/minute

• Should take extra calories for high intensity prolonged and frequent exercises.

• Advise to avoid and recognize overtraining syndrome if following symptoms are observed. [119]
  - Early and excessive fatigue
  - Sleep disorders
  - Lack of weight gain
  - Persistent tachycardia at rest
- Increased frequency of musculoskeletal injuries
- Discontinue/modify training if there is previous or current history of a small for gestational age infant. \[^{[120]}\]

9: Pharmacological management of hyperglycaemia in pregnancy (HIP)

9.1: Self-monitoring of blood glucose (SMBG)

The following advice should be given to pregnant women with diabetes:
- The recommended frequency of capillary glucose levels (using SMBG) is 4 times a day including fasting and 1 or 2 hours after each meal.
- Monitor BG at bedtime or during the night especially if hypoglycaemia is experienced, (especially type 1 DM).
- The frequency of testing may be reduced if glucose levels are well-controlled with diet and lifestyle in GDM and type 2 DM.

9.1.1: Target glucose levels

Advice pregnant women with type 1 diabetes, type 2 diabetes or GDM that the recommended targets of capillary glucose levels (using SMBG) are as follows:
- Fasting \(<95 \text{ mg/dL (5.3 mmol/L)}\)
  
  \textit{And either}

- 1 hour postprandial \(<140 \text{ mg/dL (7.8 mmol/L)}\)
  
  \textit{Or}

- 2 hours postprandial \(<120 \text{ mg/dL (6.7 mmol/L)}\)
9.2: Pharmacological management of Gestational Diabetes Mellitus (GDM)

GDM is characterized by an increased risk of macrosomia and birth complications as well as an increased risk of maternal type 2 diabetes after pregnancy. [30], [121] Treatment of GDM with the aim of achieving target glucose levels has been demonstrated to improve perinatal outcomes. [30], [115] Glycaemic targets for GDM are similar to those for pre-gestational type 1 or type 2 diabetes. [30], [55], [123] (See recommendation 9.1.1)

9.2.1: Women with GDM in whom glycaemic targets have not been achieved with diet and lifestyle, pharmacological therapy should be added in the form of Metformin and/or insulin.

9.2.2: Use insulin, with or without Metformin, in addition to diet and exercise, as the first line treatment in women with GDM who have a fasting blood glucose (BG) level of > 126 mg/dL (7 mmol/L) or a 2 hour post OGTT blood glucose > 200 mg/dL (11.1 mmol/L).

9.2.3: Consider insulin, with or without Metformin, in addition to diet and exercise, in women with GDM who have a fasting plasma glucose level between 108-125 mg/dL (6-6.9 mmol/L) or if there are complications such as macrosomia or polyhydramnios.

9.2.4: Add insulin if target glucose levels are not achieved within 1 to 2 weeks of starting Metformin.

9.2.5: Glibenclamide is inferior to Metformin and insulin [8], [9], [30], [55], [70], [123], [124] not indicated in pregnancy. (It is still used in some situations when there is intolerance to Metformin or insulin therapy is refused by the woman).

9.2.6: Insulin therapy in GDM
1. If insulin is indicated, the type and timing of insulin should be guided by the results of SMBG \cite{8, 30, 123}, with the aim to achieve target BG levels while avoiding hypoglycaemia.

2. Regular human insulin can provide satisfactory mealtime coverage if injected about 20-30 minutes before the meal.

3. The rapid-acting insulin analogues, Lispro and Aspart are safe in pregnancy.\cite{9, 55, 70, 123} The advantages of the rapid-acting analogues over regular human insulin is consumer convenience as they can be injected immediately before the meal due to their quick absorption and rapid onset of action and better control of postprandial hyperglycaemia. Basal insulin analogues are expensive as compared to regular insulin. Long acting analogue, Detemir is safer than Glargine.\cite{9, 30, 55, 70, 123}

4. Another rapid-acting insulin analogue, Glulisine, has also recently been tested in pregnancy and found to be safe.\cite{125}

5. The recently introduced basal insulin analogues, Degludec U-100, Degludec U-200 and Glargine U-300 have not been tested in pregnancy.\cite{70}

6. If the fasting glucose levels are high, add a bedtime dose of intermediate-acting human NPH insulin or long-acting basal analogues insulin e.g. Detemir.

7. If postprandial glucose levels are above target, start short-acting human regular insulin or one of rapid-acting insulin analogues Lispro or Aspart before meal.

8. Consider a full basal-bolus insulin regime with 3 doses of regular human insulin or rapid-acting analogue before each of the 3 meals and NPH or Detemir as basal insulin once daily as indicated by the results of SMBG.
9. A less desirable alternative is the use of twice daily mixed insulin which has the advantage of convenience for patients by reducing the number of injections but with the major disadvantage of losing the flexibility of adjusting insulin doses. The use of pre-mixed insulin should only be considered for pregnant women if alternatives are not available or affordable, they are under follow up and supervision by an endocrinologist.

10. Consider starting insulin at a dose of 0.5-1 unit/kg/day depending on initial glucose levels and period of gestation.

11. Discontinue insulin and other blood glucose lowering therapies immediately after birth in women with GDM provided that glucose levels remain normal after delivery.

9.2.7: Metformin

1. Metformin crosses the placenta but there is no evidence for increased congenital anomalies, lower incidence of neonatal hypoglycaemia and less maternal weight gain when compared with insulin.\[124], [126], [127]

2. Start Metformin at a dose of 500 mg once or twice daily after meals and increase gradually to the required maximum dose.

3. Most patients derive maximum benefit from a total dose of 2000 mg/day but it is licensed up to 3000 mg/day.

4. Use either the immediate or the slow-release form.

5. Avoid Metformin in women with a serum creatinine level ≥150 µmol/L.

9.3: Pharmacological management of type 1 diabetes in pregnancy

9.3.1: During pregnancy Insulin requirements increase especially from 28 weeks to 32 weeks of gestation.
9.3.2: On average, insulin needs increase from 0.7-0.8 units/kg/day during
the first trimester to 0.8-1.0 units/kg/day during the second trimester
to 0.9-1.2 units/kg/day during the third trimester.

9.3.3: If women cannot achieve targets without significant hypoglycaemia,
set less stringent targets, based on individualization of care.

