



Society of Obstetricians &
Gynaecologists of Pakistan

GUIDELINES

HYPERGLYCAEMIA IN PREGNANCY (HIP)

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**Society of Obstetricians &
Gynaecologists of Pakistan**

Guidelines for Management of Hyperglycaemia in Pregnancy (HIP): A practical guideline by Society of Obstetrics and Gynaecology of Pakistan (SOGP)

**Masood SN, Baqai S, Naheed F, Masood Y, Sikandar R,
Chaudhri R, Yasmin H, Korejo R,**

Endorsed by
Diabetes in Asia Study Group (DASG)



President Message



Dear Members,

I would like to offer my heartiest congratulations to you all on the successful publication and International recognition of our “Guidelines for managing Hyperglycemia in Pregnancy”. These guidelines as well as awareness and prevention of diabetes mellitus are of great importance to us and all pregnant women. With the distribution of this pamphlet, we are immensely proud to have taken a step towards creating awareness of a matter of such significant importance that is to be disseminated and practiced at all forums for better patient management.

I also take this opportunity to extend my sincerer congratulation to the GDM Guidelines development core group specially, Prof. Shabeen Naz Masood, Prof Maj Gen. Shehla Baqai HI(M), Prof. Rizwana, Chaudhry, Prof. Raheel Sikandar, Prof. Haleema Yasmin & Prof. Farrukh Naheed for their tireless efforts in this regard.

I am fortunate to have a wonderful team as my Executive Committee and very valuable members of Academic Board of SOGP. All of them have been sharing their wisdom for uplift of academic cause of national society.

With warm regards,

Prof. Razia Korejo

Secretary General Message



Dear Member SOGP,

It gives me great pleasure to write this message on the event of launch of “SOGP GDM Guidelines”. The burden of non-communicable diseases is considerably effecting the wellbeing of our women. We needed to develop this document as the South east Population is at a very high risk to develop Diabetes in Pregnancy.

This endeavor of SOGP can be a game changer for managing hyperglycemia in pregnancy for our practitioners.

Prof. Haleema Yasmin

Secretary General SOGP

Chair Guideline Committee Message



The guidelines for Hyperglycemia in Pregnancy (HIP) cannot come about without deep gratitude and thanks to be offered to many colleagues. As is true for many academic professionals, I am a clinician, researcher and teacher. I could not have developed these guidelines without the help, guidance, support and critique from my mentors, colleagues and friends.

I have to start by thanking the core group of Society of Obstetricians and Gynecologists of Pakistan (SOGP) guideline committee: Prof. Shehla Baqai, Prof. Farrukh Naheed, Dr. Yasir Masood, Prof. Raheel Sikandar, Prof. Rizwana Chaudhri, Prof. Haleema Yasmin, Prof. Razia Korejo, for their professionalism and their patience towards preparation of these guidelines. I appreciate their valuable time for virtual weekly meetings,

stimulating discussions and constant help in spite of their enormous clinical workload. I would also like to acknowledge my thanks to other unsung heroes in my clinical practice that took care of my clinical workload when I was busy with the guidelines.

Behind the successful completion of these guidelines, my very patient and supportive husband Wajid Masood, owes my deep thanks not only for these guidelines but he steadfastly stood by me all through my years of training research and clinical practice.

I would like to acknowledge my enormous debt of gratitude to my teacher Prof. Noor Jahan Samad and my mentor Prof. A. Samad Shera (Late), who encouraged the pursuit of excellence in academics and research in pregnancy with diabetes.

My huge thanks to Dr. Viswanathan Mohan, for his guidance, persistent help, encouragement and unconditional support for critical insight and in-depth review. My sincere gratitude to Prof. Akhtar Hussain, President Elect IDF, and Prof. Jamal Belkhadir, Chair IDF-MENA Region, for their kind review and support. I am listing the acknowledgement to Prof. Ahmed Bilal and Prof. Zaman Shaikh for their help in providing postscripts and add-ons for the guidelines.

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Thanks to Getz Pharmaceuticals, for their enormous support towards dissemination of the guidelines. In the end I would like to acknowledge my thanks to the health care and nurse practitioners who helped me gain the inspiration, confidence and hubris to take on such a monumental task.

Prof. Dr. Shabeen Naz Masood

Message by Authors

SOGP HIP Guideline

It gives us immense pleasure to write at the launch of SOGP guideline for management of hyperglycaemia in pregnancy.

Raised blood glucose in pregnancy is a major public health issue in the ever growing diabetes epidemic witnessed in Pakistan. Timely identification and intervention of HIP reduces the risk of adverse pregnancy outcomes. The aim of the proposed pragmatic HIP guidelines by the SOGP is to standardize clinical practice for diagnosis and management of hyperglycaemia in pregnancy across the country. SOGP- HIP guidelines will go a long way in improving clinical practice and women health.

Prof. Dr. Shabeen Naz Masood

Prof. Shehla Baqai HI(M)

Prof. Farrukh Naheed

Dr. Yasir Masood

Prof. Raheel Skindar

Prof. Rizwana Chodhry

BEACON OF LIGHT

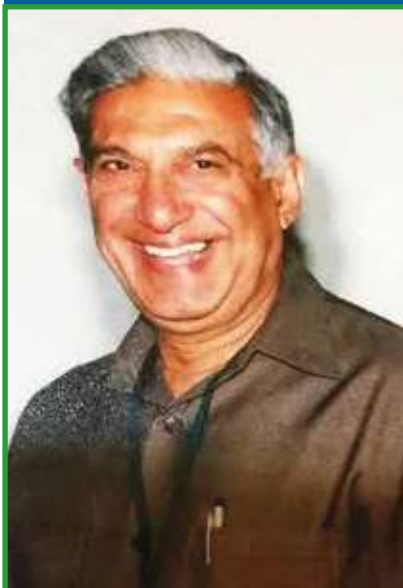
SOGP



Prof. Aftab Munir



Prof. Khalida A.K. Akhtar



Prof. Rashid Latif



**Prof. Sadiqua
Jafarey**



Prof. Shafiq Ahmed

List of Authors



Shabeen Naz Masood

(Corresponding Author)
MBBS, MCPS, FICS, FCPS, PhD, DCPS (HCSM).
Chair GDM Guidelines Committee
Society of Obstetricians & Gynaecologists
of Pakistan (SOGP).
Professor and Head Department of Obstetrics
and Gynecology,
ISRA University, Karachi-CAMPUS PAKISTAN
E-mail: sh_naz@yahoo.com
Phone: 0092(0)3332233414



Raheel Sikandar

FCPS
Professor of Obstetrics & Gynecology
Liaquat University of Medical & Health Sciences,
Jamshoro Sindh Pakistan.
E-mail: raheel.sikandar@gmail.com



Shehla Baqai

MBBS, MCPS, FICS, FCPS, MCPS-HPE
Professor of Obstetrics & Gynecology
Dean Clinical Sciences,
CMH Lahore Medical College,
National University of Medical Sciences,
Pakistan
E-mail: shehlabaqai@hotmail.com



Rizwana Chaudhri

MBBS, MCPS, FCPS, FCPS(BD), FRCP(Glasgow),
FRCOG(UK)
Professor and Head Department of translational
research,
Shifa Tameer-e-Millat University, Islamabad Pakistan.
Ex Dean and HOD Obstetrics and Gynaecology
Rawalpindi Medical University.
Editor in chief of JSOGP
E-mail: rizwanachaudhri@hotmail.com



Farrukh Naheed

MBBS, MCPS, FCPS
Professor and Head Department of
Obstetrics and Gynecology,
Baqai Medical College, Baqai Medical
University, Karachi Pakistan
E-mail: farrukhnaheed@yahoo.com



Haleema Yasmin

MBBS, FCPS
Professor of Obstetrics & Gynecology,
Jinnah Postgraduate Medical College, Karachi Pakistan
Secretary General (SOGP),
E-mail: dr.haleemayasmin@yahoo.com



Yasir Masood

M.D.
Masters of Public Health Graduate Student,
Graduate Research Assistant, Race &
Opportunity Lab, Brown School,
Washington University in St. Louis, Missouri, USA
e-mail: yasirm@wustl.edu



Razia Korejo

MBBS, FCPS
Professor of Obstetrics & Gynecology,
Bahria University Medical & Dental College,
Karachi, Pakistan
President (SOGP),
e-mail: sogjpjmc@hotmail.com

**SOGP is pleased to share
the Hyperglycaemia in
Pregnancy (HIP) Guidelines
developed for Pakistan
recognized internationally
and published in Journal
of Diabetology**

Guidelines for Management of Hyperglycemia in Pregnancy (HIP) by Society of Obstetricians & Gynaecologists of Pakistan (SOGP)[#]

Shabeen Naz Masood¹, Shehla Baqai², Farrukh Naheed³, Yasir Masood⁴, Raheel Sikandar⁵, Rizwana Chaudhri⁶, Haleema Yasmin⁷, Razia Korejo⁸; GDM Guidelines Committee, Society of Obstetricians & Gynaecologists of Pakistan (SOGP)

¹Department of Obstetrics and Gynecology, Isra University, Karachi-Campus, Pakistan, ²Department of Obstetrics & Gynecology, CMH Lahore Medical College, National University of Medical Sciences, Lahore, Pakistan, ³Department of Obstetrics and Gynecology, Baqai Medical University, Karachi, Pakistan, ⁴Brown School, Washington University in St. Louis, St. Louis, Missouri, USA, ⁵Department of Obstetrics & Gynecology, Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan, ⁶Department of Translational Research, Shifa Tameer-e-Millat University, Islamabad, Pakistan, ⁷Department of Obstetrics & Gynecology, Jinnah Sind Medical University, Karachi, Pakistan, ⁸Department of Obstetrics & Gynecology, Bahria University Medical & Dental College, Karachi, Pakistan

Abstract

Hyperglycemia in pregnancy (HIP) is an important component of primary prevention of diabetes both globally and in Pakistan. To ensure that the opportunity of primary prevention is not missed it is important to diagnose hyperglycemia early in pregnancy. Universal screening in pregnant women at booking is recommended with its implementation at primary, secondary and tertiary levels of health care settings. These guidelines by Society of Obstetricians and Gynecologists (SOGP) are pragmatic addressing screening methodology, preconception care screening & diagnosis, antenatal care plan, intrapartum and postpartum management & follow up, neonatal care, breastfeeding, contraception, counseling for future pregnancy, lifestyle modification, nutritional recommendations and proper techniques for insulin injection, management of diabetic ketoacidosis (DKA) and recommendations for future research. There are many available guidelines for the screening, diagnosis and management of HIP. The SOGP GDM guidelines recommendations are simple, tailored to the local context especially for the busy health care providers; medical as well as nurse practitioners, for whom it is confusing to choose the recommendations from different available guidelines. These guidelines are meant to standardize clinical practice at all health care levels across the country. In order to ensure its practical utilization, a national GDM registry has been proposed and designed so as to observe its applicability in the clinical practice by health care providers.