9.3.4: For women with type 1 diabetes who use CGM or FGM, aim for the
following targets:

<table>
<thead>
<tr>
<th>Glucose Levels</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIR (63-140 mg/dL)</td>
<td>&gt;75%</td>
</tr>
<tr>
<td>&gt;140 mg/dL</td>
<td>&lt;25%</td>
</tr>
<tr>
<td>&lt;63 mg/dL</td>
<td>&lt;4%</td>
</tr>
<tr>
<td>&lt;54 mg/dL</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

9.3.5: Advise women to seek medical consultation to adjust insulin doses if
BG results of SMBG are not according to target values.

9.3.6: Educate women and family members about the prevention,
recognition and treatment of hypoglycaemia, before, during and after
pregnancy to help prevent and manage the risks of hypoglycaemia.

9.3.7: Insulin requirements decreases immediately after delivery, adjust
insulin requirements according to SMBG.

9.3.8: There is no evidence that any particular insulin regime or insulin type
is better than another in management of diabetes in pregnancy.

9.3.9: Treat pregnant women with type 1 diabetes with both basal and meal-
time insulins in a multiple dose injection (MDI) regime.
9.3.10 Consider as an alternative, the use of continuous subcutaneous insulin infusion (CSII), or insulin pump therapy in those who can afford and have the availability of the necessary support and expertise.

9.4: Pharmacological management of type 2 diabetes in pregnancy

9.4.1: As type2 diabetes may often be associated with obesity, lifestyle and dietary advice should be intensified to avoid excessive weight gain during pregnancy.

9.4.2: Use insulin as the preferred treatment if BG is not controlled on diet and lifestyle alone.

9.4.3: Women on Metformin and/or Glibenclamide preconception may continue on these agents if glycaemic control is adequate until pregnancy is achieved.

9.4.4: Women taking oral hypoglycaemic drugs other than Metformin or on GLP agonist injections, shift them to insulin (and/or Metformin) prior to conception.

9.4.5: For women who decline insulin, cannot afford or cannot safely administer insulin, consider oral therapy with Metformin.

9.4.6: Glycaemic control is often easier to achieve in women with type 2 diabetes than in those with type 1 diabetes.

9.4.7: Consider the use of Metformin together with insulin as this may help reduce the insulin doses and help prevent excess weight gain.

9.5: Pregnant women with diabetes receiving steroids

9.5.1: In women suspected of preterm delivery, 2 doses of Betamethasone are often given to aid in the maturation of the foetal lungs.
9.5.2: Adjust insulin doses to prevent severe hyperglycaemia and DKA in women with type 1 diabetes.

9.6: Management of women with diabetes on insulin receiving Betamethasone for lung maturity

Following the first dose of betamethasone:

- Day 1: Increase the night insulin dose by 25%
- Days 2 and 3: Increase all insulin doses by 40%
- Day 4 & 5: Increase all insulin doses by 20%
- Days 6 and 7: Gradually taper insulin doses to pre-Betamethasone doses.

9.6.1 Elective caesarean section <38 weeks of gestation

- The woman may require antenatal betamethasone. Betamethasone can lead to hyperglycaemia and the effect can last up to 5 days. Consider admitting the woman for a minimum of 48 hours. Commence seven (7) point blood glucose monitoring.
- Give stat dose of insulin in addition to routine insulin according to the following BG levels:

<table>
<thead>
<tr>
<th>Blood glucose mg/dl (mmol/L)</th>
<th>Rapid acting/regular insulin Subcutaneous (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1 DM</td>
</tr>
</tbody>
</table>
10: Diabetes-related Emergencies during Pregnancy

10.1: Diabetic ketoacidosis

- Diabetic ketoacidosis (DKA) in pregnancy is a serious life-threatening, medical emergency, especially for the foetus.
- Maternal mortality is estimated to be less than 1% while foetal mortality can be as high as 9-35%. \[^{129}\]
- DKA mainly occurs in patients with type 1 diabetes but may also occur in some patients with type 2 diabetes \[^{14}\] and GDM.
- Management should be by a multidisciplinary team.

10.1.1: Diagnosis

The diagnostic criteria for DKA are: \[^{130}\]

- **Hyperglycaemia**: BG usually \(\geq 200 \text{ mg/dL (11.1 mmol/L)}\), however it can occur at lower levels in pregnancy (euglycaemic ketoacidosis)
- **Ketonaemia**: \(\geq 3 \text{ mmol/L or ketonuria } \geq 2^+ \text{ on standard urine sticks}\)
- **Metabolic acidosis**: bicarbonate <15 mmol/L and or/ arterial or venous pH <7.30

10.1.2: Precipitating factors

- Infection
- Non-compliance with insulin treatment
- Inappropriate dose of insulin (example: pump failure, omission of doses)
- Drugs which cause hyperglycaemia (e.g. corticosteroids)

10.1.3: Foetal effects of diabetic ketoacidosis

- Ketoacids and glucose both cross the placenta.
- Foetal heart abnormalities on cardiotocograph (CTG) are expected but usually reverse with the treatment of DKA.

10.1.4: History and physical examination

- Thirst / polyuria / nocturia
- Generalised weakness
- Nausea / vomiting
- Tachypnoea / tachycardia/ ketotic breath
- Kussmaul’s respiration or air hunger
- Dehydration/ hypotension
- Muscle cramps
- Abdominal pain
- Confusion / coma (exclude other causes)
- Abnormal foetal heart tracing
10.1.5: Investigations

- Complete Blood Count (CBC)
- Urea & electrolytes (U&Es)
- Blood glucose
- Blood culture, if infection is suspected
- Midstream Urine
- Arterial Blood Gases/Venous pH
- Serum/urine Ketone levels
- Electrocardiogram (ECG)
- Chest X–ray if indicated (with shielding of abdomen)

10.1.6: Management [130]-[132]

- Management should be by multidisciplinary team.
- Fluid resuscitation
- Correction of hyperglycaemia
- Correction of electrolyte abnormalities
- Treatment of precipitating factors
- Foetal assessment

Fluid Replacement [130]-[132]

- Insert two wide bore IV cannulas
- Commence intravenous (IV) normal saline 0.9%, via volumetric pump as follows:
  - 1 litre over 30 minutes
  - 1 litre over 1 hour
- 1 litre over 2 hours
- 1 litre over 4 hours
- 1 litre over 6 hours

- Monitor blood glucose levels using glucometer hourly. When the blood glucose $\leq 180$ mg/dL (10 mmol/L), the IV fluid should be changed to 5% dextrose.

**Electrolyte Replacement** [130]-[132]

- Add potassium chloride to each 1 litre of IV fluids after the first litre of fluid has been infused according to serum potassium level as follows:

<table>
<thead>
<tr>
<th>Serum potassium</th>
<th>Potassium replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 mmol/L</td>
<td>40 mmol/L</td>
</tr>
<tr>
<td>3 - 4 mmol/L</td>
<td>30 mmol/L</td>
</tr>
<tr>
<td>4 - 5.4 mmol/L</td>
<td>20 mmol/L</td>
</tr>
<tr>
<td>&gt;5.5 mmol/L</td>
<td>None</td>
</tr>
</tbody>
</table>

**Insulin infusion** [130]-[132]

- A fixed rate intravenous insulin infusion calculated on 0.1 unit/kg/hour is recommended.

- The metabolic targets are:
  - reduction of blood ketone concentration by at least 0.5 mmol/L/hour
  - in the absence of blood ketone monitoring, the venous bicarbonate should rise by 3 mmol/L/hour and capillary blood glucose should fall by 55 mg/dL/hour (3 mmol/L/hour)
  - Long acting basal insulin analogues should be continued subcutaneously as normal
10.1.7: Resolution of DKA is identified as:

- PH > 7.3 and/or bicarbonate > 15 mmol/L
- Blood ketone levels < 0.6 mmol/L

10.1.8: Ongoing assessment and monitoring\[130\]

- Following initial stabilization, woman should be transferred to ICU or HDU.
- Woman should be under a multi-disciplinary team of an endocrinologist, an obstetrician, an intensivist as well as trained midwives and nurses.
- Urea and electrolytes should be performed every 4 hours

10.1.9: Foetal assessment

- Maternal resuscitation and stabilization measures should take priority before any surgical intervention.
- Most fetal losses occur before diagnosis, may be due to maternal dehydration with acidosis possibly leading to reduced utero-placental circulation, high potassium may lead to fetal cardiac arrhythmias.\[133\]
- After 28 weeks of gestation, CTG monitoring should be performed & continued until patient is stable.
- If in labour, continuous CTG should be initiated
- In cases of pre-term labour, avoid betamethasone in women with DKA.
- Give magnesium sulphate for neuroprotection to all women delivering between 28-33 weeks +6 (refer to section on pre-term labour).

10.1.10: Prevention

- Pre-pregnancy and antenatal education of pregnant women
- The importance of SMBG should be stressed to women and family
- Ketone strips and should be considered for early detection if resources allow.
10.1.11: Uncontrolled hyperglycaemia

- Hyperglycaemia is defined as glucose levels above the recommended targets in pregnancy. [30]
- For pregnant women who present with acute hyperglycaemia, it is most important to rule out DKA, especially in type 1 diabetes. [30]
- If DKA is confirmed, follow the DKA protocol (see recommendation 10)

10.1.12: Decide on need for hospital admission

- If DKA is ruled out, the next step is to decide whether the woman needs admission to hospital.
- If the woman is clinically unwell, vomiting or unable to take orally, stabilization in hospital is preferred.

10.1.13: In-hospital treatment [30], [70]

- For women admitted to hospital, perform clinical assessment to identify the reasons for hyperglycaemia and provide the appropriate treatment e.g. UTI, hyperemesis, etc.
- While the underlying cause is being treated, specific treatment for the hyperglycaemia should be provided as below:
- For women who are already on insulin: review insulin regime and step up insulin doses aiming for pregnancy glycaemic targets (see HIP treatment protocol)
- For women who are on Metformin or Glibenclamide, consider switching to insulin
Prior to discharge from hospital, identify any gaps in diabetes education and arrange for re-education, help should be sought from the diabetes educator/dietician

Avoid using insulin sliding scale as it results in fluctuating glucose levels

10.1.14: Out-patient management

- If the woman is clinically well, she can be managed as out-patient.
- Seek help from diabetes educator.
- Give glycaemic targets and advice on how-to step-up insulin doses and arrange follow up.

10.2: Hypoglycaemia

- Hypoglycaemia is a life-threatening condition which requires immediate medical attention and can affect any patient with diabetes. It is the commonest acute diabetes emergency and most cases are avoidable.\[132], [134]
- Women with type 1 diabetes have an increased risk of hypoglycaemia in the first trimester and have altered counter-regulatory response in pregnancy that may decrease hypoglycaemia awareness.\[134]
- Education for women and family members about the prevention, recognition and treatment of hypoglycaemia is important before, during and after pregnancy to help to prevent and manage the risks of hypoglycaemia.
- Insulin resistance drops rapidly with delivery of the placenta leading to a drop-in insulin requirement and hence make the woman prone to hypoglycaemia.

10.2.1: Definition of hypoglycaemia in pregnancy\[135], [136]
The cut-off level for defining hypoglycaemia in pregnancy is a glucose level of <60 mg/dl (3.3 mmol/l)

10.2.2: Symptoms and Signs

- Adrenaline-induced:
  - Sweating/clammy skin
  - Palpitations/Tachycardia
  - Shaking/Incoordination
  - Hunger
  - Visual Disturbance
  - Tingling around lips
  - Nausea
  - Malaise

- Cognitive Symptoms:
  - Confusion
  - Drowsiness
  - Speech Difficulty
  - Atypical Behaviour

- Hypoglycaemia should be considered in an individual with acute agitation, abnormal behaviour or impaired consciousness. These signs do not usually occur unless blood glucose falls below 45 mg/dL (2.5mmol/L) but can occur at higher concentrations in patients with type 1 diabetes who have poor control.

- Investigations
  - Blood glucose measurement using a glucometer (if not available, treatment should not be delayed)
A glucose level of <60 mg/dL (3.3 mmol/L) suggests that the symptoms are caused by hypoglycaemia.

10.2.3: Immediate Treatment[^132] [^135]

- **If able to take orally:**
  - Oral glucose (15-20 grams) given immediately in liquid form:
    - e.g. 4 teaspoons of glucose powder in 100 ml water
    OR
  - 150-200mL of fruit juice (approximately one teacup)
    - An alternative is 3 dextrose tablets, or 3-4 dates with instruction to chew and swallow
    OR
  - Any available glucose drinks.
    - Repeat after 5 minutes if no improvement in symptoms

- **If semi-conscious or unconscious:**
  - IM/SC Glucagon 1mg
  OR
  - IV Dextrose 50% (50mL) or 20% (100mL) into a large vein over 15 min and flush with sodium chloride 0.9% 10mL – repeat once if still unconscious after 15 min. If still failing to respond start IV 10% Dextrose 500 ml over 2 hours.
  - Once conscious, give oral glucose or further carbohydrate intake.