Keywords: Antenatal postnatal surveillance management, diabetes, GDM guidelines, hyperglycemia in pregnancy, preconception counseling

OVERVIEW

The Society of Obstetricians and Gynecologists of Pakistan (SOGP) is the specialist professional body of Obstetrics and Gynecology founded in March 1957, with the mission to provide evidence-based Continuous Medical Education to obstetricians and gynecologists of Pakistan and to improve reproductive health of women and new-borns through education, service provision, advocacy, research, and leadership. Overall SOGP has

3,500 members, with two International, and 21 Regional Chapters throughout Pakistan. SOGP has international affiliation with South Asia Federation of Obstetrics and Gynaecology (SAFOG), Asia and Oceania Federation

Address for correspondence: Dr. Shabeen Naz Masood, Department of Obstetrics and Gynecology, ISRA University, Karachi Campus, Pakistan.
E-mail: sh_naz@yahoo.com

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of Obstetrics and Gynaecology (AOFOG), and The International Federation of Gynecology and Obstetrics (FIGO).

SOGP in view of its mission aims to bring together its members to provide quality reproductive health care to women and realized that in the presence of a number of international guidelines for diabetes in pregnancy, a comprehensive local guideline was needed to overcome contextual barriers. In resource constrained health settings of Pakistan a cost -effective and uniformed guidelines for screening, diagnosis, and management of diabetes in pregnancy was essential. This would help to optimize the uniformity of clinical care pragmatically and would assist in assessing the prevalence of disease.

These guidelines are endorsed by Diabetes In Asia Study Group; an international organization with the aim to promote education and awareness of diabetes, to encourage research in the field of diabetes and related disorders, to promote exchange of opinions and to foster advocacy.

The end users of the guidelines are practitioners like obstetricians, family physicians, internist physicians, endocrinologists, diabetologists, primary healthcare physicians, nurse practitioners, and midwives. These health care providers are confronted with a number of varied gestational diabetes mellitus guidelines which are difficult to choose and follow in their busy clinical practices. The best evidence -based descriptiveness about the appropriate use of insulin will be of particular help to nurse practitioners and midwives. Standard protocols, diagnostic tools, feedback mechanism, follow -up system, and future research recommendations have also been included in the guidelines.

Guidelines are intended to assist in the provision of optimal clinical care and to make informed decisions with full responsibility and not to override or supersede clinical judgments.

Society of Obstetrics & Gynecologists of Pakistan (SOGP)
Department of Obstetrics and Gynaecology, Jinnah
Postgraduate Medical Center, Karachi, Pakistan
Telephone: +92 -99205040
Fax: +92 -99205040
Email: sogpjpmc@hotmail.com
Website: <http://www.sogp.org>

EXECUTIVE SUMMARY

International Diabetes Federation (IDF) estimates that 463 million people of world's population aged 20–79 years (9.3%) are coping and living with diabetes.^[1]

Among all IDF Regions, Middle East and North Africa (MENA) Region has the highest age -adjusted diabetes prevalence of 12.2%. In the MENA Region, Pakistan ranks second in number (19.9%) after Sudan (22.1%),

of adult population is living with diabetes. In India, Bangladesh, and Sri Lanka, people in the age group of 20–79 years make up 98.9% of the total adult population with diabetes in this Region.^[1]

Gestational diabetes mellitus (GDM) is reflected by the global epidemic of Type 2 diabetes mellitus (T2DM) with an estimated 223 million women aged 20–79 years living with diabetes.^[1]

Globally, of 76 million women of reproductive age, about 22 million women are with diabetes and 54 million had impaired glucose tolerance (IGT) or prediabetes with potential to develop GDM if they become pregnant.^[2]

Of the seven IDF Regions, prevalence of hyperglycemia in pregnancy is highest in IDF -MENA and SEA Regions in women aged 20–49 years. The age-adjusted prevalence is 17.9% and 26.6%. ^[2] IDF in 2019 estimates that 20.4 million (15.8%) live births are affected by hyperglycemia in pregnancy; that is, 1 in 6 births are affected by GDM.^[1]

The prevalence of GDM in different studies is 1–28% of all pregnancies. These wide variations are because of nonuniformity of universally agreed definition, screening, and diagnostic criteria for GDM.^[3,4]

Although GDM is a short -term disorder and resolves after the birth, it leaves its legacy in the form of future development of T2DM, 3–6 years after the index pregnancy. This exposes the women to high risk of all complications related to T2DM and 1.9 -fold odds of developing cardiovascular disease.^[5]

Uncontrolled hyperglycemia not only results in early pregnancy losses, it also exposes neonate to the risk of congenital abnormalities, metabolic disorders like hypoglycemia, hypocalcaemia, and hypomagnesaemia immediately after birth. Infants born out of a diabetic pregnancy may develop insulin resistance and IGT as early as 10–14 years of age,^[6] and lifetime risk of development of T2DM, hypertension, obesity, cardiovascular disease, and metabolic syndrome in the future.^[7]

To prevent future complications of diabetes in women and in children in early adulthood, screening diagnosis and appropriate management of hyperglycemia in pregnancy can reduce the risk and future burden of the disease. Adequate glycemic control during pregnancy has shown to improve insulin resistance, particularly in female offsprings, which they may develop as early as 5–10 years of age and prevent them from future development of T2DM. ^[8]

The overall objective of this guideline was to provide healthcare professionals a pragmatic approach for clinical management of women with preexisting diabetes or with previous history of GDM. It addresses prepregnancy counseling to women and their families so that they

pregnancy. This guideline incorporates evidence- and practice-based recommendations about prevention, blood glucose (BG) screening and diagnosis, management of diabetes in pregnancy, neonatal care, and breastfeeding. In addition, it also emphasizes postpartum follow-up for BG screening and contraception. It also includes implications and recommendations for future research.

GDM guideline recommendations are made after reviewing different guidelines, researches, reviews, updates, consensus, and meta-analysis from EMBASE, MEDLINE, PsycINFO, Cochrane Database of Systematic Reviews (CDSR), Google Scholar, and MedlinePlus by using MESH terms. The literature was reviewed over the period of 2008 to 2020. Search strategy was systematic and transparent to avoid biases, devised as Population Intervention Comparison Outcomes (PICO). Only published evidence-based guidelines were included in the study, anecdotal and experimental studies were excluded, and robust evidence was selected with the group consensus. The information gathered from the above-mentioned literature search was used by the committee for the development process and formation of recommendations according to scientific evidence and local cultural practices to assist in making informed clinical decisions and modify practices to improve the standard of care for women with diabetes. All the recommendations are evidence-based and supported by the references.

AREAS OF DISAGREEMENT

The areas of disagreement were fundamentally about the timings of screening, its methodology and diagnostic criteria. IDF-MENA and SEA Regions are known to have a high prevalence of T2DM in the younger age group, increasing prevalence of metabolic syndrome, central obesity, and ethnicity being the highest risk factors. Therefore, the link between scientific evidence and clinical recommendations were reinforced, and the consensus were agreed for universal, single-step OGTT at first antenatal booking visit.

After an in-depth review of NICE, FIGO, WHO, and IADPSG guidelines, the committee developed consensus for diagnostic and control values of BG, its feasibility, application, and implementation in the local context.

In view of poor postpartum follow-up by women, the difference of opinion among the core group was on appropriate timings of postnatal BG screening and diagnosis, (within 24–48 h or 6 weeks after birth). This was resolved by discussion and evidence from literature, published studies, and guidelines.

To address the screening diagnosis and management of GDM, these guidelines recommend the following:

- Prepregnancy clinic includes the importance of screening and counseling of women and their family

members regarding control of BG before planning a pregnancy. Review and adjustment of dosage and types of medications being taken for preexisting diabetes which includes oral hypoglycemic drugs and insulin. Antihypertensives like ACE inhibitors and ARBs to be replaced with safer antihypertensives. Statins and fibrates are to be stopped. Advice for folic acid 5 mg 3 months prior to planning pregnancy were incorporated.

- Blood glucose screening: In view of rising trends of central obesity, increasing prevalence of metabolic syndrome, high prevalence of young age onset of T2DM and Asian ethnicity, this guideline recommends Universal BG screening of pregnant women using one-step OGTT at first antenatal booking visit.^[9-11]
- In screen negative women, subsequent screening in later trimesters of pregnancy as per guidelines should be continued.
- Diagnostic criteria for GDM: The diagnostic criteria for GDM are based on WHO 2013 and IADPSG 2010 criteria using venous serum/plasma glucose.
- Management of GDM: It includes nonpharmacological management, lifestyle, and diet.
- Pharmacological management: Insulin and or Metformin when NPT alone fails to control BG.
- Antenatal and intrapartum management: The protocol for antenatal management has been summarized according to the gestational age, which includes glycemic and clinical management.
- Neonatal management: It includes a protocol for BG estimation by heel prick, metabolic screening, and breastfeeding.
- Postpartum follow-up: BG screening at 6 weeks after birth then every year.
- Contraception: Recommendations are provided according to women's wishes and safety of medications.
- Future research recommendations: These have also been proposed for a better understanding of the disease process and its outcomes to seek wider collaboration between IDF Regional partners.

In view of rapidly evolving scientific evidence, the guidelines are proposed to be updated after 2 years.

Strengths and limitations

- This additional Executive Summary is provided as a tool to support the implementation of GDM guidelines in practice.
- The guidelines are practical and can be implemented nationwide as was tested by a pilot study at two public sector hospitals which verified that it is easier to use and follow-up in clinical practice.
- Monitoring and or auditing to assess guideline implementation or adherence to recommendations will be evaluated by the results from National GDM Registry.

- Early identification of the pregnant women with diabetes is known to improve pregnancy outcomes. The limitations of early and universal BG screening by OGTT at booking visit may increase the laboratory workload and can be a little uncomfortable for the women.

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy whether or not the condition persists after pregnancy.^[12]

However, there is a possibility that unrecognized glucose intolerance may have antedated or begun concomitantly with the pregnancy. Hence, if the pregnant woman on screening meets the criteria for diabetes mellitus (DM), then she is considered as having preexisting DM or Pre-Gestational DM.

According to the latest National Survey,^[11] almost 25% of the population is suffering from Type 2 diabetes mellitus (T2DM) and 76.2% and 62.1% are overweight and obese, respectively. Obesity, higher body mass index (BMI), and insulin resistance are added risk factors for undiagnosed diabetes in early pregnancy.^[13] Where metabolic testing outside the pregnancy is not commonly performed, this increases the need for early screening during pregnancy to identify and treat dysglycemia before the period of rapid fetal organogenesis from 0 to 8 weeks to avert congenital fetal anomalies.

Recent improvements in maternal health indicators show that maternal mortality has decreased from 276 to 186 deaths per 100,000 live births. Reproductive healthcare coverage in Pakistan is improving; nearly 9 in 10 women of reproductive age receive antenatal care from a skilled provider.^[14] However, among noncommunicable diseases (NCDs), diabetes in pregnancy is a medical disorder that needs serious attention for implementation of guidelines at

national levels so that the screening, diagnosis, and control of diabetes is instituted. This will help to reduce maternal morbidity and perinatal mortality and transmission of disease in future generations.

Recent national health data shows that more births are delivered in health facilities, from 48% in 2012–2013 to 66% in 2017–2018, yet 1 in 3 births are delivered at home. In view of higher maternal and perinatal morbidity and mortality associated with diabetes in pregnancy, institutional delivery should be encouraged.^[15]

Asian ethnicity falls under high risk of hyperglycemia during pregnancy with previously undiagnosed diabetes.^[16–18]

The detection rate in 90% of all cases of GDM is poor because of low level of literacy, awareness, and inappropriate data keeping.^[19–25]

Universal screening of all pregnant women is recommended in early pregnancy, and selective risk-based screening has poor sensitivity for the detection of GDM in our population.^[19]

RECOMMENDATION 1: BG SCREENING

1.1: Screening methodology

At first antenatal visit, all pregnant women are advised a 75 g 2 h oral glucose tolerance test (OGTT), irrespective of risk factors.^[19] OGTT and blood glucose screening should be done following 8 h of fasting and 2 h after 75 g glucose load, dissolved in 250 cc of water which women are advised to drink over a period of 3–5 min to avoid nausea and vomiting. For diagnostic values of OGTT, see Table 1. For diagnostic values of preexisting diabetes, see Table 2.^[12]

Women who have normal glucose values on initial OGTT, a second OGTT is recommended during 24th to 28th weeks and again in third trimester if she is screen negative in first two trimesters, especially if she belongs to high risk group* (see Recommendation 1.3).

Table 1: GDM, diagnostic values of blood glucose for OGTT

BG Values		mg/dL	mmol/L
	Fasting	92	5.1
	1 h	≥180	≥10
	2 h	≥153	≥8.5
Remarks	Any one of the above values is considered as diagnostic of GDM.		

IADPSG 2010 criteria,^[21] WHO 2013 criteria,^[91]

Table 2: Preexisting diabetes mellitus, diagnostic values of blood glucose for OGTT

Test	FPG	2 h PG	HbA1C	RBS	Diagnosis
75 g 2 h OGTT	≥126mg/dL	≥200mg/dL (≥11 mmol/L)	> 6.5%	Women having random glucose ≥200mg/dL (≥11.1 mmol/L) with symptoms of diabetes	One or more positive value(s) is sufficient for diagnosis
	(≥7.0 mmol/L)				

Women who do not tolerate 75 g glucose load may be tested with 8 h fasting BG or glycosylated hemoglobin (HbA1c).^[25]

Women who were subjected to fasting BG only in their first trimester, and were normoglycemic, they should also undergo an OGTT at 24–28 weeks gestation (see Recommendation 1.2).^[25]

1.2: Diagnostic values for blood glucose

If fasting BG is more than ≥ 126 mg/dl (≥ 7 mmol/L) or HbA1c $\geq 6.5\%$ women will be diagnosed as preexisting DM, and if fasting BG is between 92 and 125 mg/dL (5.1–6.9 mmol/L) women will be considered as GDM.

1.3: HbA1c test

HbA1c test should be performed during the first trimester of pregnancy to identify and prevent poor pregnancy outcome. Higher value, $\geq 6.5\%$, is diagnostic of pre-gestational DM that may be associated with higher risk of fetal anomalies in women with preexisting diabetes.^[26–29]

However, HbA1c testing is not recommended for screening and diagnosis of GDM.

1.4: Serum fructosamine test

Serum fructosamine is a marker of glycemic control and reflects blood glucose levels of past 2–3 weeks. Its laboratory measurement is quick, cost-effective, and simple. However, its use for the predictions of GDM and neonatal outcomes is controversial.^[30–34]

Measurement of plasma serum fructosamine may help simplify the first step for detecting GDM. It has a poor sensitivity and low predictive value to detect abnormal glucose tolerance test with no definite cut-off values for different trimesters of pregnancy.^[35] It may be a poor tool to monitor the control of BG during pregnancy as fructosamine levels can be influenced by relative hypoproteinemia seen in pregnancy.^[35]

1.5: *High-risk group for GDM^[36]

- Family history of diabetes
- History of GDM in previous pregnancy
- Maternal obesity
- Macrosomia in current or previous pregnancies
- Ethnicity, e.g., Asians.

1.6: Additionally high-risk group has also been identified as^[37–40]

- Age >35
- High parity
- Polyhydramnios
- Fetal anomaly
- Recurrent pregnancy losses
- Bad obstetric history
- Multi-fetal pregnancy

- Polycystic ovarian disease (PCOD)
- Unexplained still birth/intrauterine fetal death (IUFD)
- Physical inactivity/sedentary lifestyle
- Persistent hypertension more than 135/80 mmHg

RECOMMENDATION 2: MANAGEMENT OF GDM

2.1: Education and counseling of women

2.1.1: Self-monitoring of blood glucose (SMBG)

Counsel the woman and her family about the appropriate use and storage of glucometer and its sticks. SMBG should be done to achieve good glycemic control and the frequency may be tailored and customized.

The recommendations for the usual frequency of SMBG are as under:

1. Fasting capillary glucose (following 8 h overnight fasting) and three postprandial capillary glucose values (i.e., 1–2 h after each major meal).^[41]
2. Once the target BG levels are achieved, SMBG may be done less frequently, at least 2 readings daily rotating around different meals/fasting on different days of the week.
3. Monitoring BG before going to bed around 11 pm should be done in women experiencing nighttime symptoms suggestive of hypoglycemia.
4. The aim of SMBG was to achieve adequate control of BG without inducing hypoglycemia.

2.1.2: Continuous glucose monitoring system (CGMS)

CGMS is safe and effective tool to evaluate ambulatory maternal glucose profile continuously and helps to prevent glucose variability through all trimesters. It measures glucose levels in real time by sensing glucose present in interstitial fluid and transmits the results via a connected device to a small receiving device and provides a new glucose levels every 5 min; 288 times/day. The CGMS does not replace SMBG, as frequent calibration of system with SMBG is needed, and the prohibitive cost of transmitter and sensors in resource constrained settings is the prime limiting factor for its use in community and public healthcare settings. It is a good technology for the management of blood glucose, but every new technology comes with a higher cost in the beginning, it may become affordable in the years to come.

2.2: *Control levels of blood glucose during pregnancy

Following the diagnosis of diabetes in pregnancy, control values of BG are same, irrespective of preexisting diabetes or GDM, see Table 3.^[19,36–40,42–45]

*However, the control values of BG are different from diagnostic values.^[46] See Recommendation 1.2.

RECOMMENDATION 3: TREATMENT

3.1: Non-pharmacological treatment (NPT)

Lifestyle modification comprises of diet and exercise.

Medical nutritional therapy (MNT) should be advised soon after diagnosis of GDM.

3.1.1: Lifestyle modification

3.1.1.1: Exercise/physical activity

Women with GDM should be encouraged to be as active as possible throughout the day.

The recommendations are as under:

1. Moderate exercise of 30 min/day 1 h after light meals/snacks. [19,36-39,42,43,47,48] This may be split into 15 min duration twice a day.
2. Brisk walking can be continued till term at a pace that is comfortable except in women with obstetrical or medical complications.
3. If brisk walking is not possible, then arm exercises in sitting posture for at least 5–10 min post meal is recommended.