10.2.4: Subsequent Management

- Check finger prick glucose every 30 minutes until it has arisen to >70 mg/dL (3.9 mmol/L).
• Oral glucose should be followed by complex carbohydrates e.g. 2-3 biscuits or a sandwich

• If the hypoglycaemia was induced by a sulphonylurea or an intermediate-acting or long-acting insulin (e.g. Human NPH insulin or Glargine), the patients should have regular monitoring of finger prick glucose levels every 2 hours until stable then 4-hourly for 24 hours.

• If there is failure to recover consciousness within 15 minutes, an intravenous infusion of dextrose 10% should be started and the blood glucose level should be maintained between 140-220 mg/dL (7.7-12.2 mmol/L).

• Continuous foetal monitoring should be applied during management of hypoglycaemia.

• Consider the possible causes of hypoglycaemia and the appropriate action should be taken:
  
  Possible cause: Has the correct dose of insulin or tablet been taken at the correct time?  
  Action: Make the appropriate adjustment to treatment.

  Possible cause: Has adequate carbohydrate been taken to cover activities?  
  Action: Re-educate patient.

  Possible cause: Is the current treatment appropriate e.g. patient on Glibenclamide.  
  Action: Discontinue Glibenclamide.

• A major change to the patient’s regular diabetes medications should not be made unless it is absolutely necessary.
• Remember that in most cases the hypoglycaemic episode might have been caused by missing or delaying a meal, and in these cases all that is needed is to correct the hypoglycaemia by glucose administration followed by a carbohydrate meal or snack.

• Remember that patients with type 1 diabetes in particular are prone to ketoacidosis and their insulin should not be omitted.

11: Insulin Injection Techniques and Storage Guidelines

11.1: Injection sites

The following instructions should be given to women regarding insulin injection site:

• Inject Insulin into the fat layer just under the skin.

• Inject on the lateral side of abdomen and thigh in pregnancy. See figure 6: (Insulin injection sites).

11.1.1: Example of Insulin Injection Sites:

• **Abdomen:**
  - In the abdomen Inject insulin between the bottom of ribs and pubic area, 1 cm away from umbilicus. Avoid Insulin injection around scars, moles, or skin blemishes see figure 7: (Insulin injection sites, Abdomen).

• **Thighs:**
  - In the abdomen Inject insulin between the bottom of ribs and pubic area, 1 cm away from umbilicus. Avoid Insulin injection around scars, moles, or skin blemishes figure 8: (Insulin injection sites, Thighs).
11.1.2: Site assessment

- Examine before each insulin injection and on follow up for inflammation, bruise, wound or lipohypertrophy.
- Change the injection site (example: from abdomen to thigh) after 3 months and methodical site rotation within site must be advised for each injection. [130]
- Increase self-monitoring of blood glucose while switching injection sites as the rate of absorption may vary the blood glucose levels.

11.1.3: Special conditions

Exercise, local massage, exposure to heat, hot bath or long exposure to sun, may change the rate of insulin absorption. Insulin in these situations gets absorbed more quickly than its normal course so special instructions must be provided.

11.1.4: Injection Site Rotation

The systematic switching of insulin injections from one site to another and within injection site is important to avoid complications such as lipohypertrophy which can slow down the absorption of insulin. [3]

- Take another injection at least 1 inch away from first injection.
- The best practice is to rotate injections site clockwise or anti-clockwise within site (see figure: 9, Insulin injection site rotation).

11.2: Insulin injection during pregnancy

- First Trimester:
• No change in insulin site or technique is needed and women to be reassured.

• **Second Trimester:**
  - Lateral sides of the abdomen are recommended for the injections because of stretching of skin over the central abdomen.

• **Third Trimester:**
  - Skin folds has to be ensured to be properly raised. Very apprehensive patients may use other sites like thighs.

11.3: **Insulin technique through syringe[^139]**

• Wash hands thoroughly with soap and make sure to clean and properly dry them (see figure 10: Wash hands).

• Always inspect insulin vial for correct type of insulin.
  - Visual appearance and expiry date should be checked.
  - If woman is using new vial than make sure to remove its seal first (see figure 11: Inspect insulin vial).

• Roll the clear insulin vial to bring it on room temperature though it doesn’t require mixing (see figure 12: Roll the insulin vial).

• Roll cloudy insulin vial to mix it homogenously, at least ten time between palms.

• Do not shake insulin as it will damage its molecules and create bubbles inside the vial which may be transferred into syringe and cause pain and reduce the insulin dose as prescribed.

• Check syringe, either that is working properly or not by pulling plunger out and in few times to avoid malfunctioning of syringe (figure 13: Check the syringe).
• Put vial on angle at 45 degree and insert needle into it (figure 14: Insulin drawing technique).

• Always draw clear insulin (short acting) in syringe first.

• Draw cloudy insulin from the vial after drawing clear insulin.

• Make sure that no bubbles are formed while drawing insulin from vial as they may cause pain while taking insulin.

• If any bubbles are formed, they can be removed by tapping syringe with fore-finger nail.

• Pinch a generous fold of skin for insulin injection (see figure 15: Skin fold for insulin injection, abdominal area).

• Insert needle with angle of 90 degree (see figure 16 and 17: Insulin injection insertion technique, abdominal and thigh area).

• Before disposing off syringe, clip it properly and dispose-off in safe manner (see figure 18: Disposal of used injection).

11.4: Insulin technique through Insulin pen / Pen device

• Roll the pen at least 10 times between palms of hands to bring insulin on room temperature or take out of refrigerator, 10 minutes prior to injection time (see figure 19: Roll the insulin pen / pen device).

• Never shake pen as it will damage insulin molecules and create bubbles inside the cartridge area.

• Remove packing of needle first (see figure 20).

• Mask needle on interior side of pen (see figure 21).

• Remove the outer cover of the needle and dispose it off (see figure 22).
• Select prescribed units of insulin by rotating rotator at the posterior end of the pen (see figure 23).

• Uncap the inner cover of the needle (see figure 24).

• Insert needle with angle of 90 degree (see figure 25 and 26: Insulin injection insertion technique via pen, abdomen and thighs).

• Always avoid taking insulin inject over the cloths. It may contaminate the insulin or needle or may inject microfibers of fabrics too (see figure 27).

• Before disposing pen needle, clip it properly and dispose-off in safe manner (see figure 28).

11.5: Mode of Insulin Storage

Women should be advised about the storage of insulin on the following important principles:

• If refrigerator is not available, Insulin can be stored in bowl of the cooler containing cold water. There should be no ice. Water must-be clean and should be daily changed (see figure 29).