3.1.1.2: Diet

1. Consult dietician if available in healthcare settings since dietary advice and adjustments are required throughout pregnancy to maintain glycemic goals.
2. Women should be advised to avoid dietary items/foods containing simple sugars and honey, and awareness should be given to read food labels and calorie count.
3. Manage calorie intake, 25–35 kcal/kg according to the body weight. In obese women with GDM, a minimum of 1500–1800 kcal/day is recommended. Calorie restriction less than 1500 kcal/day for women with GDM is not safe. [49]
4. A minimum of 175 g of carbohydrate (CHO) and 28 g of fiber per day should be included in the diet.

5. Take complex CHO, 3 meals +3 snacks (including 1 snack at bed time). [50,51]
6. Women should be guided to replace high glycemic index (GI) foods with low GI ones. This will help to reduce the risk of macrosomia by lowering BG peaks after meals. [52,53] (For GI of common food items, see Table 4.)
7. Artificial sweeteners are not recommended during pregnancy. Although in some studies, Aspartame is reported to be a safer artificial sweetener if taken in moderation whereas saccharine is reported to cross placental barrier. [54,55]
8. Women on insulin should have sweets or sugar candies readily available with them if they experience hypoglycemia.
9. The aim was to achieve normoglycemia, providing adequate maternal weight gain and adequate fetal growth, and to prevent starvation ketosis.

3.2: Pharmacological treatment (PT)

Oral hypoglycemic drug (OHD)/insulin should be started if target BGs are not achieved within 1 week of MNT and exercise.

3.2.1: Oral hypoglycemic drugs (OHDs)

3.2.1.1: Metformin is safely recommended during pregnancy. [56,57] The doses of metformin may vary from 250mg per day to 2550 mg per day depending upon individual's BG control.

Insulin must be supplemented if metformin monotherapy is unable to achieve control within a week.

3.2.1.2: Sulphonylureas are not recommended during pregnancy according to clinical evidence. [58-60] Although some studies, recommend Glibenclamide in pregnancy with diabetes. [61,62]

3.2.1.3: Other OHD to be avoided.

3.2.2: Insulin

- Insulin is gold standard of treatment for women with diabetes in pregnancy. [63]
- When NPT and OHD fail to control BG values (see Recommendation 2.2), either insulin only should be started or may be combined with metformin. [64,65]

Table 3: The recommended control values for FBG and 1 h or 2 h PPG^[36-39]

	mg/dL	mmol/L
FBG	<95	<5.3
1 h PPG	<140	<7.8
2 h PPG	<115	<6.4

Table 4: Glycemic index of common food items^[137]

Foods	Serving size (available CHO g)	Glycemic index	Glycemic load
Chapati	1 medium (32 g)	66	21
White bread	1 slice (14 g)	70	10
White Rice	1 cup (36 g)	65	23
Lentils boiled	50 g (18)	36	6
Milk	8 oz (13 g)	32	4
Carrots	½ cup (6 g)	92	5
Orange Juice	6 oz (26 g)	57	15
Mango Pulp	150 g (15)	86	9
Water melon	1 cup (6 g)	72	4
Ice cream	½ cup (13 g)	62	8

- Insulin may be started as a first -line treatment in women with associated obstetrical complications, e.g., pre-eclampsia, polyhydramnios, macrosomia or when FBS ≥ 126 mg/dL (≥ 7.0 mmol/L) and for RBS ≥ 200 mg/dL (≥ 11.1 mmol/L).

3.2.2.1: Insulin types

The type of insulin and treatment regimens should be individualized.

Basal insulin: Recombinant human intermediate acting (NPH) or detemir.

3.2.2.2: Bolus insulin

1. Recombinant human short -acting (regular) insulin.
2. Insulin analogues, e.g., Aspart and Lispro.^[63,66-69]

For women with nausea and vomiting, short -acting insulin analogues, e.g., Aspart and Lispro, can be taken after the successful meal as this has a tendency to reduce hypoglycemic episodes and improve postprandial BG levels.^[70]

3.2.2.3: The premixed insulin regimens put the woman at risk of fluctuating glycemic control during pregnancy and should be avoided. Women well controlled on this regimen may continue the same.

3.2.2.4: Use of Glulisine, Degludec, is not recommended until more safety data are available.^[71]

3.3: Calculation of insulin dosage

Table 5 shows an arbitrary guide to start insulin dosage according to body weight and period of gestation:^[63]

- As an example, for a woman with 60 kg of body weight at term, the requirements of insulin will be 1 unit \times weight in kg = 60 units.
- Split these 60 units, into morning dose of insulin two - thirds ($2/3 \times 60 = 40$) and evening dose of one-third ($1/3 \times 60 = 20$).
- Further split morning dose (40 units) into one -third of regular insulin ($1/3 \times 40 = 13$ approx.) and two-thirds of NPH ($2/3 \times 40 = 26$ approx.).
- Split remaining one -third (20 units) of evening dose into half regular ($1/2 \times 20 = 10$ units) and half NPH Insulin ($1/2 \times 20 = 10$ units). See Figure 1, insulin dosage chart.
- The optimal glycemic goals after insulin therapy should be achieved as per Recommendation 2.2.
- See Appendix 1. Appropriate techniques for use of insulin.

3.4: Titration of insulin dosage

1. Titrate the dose of insulin after 48–72 h, if BG control values are not achieved.
2. If FBS is persistently high, the dosage of basal insulin (NPH) may be increased.
3. Similarly, if any post-prandial BG level is high, then increase the dosage of Bolus insulin either regular/lispro/aspart before meal.

4. For every 10 mg change in BG control values as given in (Recommendation 2.2), titrate the dose of insulin by 1 unit.
5. If hypoglycemia occurs, i.e. <63 mg/dL (<3.5 mmol/L), reduce insulin dosage and increase fetal surveillance.

3.4.1: Insulin titration after steroid administration

If administration of corticosteroid is required for obstetrics indications in women on insulin therapy^[72]:

1. Following first dose of prophylactic administration of corticosteroids, the dosage of insulin adjustments is required to increase by 20–40% of their pre-corticosteroids insulin dosage according to SMBG.
2. This increase in dosage is required from day 1 of steroid administration up to day 5.
3. Thereafter taper the dose of insulin by 6–7th day to presteroid administration dosage.

RECOMMENDATION 4: PRECONCEPTION CARE

4.1: Risk factor identification before planning pregnancy

Women, planning pregnancy who visit health care for some other reasons, should undergo risk factor identification and a BG screening by OGTT (12 h fasting and 2 h after 75 g glucose load) to screen for abnormalities of glucose homeostasis prior to conception. (See diagnostic values in Recommendation 7.5.2.)

4.2: Prepregnancy care for women with preexisting diabetes

All women with previous history of diabetes who plan pregnancy must be counseled to attend prepregnancy clinics.^[73]

For control levels of BG in preconception period, see Table 6.^[36]

Table 5: Arbitrary guide to start insulin dosage according to body weight and period of gestation

Weeks of gestation	Total daily dose insulin
1–13	$0.6 \times Wt$ (kg)
14–26	$0.8 \times Wt$ (kg)
27–37	$0.9 \times Wt$ (kg)
38–40	$1.0 \times Wt$ (kg)

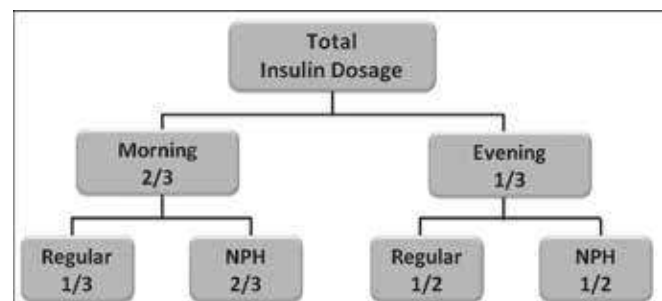


Figure 1: Insulin dosage chart

4.2.1: Review and adjustment of medications

4.2.1.1: OHDs

Discontinue medications which are teratogenic/not safe at the time of conception, e.g. oral hypoglycemic drugs other than Metformin and Glybenclimide.

4.2.1.2: Insulin

Switch from noninsulin agents to insulin. However, metformin can be continued.

4.2.1.3: Antihypertensive drugs

Stop statins and replace ARBs, ACE inhibitors by Labetalol, Methyl DOPA, or Nifedipine.

Table 6: Control levels of BG in preconception period		
	mg/dL	mmol/L
Fasting	90–126	5–7
Preprandial	72–126	4–7
HbA1C	6–6.5 if higher, then pregnancy should be delayed ^[73]	
NICE guidelines ^[36]		

4.2.1.4: Folic acid

Supplement folic acid 5 mg starting 3 months prior to conception and continue for 3 months after conception.^[74]

4.2.2: Manage comorbidities

Women with preexisting T1DM or T2DM should get baseline screening for retinopathy and nephropathy. Appropriate treatment and stabilization of any complications prior to conception are prudent.

4.2.3: Target blood glucose values during preconception period

Educate and ensure SMBG. ^[41] Targets for fasting and post prandial glucose should be optimized. Counsel to achieve good glycemic control with an HbA1C closer to 6–6.5%, if these values can be safely attained without putting the woman at risk of hypoglycemia.

RECOMMENDATION 5: ANTENATAL CARE (ANC) Education and counseling at booking

Antenatal care plan for women with diabetes during pregnancy		
5.1 Booking appointment: up to 12 weeks*	5.1.1 Education and counseling	<ul style="list-style-type: none"> Educate and counsel women and family about the importance of achieving euglycemia, use of glucometer and importance of frequent SMBGs and regular antenatal visits over and above what is required of a nondiabetic pregnant women. ^[19,36,39,40,42,47,75,76] Provide information about diabetes and its impact on pregnancy, child birth and breastfeeding, neonatal care, and contraception. Explain future risk of development of diabetes in mother and child in case of noncompliance to maintain the recommended BG values. Evaluate in joint diabetes and ante natal clinic. Retinal and renal evaluation in women with preexisting DM if it was not done in the last 3 months
	5.1.2 Review medication	Review medication according to Recommendation 4.2.1.1 <ul style="list-style-type: none"> Tab folic acid 5 mg once daily for 3 months Tab aspirin 75–150 mg once daily up to term or 34 weeks of gestation respectively as per Recommendation 4.2.1.4. Stop medications like ACE inhibitors, ARB's, statins, and OHD other than Metformin and Glyburide.
	5.1.3 Lifestyle modification and diet	See Recommendations 3.1.1
	5.1.4 Blood glucose monitoring	Ensure appropriate control of BG as per Recommendation 2.2
	HbA1c	Monitoring HbA1c * Measure HbA1c in pregnant women with preexisting diabetes at the booking appointment to determine the level of risk for the pregnancy.
	5.1.5 Investigation at booking visit	Blood complete picture, blood grouping and RH factor, urine analysis, hepatitis B and C screening, thyroid profile (including TSH, FT3, and FT4), TPO antibodies, ^[77] HbA1c (if indicated).
13–24 weeks* regular 1–2 weekly visits, review and optimize glycemic control adjust/add insulin	5.1.6 Ultrasound at booking visit	For confirmation of pregnancy, dating and fetal viability and single/multiple pregnancy. To measure nuchal thickness and to rule out anencephaly.

5.2: 20–22 weeks*	5.2.1 Medication and BG	Review medications and BG control.
	5.2.2 Ultrasound at 20–22 weeks	Detailed anomaly scan and four-chamber view of the fetal heart, outflow tracts, and 3 vessels to be done.
	5.2.3 Immunization	First dose of tetanus toxoid should be given
5.3: 24–26 weeks*	5.3.1 2 h 75 g OGTT	Offer sequential screening with 75 g OGTT, in previously screen negative women.
	5.3.2 2-D fetal echo cardiograph	Offer 2-D fetal echo if cardiac anomaly is suspected
28–32 weeks*		
Routine frequent ANC with review of glycemic control		
5.4: 28–34 weeks*	5.4.1 Immunization	Second dose of tetanus toxoid immunization at 26–28 weeks of gestation.
	5.4.2 Steroid administration	Prophylactic corticosteroid therapy for obstetric indications is recommended in the same dose and same gestational age as in nondiabetic pregnancy. ^[72] For adjustments in insulin, following corticosteroids administration, see Recommendation 3.4.1
	5.4.3 Ultrasound	After 28 weeks, weekly monitoring of fetal growth, abdominal circumference, and amniotic fluid volume.
	5.4.4 Investigations	Repeat CBC and urine DR. Screening and diagnostic test for BG (if not done previously) should be done either before the administration of steroids or at least 7 days thereafter. ^[72]
33–36 weeks*		
5.5: 34–36 weeks*	5.5.1 Ultrasound	Monitoring of fetal growth, abdominal circumference, amniotic fluid volume, and placental localization to be done.
	5.5.2 Doppler and biophysical profile	When there is clinical evidence or risk of fetal growth restriction and in women with preexisting diabetes with vasculopathy.
	5.5.3 OGTT (32–34 weeks)	Offer sequential screening with 75 g OGTT, in previously screen negative women.
	5.5.4 Discussion and counseling to women and family	Timing, mode of birth
		Regional analgesia and anesthesia Neonatal care, possibility of NICU admission and early breastfeeding Postpartum care, BG screening, and contraceptive advice
37–40 weeks*		
Weekly ANC		
5.6: 37–40 weeks*	5.6.1 Glycemic monitoring	Assess glycemic control
	5.6.2 Discuss mode of delivery	Offer induction of labor/Cesarean section (where indicated) for uncontrolled diabetes/obstetrical complications.
	5.6.3 Spontaneous onset of labor	In uncomplicated pregnancy, well -controlled diabetes and no fetal compromise wait for spontaneous onset of labor till 38–39 weeks. All pregnant women with diabetes to deliver no later than 39 weeks.

*

- Routine ANC should be given every 15 days or may be more frequent in the presence of complications.
- ANC should be provided by obstetricians with expertise in management of diabetes in pregnancy.
- Regular monitoring of weight, blood pressure, and review of BG charting.
- Pregnant women with diabetes who are on diet and life style/PT are advised to keep a record of 8 h fasting, 2h post-meal, and bedtime BG levels.
- Maintain capillary plasma glucose by SMBG below the target levels (Recommendation 2.2), if achievable without causing problematic hypoglycemia BG <70 mg/dL (4 mmol/L).
- Healthcare provider may be approached by the women either telephonically, e-mail, Tele-health, or attend clinic.
- To check ketones by blood testing strips if woman is hyperglycemic and feels low and unwell particularly if she is T1DM or on insulin treatment. ^[36,39] See Appendix 2 for the management of DKA in pregnancy with diabetes.
- The incidence of auto -immune thyroid disease is high (44%) in young women and requires screening of thyroid hormonal profile during pregnancy specially in women with T1DM.^[77]

RECOMMENDATION 6: INTRA-PARTUM MANAGEMENT

6.1: Timing and mode of delivery

6.1.1: Timing of delivery

Women with well-controlled diabetes without obstetric complications may go for spontaneous labor up to 38–39 weeks of gestation.

In women with uncontrolled diabetes earlier intervention may be required after 37 completed weeks.

6.1.2: Mode of delivery

Vaginal delivery should be the aim in women with well-controlled diabetes.

C-Sec is indicated if there is fetal macrosomia, bad obstetric history (BOH), pre-eclamptic toxemia (PET) or any other obstetric indications/complications.

6.2: Glycemic management during labor

6.2.1: Intra-partum blood glucose monitoring

If the woman is on MNT, BG monitoring is recommended 6 to 8 hourly. If she is on pharmacotherapy for glycemic control, she needs more frequent BG monitoring (every 1 to 2 hourly).

6.2.2: Intra-partum target blood glucose level

Goal of intra-partum capillary BG should be between 72 and 126 mg/dL (4–7 mmol/L).^[19,36,37,39,43,44,75,78]

In women on insulin or in whom the BG is not maintained between 72 and 126 mg/dL (4–7 mmol/L), 12 units of insulin in 1000 cc of 5% dextrose water may be added. This should be separate from the infusion which may be given for induction/augmentation of labor.^[36]

6.3: Management of diabetic ketoacidosis

Diabetic ketoacidosis (DKA) is a critical condition commonly seen in pregnant women with T1DM but may be present in T2DM and GDM. This condition requires immediate intensive care admission. If woman is hyperglycemic or feels unwell ketone testing in the blood is advised for an accurate and timely assessment of ketosis. See Appendix 2 for the management of DKA in pregnancy with diabetes.

6.4: Management of preterm labor

HIP increases the risk of spontaneous and iatrogenic preterm labor.^[136] A three-pronged approach to manage threatened/established preterm labor in women with GDM is recommended:

1. Tocolysis and *in utero* transfer to tertiary care with neonatal care facilities.
2. Antenatal corticosteroids (ACS) as given in Recommendation 5.4.2.
3. Give magnesium sulphate for neuro-protection.
4. Give Tocolytics,^[79] for 48 h after the first dose of antenatal corticosteroids.

5. Start calcium channel blocker Nifedipine,^[80] 10 mg oral/sublingual.
6. Repeat every 15–20 min if uterine contractions persist.
7. The maximum total dose of calcium channel blockers is 40 mg during the first hour of treatment followed by 20 mg orally every 8 h for 2–3 days.
8. Indomethacin^[79] can be used in gestation 24 weeks to 30 weeks but is contraindicated after 32 weeks of gestation because of risk of premature closure of the ductus arteriosus in the infant.
9. Atosiban (oxytocin receptor antagonist) can be used as second-line tocolytic but is expensive and not available in Pakistan.^[36,79]
10. Caution must be used if combining magnesium sulfate with β -adrenergic receptor agonists or calcium channel blockers because of possible maternal complications.
11. Injection magnesium sulphate^[81] should be given to women below 34 weeks of gestation to reduce the incidence of cerebral palsy.

RECOMMENDATION 7: POSTPARTUM MANAGEMENT

7.1: Re-adjustment of pharmacological treatment (PT)

Women on pharmacotherapy require re-adjustment of their medication.

7.1.1: Women with GDM

Insulin sensitivity increases and insulin/OHD requirements go down with the delivery of placenta.

Women with GDM usually revert back to normoglycemia and PT should be stopped/modified.

7.1.2: Women with preexisting diabetes

7.1.2.1: Type 1 diabetes mellitus (T1DM)

In women with T1DM, particular attention is needed to hypoglycemia because of temporary Honey Moon Phase, lactation, erratic sleep, and disturbed eating schedules.

Insulin sensitivity increases and insulin requirements and dose of insulin both Basal and Bolus go down by about 50% with the delivery of placenta.^[82-85]

Women who are on insulin >1 units/kg/day, the dose of insulin may be reduced to 50% after birth while those on 0.5–1 units need individualized clinical decision according to BG levels on SMBG.

7.1.2.2: Type 2 diabetes mellitus

Women with preexisting T2DM can resume or continue to take OHD, Metformin/insulin after birth according to BG values on SMBG, see Table 7.

Women with preexisting diabetes should be advised to see their primary care physician postnatally for further management of diabetes.