• Once insulin vial is opened, it should not be used for more than 28 days, except for insulin Detemir which may be used for up to 42 days.\textsuperscript{[131]}

• To keep insulin in a Matkka (clay pot), hang insulin vial tied with threads of different colour at the neck of Clay pot of for identification (see figure 30).

• The water should be changed daily. Matkka should be kept in shaded cool place.

• Insulin pens and/or vials should not be immersed in water as this can contaminate the inside of the pens or compromise sterility.\textsuperscript{[132]}
• Women can also use a double clay pot cooler, in which one bigger pot contains water and other smaller pot contains insulin. The water should be changed on daily basis. These pots should be placed in shade at cold place (see figure 31).
• Insulin should be stored in the door or vegetable compartment of refrigerator between 2 – 8 °C, can be stored up to 2 years (see figure 32).
• Do not store insulin in freezer as insulin loses its efficacy below 2°C. [139]

12: Clinical Management of Neonates of Mothers with diabetes

12.1: Background

• Hypoglycaemia in neonates may be asymptomatic or may show clinical signs.
• All neonates of mothers with diabetes are at risk for development of hypoglycaemia irrespective of treatment whether they are on insulin or not and they should be observed closely. [141]
• Advise women with diabetes to give birth in hospitals where advanced neonatal resuscitation skills are available 24 hours a day. [8], [142]-[146]
• These clinical guidelines have been developed because of the observed association between symptomatic neonatal hypoglycaemia and neurodevelopmental impairment. [147]
• Evaluate newborn for major congenital malformation. [148]

12.2: Clinical Neonatal Management

12.2.1: Thermoregulation

• Thoroughly dry the newborn after birth and cover. Place a hat to cover the head at all times. [146]
• Avoid wet clothing, use warm blankets when wrapped, and set ambient temperature set to > 22°C.\textsuperscript{[146]}

12.2.2: Feeding\textsuperscript{[8],[149]-[154]}

• Initiate skin to skin contacts and start breastfeeding as soon as possible after birth; preferably within the first hour
• Provide feeding at frequent intervals (every 2 to 3 hours) until neonate maintains normal pre feed capillary BG levels around 40-45 mg/dL.
• Neonates should be given supplemental breastmilk substitutes. Feeding may be supplemented, to low-birth- weight neonates (<2.5KG) and also to newborn who cannot be fed their mother’s breastmilk as direct, or expressed breast milk
• If the hospital has a policy for using of donor human milk it can be considered. If donor milk* is unavailable or culturally unacceptable, breast milk substitutes are required.\textsuperscript{[155]}

*Donor human milk: When mother’s milk is not available, the alternatives are either expressed breast milk or breast milk from a donor mother if acceptable.

12.2.3: Rooming-In\textsuperscript{[8],[155]}

• Newborns should stay with their mothers, unless complications or abnormal clinical signs require intensive or special care admission.\textsuperscript{[8],[147]}

12.2.4: Neonatal Assessment

• Do careful examination and observation looking at morbidities after birth and at 24 hours of age (appendix 1). And observe for symptoms and clinical signs (Table 11)
12.3: Observe for Symptoms of hypoglycaemia

- Observe for following signs in a newborn for hypoglycaemia [156], [157] (Table 11)

12.4: Diagnosis of hypoglycaemia

- Hypoglycaemia is defined as capillary glucose by glucometer less than 45 mg/dL (or 2.5 mmol/L)
- Intervention is recommended for blood glucose <40 mg/dL (<2.22 mmol/L) in the first 4 hours of life and <45 mg/dL (<2.5 mmol/L) at 4 to 24 hours of life.

12.5: Point-of-care testing (POCT)

- **Procedure for capillary blood glucose testing**
  - A blood sample obtained from a heel puncture is useful and recommended test in neonates (appendix 2) [158], [159]
  - Allow trained health care personnel, preferably a paediatrician or trained healthcare provider to perform heel prick for BG estimation. The procedure may cause increased pain in newborn, local trauma, damage to nerves, blood vessels and bones, excessive blood loss and infection. [158], [159]
  - The glucometers use non-enzymatic methods are less accurate at lower glucose values than laboratory analysis using glucose oxidase method (the gold standard). [160]
Whole blood samples have 10% to 18% lower glucose concentrations than plasma, depending on the haematocrit. \(^{[160]}\) Therefore, abnormally low glucose values require confirmation by measuring plasma glucose concentration using clinical laboratory methods. \(^{[157]}, [158], [161]}\)

- The most definite diagnosis of hypoglycaemia is by measurement of plasma glucose by established laboratory methods. \(^{[135]}, [150], [153]}\)
- In view of non-availability of laboratory facilities at all places and time delay in getting result, blood glucose values obtained by glucometers is an acceptable alternative. Wherever lab facilities are available, treating physician can take a decision to send a BG sample to the lab without delaying management.

12.6: Refer babies to higher care level service or intensive care management\(^{[8]}\)

- Hypoglycaemia associated with abnormal clinical signs
- Respiratory distress
- Signs of cardiac decompensation from congenital heart disease or cardiomyopathy
- Signs of neonatal encephalopathy
- Signs of polycythaemia, and are likely to need partial exchange transfusion
- Neonate is not able to suck at repeated attempts and blood glucose is <45 mg/dL
- Need for tube feeding (unless adequate support is available on the postnatal ward)
- Jaundice requires intense phototherapy and frequent monitoring of bilirubinaemia
1. Neonate with persistent hypoglycaemia <45mg/dl despite increased feeding frequency
2. If BG cannot be maintained and is > 40-50mg/dl despite IV infusion, 10% dextrose infusion (5-8 mg/kg/minute) at a rate of 80-100 ml/kg/day neonate is recommended
3. If GIR* > 8 to 10 mg/kg/min, may need central line, medical therapy and further investigation.
4. Need for intravenous fluids
5. Neonates born before 34 weeks (or between 34 and 36 weeks, if the initial assessment of the neonate and their feeding suggests this is clinically appropriate).
6. * GIR: Glucose Infusion Rate

12.7: When to discharge the newborn

- They are at least 24 hours old and
  - The neonate is maintaining blood glucose levels and is feeding well.
  - BG is maintained above the threshold of BG goals.
    - Maintain pre-prandial glucose concentrations through three feed-fast cycles should be >50 mg/dL in neonates<48 hours of age.
    - Maintain pre-prandial glucose concentrations > 60 mg/dL in those who are ≥48 hours of life.

13: Breastfeeding

Introduction:
Considering the value of breastfeeding for both mother and newborn, all women should be encouraged and supported to attempt breastfeeding. Breastfeeding is known to offer longer-term metabolic benefits to both mother and offspring. Furthermore, it is protective from several complications in the infant and mother including reduction of childhood obesity, T1DM and T2DM and helps with postpartum weight loss. Give additional support and encouragement to women with pre-existing diabetes as they tend to have delayed milk production due to poor glycaemic control.

### 13.1: Recommendations:

1. **Encourage women with history of HIP to initiate and maintain breastfeeding.**
   - [70] Start counselling from the prenatal period and motivate women to breastfeed using strategies from guidance on baby-friendly hospital initiative by the WHO. [155]

2. **Encourage women with pre-existing diabetes to breastfeed immediately after delivery and for at least 6 months postpartum, as it may contribute to the reduction of neonatal hypoglycaemia, offspring obesity and prevent the development of diabetes.** [68] Exclusive breastfeeding up to 6 months and continuation of breastfeeding up to 2 years with appropriate complementary feeding has shown further benefits and is currently recommended for all women. [169], [170]

3. **Education, support and alleviate post-operative discomfort to improve BF practices.** [9], [171]

4. **Consult with a lactation consultant/diabetes educator to support women needing help with positioning, initiation of breastfeeding or support overall.** [155] Counselling should begin from the prenatal period. [155] Women
need support and encouragement to continue breastfeeding if mastitis occurs.\textsuperscript{[172]} (See Appendices 3 and 4 for links to educational videos to help promote and support breastfeeding)

5. Educate on the option of breast pumps to help achieve personal lactation goals and includes a range of options including manual, battery-operated, electric and hospital grade. \textsuperscript{[173]}

6. Explain to women with pre-existing diabetes who were treated with insulin to have a meal or snack available before or during feeds to avoid hypoglycaemia. \textsuperscript{[174]}

7. Reduce insulin doses immediately in the postpartum period by approximately 30-50% to avoid hypoglycaemia in breastfeeding women.\textsuperscript{[171]}

For women on insulin pump therapy, reduce basal insulin by at least 50% after delivery to avoid hypoglycaemia.\textsuperscript{[175], [176]}

Review the list of medications, Insulin and commonly used oral antidiabetic medications that are not contraindicated in breastfeeding as their concentration in breastmilk is negligible and does not cause hypoglycaemia in the newborn. \textsuperscript{[12], [171]} For details on the recommendations of use for individual antidiabetic medications. (See Appendix 4)

8. Advise to avoid any medicines for the treatment of diabetes complications that were discontinued for safety reasons in the preconception period.\textsuperscript{[174]}

9. For women with symptoms of COVID-19 or confirmed infection, breastfeeding can continue while the woman is wearing face mask or cloth face covering and maintaining hand hygiene. Breastfeeding women should be vigilant with washing their hands before using breast pump and should clean bottles and pump parts after every use.\textsuperscript{[177]}
Women with diabetes and HIP are considered at high risk to develop severe COVID-19 complications and therefore vaccination can be considered.\textsuperscript{[178]} Up to the date of this guidelines publication, the Center for Disease Control and Prevention (CDC) as well as the International Federation of Gynaecology and Obstetrics (FIGO) indicate that breastfeeding women can chose to get vaccinated.\textsuperscript{[179]} However, vaccines have not been studied in lactating women.\textsuperscript{[180]}

**14: Contraception**

A family planning scheme including contraception either permanent or reversible should be discussed with all women with diabetes of reproductive age.\textsuperscript{[8],[30]} The aim of pregnancy spacing is to ensure that pregnancy should be planned when the mother’s metabolic health is optimum to reduce risks of spontaneous abortions or congenital malformations and to maintain and achieve ideal wellbeing between pregnancies.\textsuperscript{[8],[9],[30]}

The WHO Medical Eligibility (MEC) Criteria for Contraceptive may be considered for categorization of contraceptive methods into beneficial categories.\textsuperscript{[181]}

**Recommendations**

**14.1: Providing Family planning solutions**

14.1.1: Advise women with diabetes that they can use oral contraceptives if there are no comorbidities like including nephropathy, retinopathy and vascular complications.\textsuperscript{[8]}
14.1.2: Explore women’s preferences, beliefs and wishes for their optimal contraceptive method, either temporary or permanent to ensure compliance.\cite{72}

14.1.3: Arrange specialist counselling of women with diabetes and complications by specialist in respect to hormonal contraception.\cite{183}

14.1.4: Offer family planning solutions in the antenatal visits and document in the antenatal card.

14.2: Hormonal Contraceptive Therapy (HCT)

14.2.1: Recommend combined hormonal contraception (CHC) including combined contraceptive pills, transdermal contraceptive patches, combined vaginal rings, and combined injectable contraception in women <35 years of age without co morbidities like hypertension, nephropathy, retinopathy, (category 2 of MEC).\cite{2}, \cite{181}, \cite{183}-\cite{185} (see Table 12). In women with these comorbidities, other choices may be preferred where it is considered MEC 3 to 4.\cite{2}, \cite{183}-\cite{185}

14.2.2: Recommend Progestogen-only pill (POP) for women with diabetes especially lactating mothers of any age regardless of their complication status \cite{2}, \cite{183}-\cite{185} (see Table 12).\cite{181}, \cite{184}

14.2.3: The failure rate of hormonal contraceptive therapy is quite low in perfect users is 0.3% but the typical user failure rate is 9% (see Table 13).\cite{186}

14.3: Long-acting reversible contraception

14.3.1: Long-acting reversible contraceptives (LARC) including intra uterine devices (e.g., Levonorgestrel (LNGIUS)-based systems), progestogen-only injectable contraceptives, and progestogen-only subdermal
implants, are relatively safe and can be recommended if resources permit (see Table 12).\cite{183}

14.3.2: Non-hormonal Intrauterine Contraceptive Devices (NH-IUCD), e.g., Copper-T, multi-load can be offered safely as an inexpensive method especially in the immediate postpartum period (see Table 12).\cite{2,183,186}

14.3.3: The failure rate of LARC is low (0.3-0.6%) and it is very effective family planning method for women with diabetes (see Table 13).\cite{186}

14.4: Long-acting reversible contraception

14.4.1: Natural and barrier methods include condoms, vaginal diaphragm, withdrawal method, calendar method and lactation have category 1 (MEC) a failure rate of 2-28% (see Table 12 & 13).\cite{2,183,186}

14.4.2: Consider women who have irregular menstruation and rely on these methods alone may entail the risk of unplanned pregnancy.\cite{2,176,179}

14.5: Emergency contraception methods (ECM):