Table 7: Diagnostic BG values following 12 h fasting and 2 h after 75 g glucose load (OGTT: WHO criteria)^[91]

	Normal	Prediabetes/IGT	Diabetes
FBS	<100 mg/dL (<5.6 mmol/L)	100–125 mg/dL (5.6–6.9 mmol/L)	>126 mg/dL (>7.0 mmol/L)
2 h after 75g OGTT	<140 mg/dL (<7.8 mmol/L)	140–199 mg/dL (7.8–11.1 mmol/L)	>200 mg/dL (>11.1 mmol/L)

7.2: Frequency of blood glucose monitoring after birth

Women who were on Metformin or on low -dose insulin (<0.5 units/kg/day) should continue BG monitoring; fasting and 2 h post meal for the next 48–72 h, thereafter, the frequency of BG monitoring may be adjusted according to glycemic status.

In case of Caesarean section, in the immediate postoperative period BG monitoring may continue every 4–6 hourly till oral food is allowed and thereafter 2 h post prandial according to BG control on SMBG.

7.3: Postpartum counseling

7.3.1: Counseling of woman and family

Counseling of women and their families should be directed towards the importance of:

- Diet, physical activity, lifestyle modification, addressing weight reduction/obesity to prevent future development of diabetes. ^[19,36,38-40,42-44,47,86-88]
- In view of the poor 6 weeks postpartum follow -up of the women, advise for BG screening must be emphatically incorporated in the counseling sessions. ^[89]
- Women with diabetes in pregnancy should be counseled to undergo postpartum OGTT at 6 weeks, 6–12 weeks, and then yearly.
- They must be educated about the fact that if they follow the advice, they can be prevented from future development of T2DM.
- Women and their families should be cautioned that in case of noncompliance, 50–70% of mothers with GDM are at risk of development of T2DM in the next 5–10 years.^[90]

7.4: Postpartum blood sugar screening OGTT

Screen the women for diabetes at 6 weeks postpartum with 75 g 2 h OGTT** or fasting blood sugar >126 mg/dL (>7 mmol/L) using World Health Organization (WHO) criteria,^[91] to exclude/confirm preexisting undiagnosed T2DM from GDM.

This 6-week OGTT may be linked to pediatric attendance/child immunization to ensure the compliance of postpartum follow -up. If OGTT is not possible, then offer fasting plasma glucose or HbA1c.

**For diagnostic BG values following 12 h fasting and 2 h after 75 g glucose load (OGTT: WHO criteria), see Table 7.^[91]

7.5: Infections

Pregnant women with diabetes are at high risk of infections at surgical sites, i.e., Cesarean section, episiotomy, urinary

tract infections, breast abscess, and endometritis. This can be avoided if appropriate hygiene, antibiotics and proper glycemic controls are taken care of.

7.6: Postpartum thyroid dysfunction

Due to high risk (25%) of postpartum auto -immune thyroid dysfunctions in the first four weeks after delivery, the thyroid hormonal abnormalities should be screened at 1–3 months postpartum.^[92,93]

RECOMMENDATION 8: NEONATAL CARE

8.1: New-born BG should be checked by heel prick within 30 min of birth, the aim is to keep BG around 36–40 mg/dL (2–2.2 mmol/L).^[36]

8.2: Continue BG monitoring every 4 hourly. If BG of infant is below 18 mg/dL (1 mmol/L), treat hypoglycemia with intravenous dextrose immediately.

8.3: In symptomatic new borns, complete blood count (CBC), serum bilirubin, serum calcium, and serum magnesium should be done. ^[36,39,43]

8.4: Keep baby admitted in NICU or under surveillance for at least 24 h till they maintain their BG levels more than 46.8 mg/dL (2.6 mmol/L).^[36,39,40,75]

8.5: In mothers with HIP, the risk of congenital heart defect (CHD) in neonates with macrosomia is 2 - to 3-fold high.^[94] If neonate develops physical signs like difficult breathing along with cyanosis, poor feeding and sleepiness urgent echo cardiography should be advised and pediatric cardiologist should be consulted. ^[95] Prenatal detection by intrauterine echocardiography in pregnancy with diabetes allows early referral to a tertiary care center. ^[96-98]

8.6: The pregnancies complicated by HIP leads to neonatal hypoglycemia if birth weight is >90th centile, irrespective of treatment with or without insulin. ^[99] Macrosomia further increases the frequency of cesarean section and increase the risk for NICU admission due to difficult and traumatic vaginal birth because of shoulder dystocia which may cause clavicle fracture and injury to brachial plexus.^[100,101]

RECOMMENDATION 9: BREASTFEEDING

9.1: Early and exclusive breast feeding (BF) is recommended to avoid neonatal hypoglycemia. This also reduces mother's and offspring's risk of obesity and this prevents development of future T2DM.

9.2: Breastfeeding should be initiated immediately after birth and should be provided at intervals of 2–3 h.

9.3: Women with preexisting insulin -treated diabetes should take some snacks while breast feeding and at night time before going to bed.

9.4: Medications during BF

9.4.1: Review the drugs that were discontinued for safety reasons in the preconception period. These drugs may also be contraindicated for lactating mothers. See Recommendation 4.2.1.

9.4.2: In women with preexisting diabetic nephropathy, ACE inhibitors can be restarted but the use of ARBs need to be discussed with the physician and women.

9.4.3: Insulin, Metformin, ^[102] can be safely used in lactating women.

RECOMMENDATION 10: DIABETES MELLITUS AND FETAL LOSS

Women who had a pregnancy loss require special attention by the healthcare professionals for their physical and psychological well-being in consultation with a mental health professional as and when needed. They should be screened with standard 75 g 2h OGTT at 6–12 weeks following fetal loss.

RECOMMENDATION 11: CONTRACEPTION

Counseling should be done on methods of contraception that are effective to limit family size, to achieve optimal physical health, good glycemic control between pregnancies. Following contraceptive choices are recommended:

11.1: Progesterone -only contraception can be offered to lactating mothers any time after delivery including subdermal implants and Depot medroxyprogesterone acetate (DMPA). ^[103]

11.2: Estrogen containing contraceptive pills should be avoided after delivery. After 42 days postpartum, low-dose estrogen and progesterone combined hormonal pills may be given to women irrespective of lactation.

11.3: Long-acting hormonal contraceptive device like Levonorgestrel (LNGIUS) -based systems are relatively safer, if affordable.

11.4: Nonhormonal Intrauterine Contraceptive Devices (IUCD), e.g., Copper -T, multi-load are cheaper and can be used safely and placed in the immediate postpartum period. ^[103]

11.5: Barrier methods are considered safer.

11.6: Tubal ligation/vasectomy may be offered as a permanent method of contraception to couples who do not desire further pregnancies. ^[104]

RECOMMENDATION 12: COUNSELING OF WOMEN FOR FUTURE PREGNANCY

Women with pre -hyperglycemia or past history of GDM should be counseled to attend preconception care clinics before planning for next pregnancy. In women with preexisting diabetes, glycemic control and medications may be reviewed and modified before conception, see Recommendation 4.

Future research recommendation

Following are the future research recommendations for care providers, researchers, and policy makers.

- ☒ Due to poor show up of the women in postpartum clinics, it is pragmatic to do an OGTT after 24–72 h of delivery when she is still in the hospital. If BG remains elevated, continued follow -up of screened positive women is mandatory after 6 weeks postpartum.
- ☒ Advantages of IADPSG criteria compared with the previous WHO criteria, to screen and to prevent adverse neonatal and maternal outcomes.
- ☒ International Association for Diabetes and Pregnancy Study Group (IADPSG) criteria is expected to increase the number of women identified with GDM and consequently increase the burden on the health system.
- ☒ Intensive BG screening and surveillance during pregnancy results in higher rate of primary Cesarean deliveries.
- ☒ Labelling women with gestational glucose intolerance increases maternal anxiety and adverse health perceptions.
- ☒ False-positive or false-negative BG results increase inconveniences/psychological trauma and outweigh the benefits of diagnostic testing.
- ☒ Is it cost-effective to use IADPSG criteria for screening of hyperglycemia in pregnancy in low middle income countries?
- ☒ Evaluation of the new diagnostic criteria IADPSG in diverse settings and ethnic groups: costs, acceptability.
- ☒ Randomized trials (e.g. country or region specific) comparing different strategies for the detection of GDM.
- ☒ Evaluation of a “single step versus two step procedure” in diagnosing GDM
- ☒ Cost-effectiveness studies with different detection strategies.
- ☒ Long-term risks related to HIP in mother and child and impact of treatment on long -term outcomes in mother and child.
- ☒ Knowledge attitude and practice (KAP) studies to evaluate myths about diabetes in pregnancy:
 - i. Eating too much sugar during pregnancy causes diabetes
 - ii. Once on insulin will always be on insulin
 - iii. Insulin is a drug of addiction

- iv. Gestational diabetes is baby diabetes and is not worrying.
- ☒ To conduct national surveys to evaluate the level of knowledge about diabetes in pregnancy; in community, nurses, non -nurses and healthcare providers.
- ☒ Existing, Pakistan Diabetes Prevention Program (PDPP) should focus and integrate on diabetes and pregnancy with special reference to screening, management and prevention at national level.

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APPENDIX 1: APPROPRIATE TECHNIQUES FOR USE OF INSULIN

Even in developed countries many healthcare providers, nurse practitioners, midwives, and women with diabetes have deficiencies in basic understanding, ^[105,106] about subcutaneous use of insulin, drawing of insulin into the syringe, proper injection technique, site rotation, shelf life, and storage of insulin. Inadequacies of understanding and knowledge can lead to significant medication safety and compliance issues in resource constrained settings.

The dosage of insulin, the site of injection, and the chart of blood glucose values should be legible, documented, readily accessible, and visible to healthcare providers, nurse practitioners, and midwives to avoid medical errors and ensure patient safety. This should be implemented in healthcare settings and in home based self-management of women requiring insulin in pregnancy.

To ensure optimization and safety and to minimize insulin-related human errors, some practical recommendations for care providers, for women and her families are as under.