14.5.1: The use of copper intrauterine devices (Cu-IUCD) in women with diabetes is not restricted.\cite{184,187} Cu-IUCD can be inserted within 5 days of unprotected intercourse. The efficacy of emergency Cu-IUCD insertion is very high in preventing pregnancy reaching up to 99%.\cite{186}

14.5.2: The use of progesterone only oral contraceptive pills in women with diabetes is not restricted.\cite{2,181,186} The availability of emergency progesterone only oral contraceptive pills is variable in different countries of the region. The dose of Levonorgestrel (LNG) is 1.5 mg, or 2 doses of 0.75 mg each, 12 hours apart within 5 days after unprotected intercourse.\cite{188}
14.6: Permanent Contraception

14.6.1: Offer Pre procedure counselling to couples to prevent regrets. Factors like young age, number of children, religious and cultural beliefs should be taken into consideration before initiating the process. [189]

14.6.2: Provide the choice of Tubal ligation/vasectomy, as safe and effective methods for couples wishing for permanent contraception. [2], [183]-[185] The failure rate following both methods is very slim accounting for 1 in 200-2000 un-intended pregnancies (see Table 13). [2], [183]-[186]

15: Hyperglycaemia and Foetal Loss

15.1: Women with diabetes are at an increased risk of miscarriage, congenital anomalies and stillbirth with uncontrolled blood glucose. [8], [190] - [192] Foetal loss is often sudden, unexpected and has a huge psychological impact on the woman and her family [149], [193], [194], [195]

15.2: Management of women with hyperglycaemia in pregnancy and foetal loss

15.2.1: Confirm the diagnosis of intrauterine foetal death (IUFD) by ultrasonography. Communicate the diagnosis with the woman and her partner. Discuss timing and methods of pregnancy termination. [149], [150], [153]

15.2.2: Methods of pregnancy termination will vary according to gestational age and previous uterine surgery. [149], [150], [153]

- Vaginal birth is the recommended mode of delivery for most women with late uterine death (after 24 completed weeks). [141], [142], [145]
• Misoprostol is of equivalent safety, efficacy and with lower cost as compared to prostaglandin E2.\textsuperscript{[149], [150], [153]}

• The dose of misoprostol should be adjusted according to gestational age.\textsuperscript{[196]}
  
  ▪ <13 weeks: 800ug P/V every 3 hours (x2)
  ▪ 13-26 weeks: 200ug P/V/sublingual/buccal every 4-6 hours
  ▪ 27-28 weeks: 100ug P/V/sublingual/buccal every 4 hours
  ▪ >28 weeks: 25ug P/V every 6 hours

• Use lower doses of misoprostol in previous C-Sec doubling of doses should not be used because of the risk of uterine rupture.\textsuperscript{[197], [198]}

• Use Foley catheter for induction of labour specially in women with previous caesarean section.\textsuperscript{[199]}

• Prostaglandin E2 vaginal pessary can be used for termination of IUFD >28 weeks’ gestation if small dose of misoprostol is not available.\textsuperscript{[12]}

• Offer adequate analgesia during delivery and deliver in a private delivery room with careful monitoring.\textsuperscript{[149], [150]}

15.2.4: Evaluation of the unexplained intrauterine foetal death.

Parents can be offered:

• Post-mortem examination or a limited autopsy to explain the cause of IUFD.\textsuperscript{[149], [150]}

• Limited autopsy includes external examination, birth weight, karyotyping, histology of relevant tissues, skeletal X-rays and pathological examination of the cord, membranes and placenta. MRI can be used as an alternative to post-mortem examination.\textsuperscript{[149], [150]}
• A thorough maternal evaluation including Antiphospholipid Syndrome screening and a Kleihauer Betke test are advised. \[^{200}\]

15.2.5: Management following pregnancy termination

Women with late intrauterine foetal death:

• Admit in private rooms or gynaecological wards. \[^{149}, [150]\]
• Offer counselling and support to couple and their families. \[^{149}, [150]\]
• Evaluate for their psychological well-being and the advice of psychiatrists should be sought if any psychological disturbance develops. \[^{2}\]
• Offer Dopamine agonist cabergoline for lactation suppression but avoid in women with hypertension or preeclampsia. \[^{149}, [150]\]

15.3: Recommendations for the future pregnancy after foetal loss in pregnant women with hyperglycaemia

Advise the couple to:

• Delay conception until severe psychological issues have been resolved. \[^{149}, [150]\]
• Avoid pregnancy before achieving an ideal glycaemic control by using an effective contraceptive method. \[^{8}, [149]-[153]\]
• Reduce the risk of congenital anomalies and miscarriages, achieve and maintain HbA1c around 6% (48 mmol/L). \[^{84}\]
• Undertake screening with 75 g 2h OGTT 6-8 weeks postpartum and at of 6–12 weeks in their future pregnancies. \[^{2}\] Women who are planning for pregnancy are advised to take 5mg of folic acid 2 months
before conception and to continue for 12 weeks of pregnancy to prevent neural tube defect. [8], [149]-[153]

- Continue blood glucose monitoring all through pregnancy and aim at euglycaemia. [8], [84]

16: Management of Diabetes in Pregnancy in Ramadan*:

*This section has been adapted with modifications from IDF-DAR Diabetes and Ramadan: Practical guidelines 2021

16.1: General principles of care

Diabetes in pregnancy predisposes women to an increased risk of hyperglycemia and hypoglycemia, which can have adverse effects for both the mother and her fetus [201]-[203]. It is because of these risks that women with GDM, even if controlled with diet or metformin, are advised against fasting in Ramadan. Women with history of type 1 or type 2 diabetes in pregnancy are at high risk, and, consequently, advised against fasting. [203]

Observing the fast during pregnancy is a personal decision and many women wish to fast even though there is a religious exemption attributed to pregnancy and diabetes.

16.2: Pre-Ramadan Assessment for women with pre-existing diabetes who insist on fasting against advice

- Give comprehensive education to women to empower them to care for themselves leading to better pregnancy outcomes.
- Undergo full medical and obstetrical assessments and perform fasting risk
evaluations.

- **16.2.1: Education and Blood Glucose Monitoring of Pregnant Woman with Diabetes**
  - Set up an education session prior to Ramadan to ensure maternal and fetal well-being.
  - Adjust the doses of insulin according to their insulin regimen
  - Set up desired blood glucose levels and explain their effect on the mother and fetus. Educate about the pharmacodynamics of insulin, review insulin injection techniques. Make sure these women know how to cope with hypoglycemia and are aware of when to break the fast. \[204\]
  - Reassure pregnant women that finger pricking testing for blood glucose levels does not break their fast and regular monitoring is essential for safe fasting. \[205\]
  - Educate women on the use of urine ketone strips if it is affordable for them.
  - The use of CGM or GFM can provide a better assessment of glucose profiles and opportunity for intervention where resources permit. \[206\]
    - \[209\]

- **16.2.2: Physical Activity**
  - Exercise is a must. Timing and intensity may need alteration. For example, two hours after the sunset meal. Taraweeh prayer is as a form of exercise.

- **16.2.3: Nutritional care and meal planning**

  Give following professional dietary advice before Ramadan.
• Do not take high calorie meals.
• Avoid Fruit juices and sugary drinks.
• Avoid salty foods and caffeine intake.
• Eat fiber rich foods.
• Drink 2-3 liters of water a day.
• Take Suhoor close to the morning call for prayer.

○ 16.2.4: Management of hyperglycaemia in pregnancy during Ramadan fasting\textsuperscript{[210] – [211]}
  • Hyperglycemia in pregnancy is treated with metformin, insulin.
  • Glibenclamide should be discouraged during Ramadan fasting.

○ 16.2.5: Glycemic targets
  • Pregnant women must achieve the standard blood glucose targets during pregnancy even when fasting in Ramadan.
  • Fasting glucose between 70-95 mg/dL (3.9 – 5.3 mmol/L).
  • Two-hour Post-prandial glucose < 120 mg/dL (6.7 mmol/L).

○ 16.2.6: Timing of glucose monitoring
  • Conduct regular SMBG during fasting hours as well as 1-2 hours after meals.
  • Once before the sunset meal
  • 1-2 hours after the meal
  • Once during the afternoon
  • Any time the woman feels unwell

○ 15.2.7: Break the fast rules: Advise pregnant women to break their
fast whenever

- BG levels < 70 mg/dL (3.9 mmol/L),
- BG >200 mg/dl (11.1mmol/L),
- Feeling unwell
- Reduction in fetal movements
- High ketones level if using urine ketone strips.

**15.2.8: Insulin treated pregnant women:**

- Pregnant women receiving insulin should strictly monitor their blood glucose. The blood glucose should be checked at any time during the day or night when feeling unwell.
- For insulin dose adjustments see recommendation 9.1.1.
- Insulin modifications for Hyperglycemia during Ramadan fasting

- **Intermediate/ (Levemir, NPH)**
  - Give same am dose at Iftar time
  - Give pm dose at Suhoor

- **Long acting Insulins (Glargine)**
  - Not approved by FDA
  - Consider switching to intermediate insulins
  - However, if no alternatives available, give the dose of Glargine at 8-10 pm

- **Short acting insulins (Regular, Aspart, Lispro)**
  - Analogues are preferred
  - Continue insulin and carbohydrate counting
• If no CHO counting
  – **Iftar**: Give same pre-Ramadan lunch dose
  – **Night meal**: Give 50% of Iftar dose
  – **Suhoor**: 75% of Iftar dose

  – **Pre-mixed insulins**
    • Not preferred in pregnancy, however, if no alternatives available: (see 9.2.6)
      – Give pre-lunch dose at Iftar time
      – Give 50-70% of that dose at Suhoor

  – **Insulin pump**
    • Basal
      – 20-40% reduction of basal insulin (last 4-6 fasting hours)
      – 10-30% increased basal insulin (first 4-6 eating hours)
    • Bolus
      – Same short acting principles

17: **Future Research Recommendations:**

1. Comparison of standard one step 2-hour 75g OGTT and Non-fasting 75g OGTT (DIPSI method) for the diagnosis of HIP to find out what suits best for MENA region.
2. Application of glycosylated haemaglobin HbA1c in the screening and monitoring of GDM in MENA region
3. Identify factors responsible for noncompliance for postpartum BG screening and ways to improve Postpartum BG Screening uptake by the women of MENA region
4. Evaluating GDM as a risk factor for future T2DM
5. Impact of MENA region guideline recommendations on clinical practice
6. Comparing prevalence of HIP in MENA region countries using a uniform strategy and diagnostic criteria proposed by the MENA region Guideline.
7. Evaluation of the effectiveness of MNT for effective glycemic control in MENA region.
8. Impact of mobile health applications on diabetic control during pregnancy in MENA region
9. Role of prophylactic Metformin alone or with Insulin, in control of BG after antenatal Corticosteroids.
18. Sharon Kozak B, Edmond Ryan M, Mathew Sermer M. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee The initial draft of this chapter was prepared by David Thompson MD, FRCPC, Howard Berger MD, Denice Feig MD, MSc, FRCPC, Robert Gagnon MD, FRCSC, Tina Kader MD, FRCPC, Erin Keely MD, FRCP.
Choi J, Shultz L, Brazee J, Orr E. Diagnosis of Late-Onset Gestational Diabetes in the Third Trimester [34A]. Obstetrics & Gynecology. 2020;135:17S.


100. Ota E, Tobe-Gai R, Mori R, Farrar D. Antenatal dietary advice and supplementation to increase energy and protein intake. Cochrane database of systematic reviews. 2012(9).


55 G-tGN. Late intrauterine fetal death and stillbirth. In: Gynecologists RCoO, editor.: October; 2010.


196. FIGO. Misoprostol Dosage Chart (2017)


# List of Abbreviations

<table>
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<tr>
<th>No.</th>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>1</td>
<td>AGEs</td>
<td>Advanced Glycosylation End Products</td>
</tr>
<tr>
<td>2</td>
<td>ADA</td>
<td>American Diabetes Association</td>
</tr>
<tr>
<td>3</td>
<td>ACE</td>
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<td>CBC</td>
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<td>DRI</td>
<td>Daily Requirement Index</td>
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<td>13</td>
<td>Cu-IUCD</td>
<td>Copper intrauterine devices</td>
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<tr>
<td>14</td>
<td>DIPSI</td>
<td>Diabetes in Pregnancy Study Group of India</td>
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<td>15</td>
<td>ECG</td>
<td>Disseminated intravascular coagulation</td>
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<tr>
<td>1</td>
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<td>16</td>
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<td>17</td>
<td>NH-IUCD</td>
<td>Non-hormonal Intrauterine Contraceptive Devices</td>
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<tr>
<td></td>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>1</td>
<td>OGTT</td>
<td>Oral glucose tolerance test</td>
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<td>OHA</td>
<td>Oral hypoglycemic agents</td>
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<td>POP</td>
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<td>Urea &amp; electrolytes</td>
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