HAND HYGIENE

- Ensure to wash hands with soap and water before preparing and injecting insulin. ^[107]
- Gloves are generally not required for injecting insulin.

FILLING OF REGULAR (SHORT ACTING) AND INTERMEDIATE ACTING INSULIN

- Do not shake, just roll the vial or cartridge of NPH, 10 times then gently invert it 10 times and visually check that it is a milky white color before it is injected.
- First draw from the vial required units of Humulin-R, followed by NPH in the same insulin syringe. Do not shake or mix this syringe before injecting.
- Do not use an insulin pen cartridge as a vial.
- The length of the needle of insulin syringe is 4–6 mm, a lifted skin fold must be used to avoid the risk of injecting insulin into muscle. ^[108-110]

THE OPTIMAL SEQUENCE FOR INJECTION TECHNIQUE^[111]

- If a patient is physically clean, swabbing of the skin before injection is not required. ^[107]
- Insulin is administered at a 90° angle to ensure that the medication is delivered into the subcutaneous tissue. ^[112,113]
- Women who are very lean and thin and therefore have minimal amounts of subcutaneous tissue may require injections to be delivered at a 45° angle. ^[114]
- Do not massage the site before or after the injection. As it may speed up absorption. ^[111]

- Insert the needle in a quick dart like movement through the skin and inject slowly. ^[111]
- Administer insulin in subcutaneous tissue for its optimal action. Do not draw back plunger of the syringe in subcutaneous administration as the risk of inadvertent entry into the blood vessel is minimal. ^[114,115]
- Leave the needle in the skin for at least 10 s, (count from 1 to 10) after the insulin has been injected. ^[116-118]
- Withdraw the needle from the skin.
- Release the lifted skin fold.
- In resource constrained settings same insulin syringe is frequently used by the patients; however, there is no recent strong evidence to suggest for or against the reuse of insulin needles. ^[119]

INJECTION SITE ROTATION

- It is safe to inject insulin with insulin syringe or pen in abdominal wall in pregnant women.
- The insulin injection site can be changed in any of the four quadrants of abdomen.
- Do not inject around umbilical area or in the mid abdominal line.
- Insulin injection should be given on the anterolateral aspect of either thigh, about 4 inches or hands width above knee, and 4 inches down from the top of the leg. ^[120]
- Do not rotate the site of insulin injection frequently between thigh and abdomen because of varied rates of insulin absorption. ^[121]
- The insulin pen may be prefilled. In pens, the instructions about the insertion of cartridge are given by the manufactures.
- The size of the needle in insulin pen is 4 mm so the skin fold does not need to be lifted as recommended while injecting insulin by syringe.

STORAGE OF INSULIN^[122]

- Keep insulin away from direct heat and light.
- Do not freeze insulin.
- Keep unused cartridges and pens of insulin in the refrigerator.
- Insulin cartridges and pen that are currently in use may be stored at room temperature (13°–26°C).
- In resource constrained settings insulin vials can be stored in clay pots having water at room temperature or it can be kept in water coolers. ^[123]
- Advise patients to discard open bottles of vials of NPH after 42 days, and discard cartridges inserted in the pen after 14 days of use. ^[122]
- While traveling by bus or train, keep insulin in an insulated bag for example lunch bag. ^[122]
- To get through airport security advice women to carry ^[122]

APPENDIX 2: DIABETIC KETOACIDOSIS (DKA) IN PREGNANCY

A serious complication seen more frequently in pregnant women with diabetes as nausea or vomiting, abdominal pain, polyuria or polydipsia, blurred vision, muscle weakness, drowsiness, lethargy, change in mental status, hyperventilation, tachypnoea, hypotension, tachycardia, coma, or shock.^[124]

High index of clinical suspicion for DKA^[125]

Plan to admit in Intensive Care Unit (ICU) if the pregnant woman with diabetes has the following signs and symptoms:

- Feeling of unwell being
- Hyperglycemic
- Ketonemia (normal values, <5.4 mg/dL (<0.3 mmol/L)) [Table 8].

Management of DKA in pregnancy

1. Women should be hospitalized with HDU/ICU care. ^[126]
2. A multidisciplinary team including obstetrician, a diabetologist/endocrinologist, anesthesiologist, and well-trained nursing staff/midwives should be involved.
3. Fluid replacement by infusing isotonic saline (0.9%), at 10–15 mL/kg/h in the first hour. Adjust the rate according to blood pressure, urine output, and central venous pressure.
4. Cardiac monitoring, pulse oximetry would be mainstay in patient monitoring. ^[127]
5. Electrolyte correction: give potassium chloride to maintain potassium level in the range of 4–5 mmol/L. ^[128,129]
6. If the woman has good urine output and serum potassium level less than 5.5 mmol/L. The use of bicarbonate is not recommended. ^[130,131]
7. Intravenous insulin therapy: IV therapy with regular insulin should be commenced in patients
8. Monitoring of maternal and fetal responses:
 - i. Monitor capillary glucose hourly during insulin infusion.
 - ii. Monitor blood ketones hourly for the first 6 h.
 - iii. Monitor pH, bicarbonate, and serum potassium using venous gas samples every 2 h in the first 6 h.
 - iv. Urinary ketones take time to clear. ^[132]

Table 8: Diagnostic criteria for ketoacidosis^[125]

	mg/dL	mmol/L
Blood ketone level	>54	>3.0
Urine ketone level	>36	>2.0
Blood glucose level	>198	>11.0
Bicarbonate level	<270	<15.0
Venous pH	<7.3	

Fetal monitoring during DKA

Foetal heart monitoring by CTG should be continued until the maternal metabolic state is stabilized. It may require 4–8 h for the normalization of fetal heart after correction of DKA.

Individualize the decision to deliver until the complete resolution of DKA according to maternal clinical status, fetal gestational age,^[133,134] and fetal heart rate tracing. Uncorrected maternal dehydration and severe metabolic acidosis may lead to foetal death.^[135]

GLOSSARY

ACE	Inhibitors angiotensin -converting enzyme (ACE) inhibitors
ANC	Antenatal care
AOFOG	Asia & Oceania Federation of Obstetrics & Gynaecology
ARB's	Angiotensin II receptor blockers
BF	Breast feeding
BG	Blood glucose
BMI	Body mass index
BOH	Bad obstetrical history
CBC	Complete blood count
CDSR	Cochrane Database of Systematic Reviews
CHO	Carbohydrates
C-Sec	Cesarean section
DASG	Diabetes in Asia Study Group
DM	Diabetes mellitus
DMPA	Depot medroxyprogesterone acetate
DR	Detail report
FBS	Fasting blood sugar
FIGO	The International Federation of Gynecology and Obstetrics
FT3	Free triiodothyronine
FT4	Free thyroxine
GDM	Gestational diabetes mellitus
GI	Glycemic index
GL	Glycemic load
HAPO	Hyperglycemia and adverse pregnancy outcome
HbA1C	Glycosylated hemoglobin
HIP	Hyperglycemia in pregnancy
IADPSG	International Association for Diabetes and Pregnancy Study Group
IDF	International Diabetes Federation
IUCD	Intrauterine Contraceptive Devices
IUFD	Intrauterine fetal death
LNG -IUS	Levonorgestrel -Releasing Intrauterine System
MENA	Middle East and North Africa
MESH	Medical Subject Heading
MNT	Medical Nutritional Therapy
NICE	National Institute for Health and Care Excellence
NICU	Neonatal Intensive Care Unit

NPH	Neutral Protamine Hagedorn (insoluble intermediate -acting insulin)	SAFOG	South Asia Federation of Obstetrics and Gynaecology
NPT	Non -pharmacological therapy	SEA	South East Asia
OGTT	Oral glucose tolerance test	SMBG	Self-monitoring of blood glucose
OHD	Oral hypoglycemic drugs	SOGP	Society of Obstetrics and Gynecology of Pakistan
PCOD	Polycystic ovarian disease	T1DM	Type 1 diabetes mellitus
PET	Pre-eclamptic toxemia	T2DM	Type 2 diabetes mellitus
PICO	Population Intervention Comparison Outcomes	TPOAb	Thyroid peroxidase antibodies
PT	Pharmacological therapy	TSH	Thyroid stimulating hormone
RBS	Random blood sugar	WHO	World Health Organization
Rh factor	Rhesus factor		

**To provide dietary guidance
to healthcare professionals
regarding medical nutritional
therapy in management of
Hyperglycaemia in Pregnancy
a separate consensus
document for dietary
interventions is attached.**

PRINCIPLES AND PRACTICE OF NUTRITIONAL THERAPY IN HYPERGLYCEMIA IN PREGNANCY (HIP) IN PAKISTANI POPULATION

SOGP acknowledges following doctors for their contribution to this addendum for SOGP Guidelines for Hyperglycemia in Pregnancy

Prof Dr Ahmed Bilal¹, Dr Usman Musharraf², Dr Zaheer Ahmad³, Dr Muhammad Owais Fazal⁴, Dr Maham Mohsin⁵, Dr Yasir Yaqoob⁶, Dr Syed Kamal Husnain⁷, Dr Muhammad Emad⁸, Dr Atar Yaqoob⁹, Dr Sana Shahid¹⁰, Dr Sadaf¹¹, Dr Hooria Zia¹², Prof. Zaman Shaikh¹³

¹Dean of Medicine, Faisalabad Medical University, Faisalabad., ²Senior Registrar, Consultant Endocrinologist, Faisalabad Medical University, Faisalabad.

³Senior Registrar Neurology, Allied Hospital, Faisalabad. ⁴Associate Professor of Medicine, Faisalabad Medical University, Faisalabad. ⁵Postgraduate Resident, Allied Hospital, Faisalabad. ⁶Assistant Professor of Medicine, Faisalabad Medical University, Faisalabad. ⁷Postgraduate Resident, Allied Hospital, Faisalabad. ⁸Postgraduate Resident, Allied Hospital, Faisalabad. ⁹Postgraduate Resident, Allied Hospital, Faisalabad. ¹⁰Postgraduate Resident, Allied Hospital, Faisalabad. ¹¹Postgraduate Resident, Allied Hospital, Faisalabad. ¹²Postgraduate Resident, Allied Hospital, Faisalabad. ¹³Sir Syed College of Medical Sciences, Karachi.

PRINCIPLES AND PRACTICE OF NUTRITIONAL THERAPY IN HYPERGLYCEMIA IN PREGNANCY (HIP) IN PAKISTANI POPULATION

Medical nutritional therapy is essential part of treatment for both maternal and perinatal health. Desired glycemic control with essential nutrients and appropriate weight change is desirable for short- and long-term implications.

STEP 1: SETTING THE GOALS

It is important to have clear cut goals before stepping ahead in guiding women about nutrition in GDM. Goals include;

- Obtaining normoglycemia
- Providing a plan that ensures adequate nutrition to allow the healthy gestational weight gain (according to BMI)
- Preventing ketosis
- Ensuring optimum perinatal health

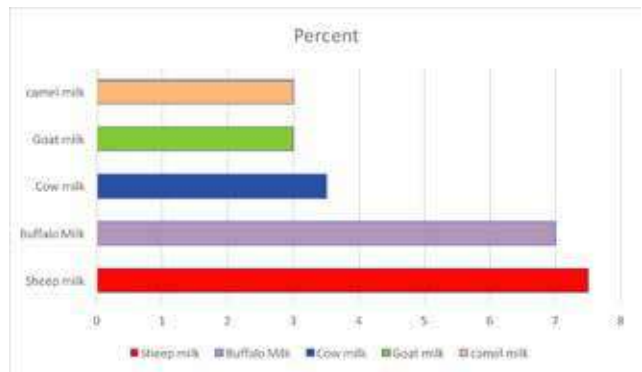
STEP 2: SENSITIZING THE WOMAN WITH GESTATIONAL DIABETES MELLITUS (GDM)

The woman needs to be sensitized about the importance and role of nutritional therapy in GDM management. Make her understand and aware that it is practically impossible to manage GDM without making some healthy changes in her lifestyle, the benefits of which will go a long way ^[1]. Build confidence that it is not very difficult to take these steps.

a. Busting the common cultural myths:

Address common myths and misconception regarding diet in pregnancy. Avoid desi ghee with milk (full cream milk), white sugar brown sugar, Jaggery (gurr) and honey should also be prohibited. 'Panjiri' is prohibited because of high sugar and cholesterol content. Fat content of sheep milk, Buffalo milk, cow milk, goat milk, and camel milk is >7%, 7%, 3.5 %, 3% and 3% respectively. Provide scientific reasons and inform that it is harmful for their health. Also debunk the common myth of 'You should eat for two'. Share the benefits of eating smart rather than just doubling it up.

Approximate fat content of various sources of milk:



b. Tailor made approach:

Every individual has their own personal, cultural and biological norms (BMI, desired body weight, day to day physical activity). Management of diabetes in pregnancy has 4 pillars, each one of them is important. .

- Pillar A- Medical nutritional therapy
- Pillar B- Exercise or day to day activity
- Pillar C- pharmacological intervention
- Pillar D- Fetal well-being evaluation

Step 3: Weight Gain during pregnancy:

Following targets of weight gain should be followed during pregnancy.

Table 1: Recommendations for Total Weight Gain and Rate of Weight Gain During Pregnancy by Pre-Pregnancy BMI [2]

PRE-PREGNANCY BMI (KG/M2)	TOTAL WEIGHT GAIN (KG)	RATE OF WEIGHT GAIN IN 2 ND AND 3 RD TRIMESTER (Kg/week)
Underweight < 18.5	12.5 - 18	0.51 (0.44 - 0.58)
Normal 18.5 - 22.9	11.5 - 16	0.42 (0.35 - 0.50)
Overweight 23 - 24.9	7 - 11.5	0.28 (0.23 - 0.33)
Obese >25*	5 - 9	0.22 (0.17 - 0.27)

*Word of Caution:

General recommendations of the minimum caloric intake for

women with GDM are available but individualized recommendations are needed in women with Polycystic ovarian syndrome (PCOS,) who may gain excessive weight.

Calculations assume a 0.5 – 2 kg weight gain in the first trimester

Obese women are recommended to reduce caloric intake. Total calorie intake should not be less than 1600 to 1800 kcal/d.

Step 4: Glycemic Index (GI)

The glycemic index is a system of assigning a number to carbohydrate-containing foods according to how much each food increases blood sugar.

“The glycemic index (GI) is a ranking system for carbohydrate rich foods based on their immediate impact on blood glucose levels” [3]

- GI of 50-gram Glucose is 100
- Low GI (55 or less) Choose most often
- Medium GI (56 to 69) Choose more often
- High GI (70 or more) Choose less often

Table 2: Glycemic Index and Calories in Common Food items

Low G.I.			Medium G.I.			High G.I.		
Food	G.I.	Calories*	Food	G.I.	Calories*	Food	G.I.	Calories*
Peanut	15	318	Popcorn	55	6	White bread	71	265
Cauliflower	15	33	Date	55	277	Bagel	72	250
Cucumber	15	45	Sweet corn	56	98	Watermelon	72	30
Spinach	15	23	Whole wheat	58	265	Boiled white rice	73	130
Tomato	15	17	Banana	58	89	French fries	76	274
Cherries	22	50	Boiled sweet potato	60	76	Boiled Potato	78	87
Dried peas	22	341	Mango	60	65	Corn flakes	81	357
Grape fruit	25	42	Papsya	60	43			
Cow Milk (3% fat)	27	146	Turnip	62	28			
Kidney peas	27	127	Pine apple	66	48			
Chick peas	28	164	Boiled brown rice	68	111			
Lentils	32	116						
Apple	38	52						
Pasta	42	150						
Macaroni	45	158						
Orange	48	47						

* Per 100 grams

Step 5: Advice for portion control:

The following principals may be followed to make a meal plate [4];

- Size of plate ----- 9 inches
- Proportion
 - One quarter whole grain* and/or starchy vegetable
 - One quarter lean protein sheep, cow, chicken, fish**
 - 50% Non-starchy vegetables
 - Other than plate contents, milk and fruits may be added.

A. Fruits (Annexure 3)

B. Skim Milk (Annexure 4) or Greek Yogurt (Annexure 5)

Note: Full cream milk contains 3% fat (cow milk). Low fat milk has got <1% fat, whereas buffalo milk contains 7% fat.

Please see annexures (1, 2, 3, 4 and 5) for details

Step 6: Learn Macronutrient and Micronutrient Distribution:

6.1: Advice women to take breakfast before 8am and dinner by 8pm. Last snack may be taken before going to bed to avoid hypoglycemia. Sleep before 10pm is advised to maintain circadian rhythm.

6.2: Severe caloric restriction in pregnancy is not advised specially in type-I DM. it will promote ketosis which is

associated with adverse effects on fetal brain and nervous system[7].

So far there is no bench mark for distribution of calories from carbohydrates, proteins and fats. Distribution is based on individual's eating choices and eating habits. A suggested distribution is as follows [5]:

Carbohydrates:

Women with GDM should limit carbohydrate intake to 35% to 45% of total calories. Meal distribution should be 3 large meals and 3 snacks. One size does not fit all, tailor made approach is recommended.

Proteins:

Insulin response is enhanced in the presence of protein diet this fact has got clinical implication. People who are taking insulin are likely to go in hypoglycemia in presence of a pure protein meal.[6] Advise a balanced mixing of protein rich meal with carbohydrates.

- At least 20% of the calories should come from proteins. Daily requirement index (DRI) for all pregnant women is 71gram of proteins daily.[11]

- Protein intake should be distributed evenly in meals and snacks, this would help achieve stable glucose levels and would maintain the level of feel satiety.

- The main course dinner should be well before bedtime, else recommend a high protein snack (like a hardboiled egg which has about 6gram of protein or a cup of Greek yogurt).

- Women who are undernourished, protein supplementation (protein powders) do not improve pregnancy outcomes [12]

- Lean meat; chicken, fish eggs, low fat dairy are some good sources of proteins.

Table 3: Daily Requirement Index (DRI) For Pregnant Women [8]

Proteins	Pre-conception 10-20% of total daily calories 0.8g/kg; minimum in 40gm/day During pregnancy minimum 71gm 20-25% of daily calories intake
Carbohydrates	45-65% of total calories before pregnancy & 35-45% of total calories during pregnancy approximately 175g of total meal
Fats	Monounsaturated fats are preferred less than 7% of daily calories should come from saturated fats and up to 10% from polyunsaturated fats 25-35% of calories should come from fats
Fibers	Same as pre-pregnancy (28gm/day)
Sodium	In GDM 2300 mg/day VS Pre-pregnancy 3000mg/day
Other nutritional supplements	Same as during pregnancy

OILS AND FATS:

The advice should be to eat mixed oil for healthy balanced diet, following table may be used as a guide regarding proportion of essential fatty acids in various fats.

Table 4: Types of fats, sources and essential fatty acids

Type of fat	Sources	Fatty Acids
Saturated	Butter, Desi Ghee, Egg yolk, Meat & animal fat	Myristic, Palmitic, stearic
Monounsaturated	Olive oil, Canola oil	Oleic Acid
Polyunsaturated	Sun Flower oil, Corn oil, Soya oil	Linoleic, Eicosapentaenoic, Docosahexaenoic

*Olive oil- (monounsaturated oil), has very low smoke point, never put it on fire. Pour it on precooked food

Consumption of fat should be according to following proportions

- Animal fats less than 7%
- Rest of calories should come from i. 90% monounsaturated fat

ii. 10% polyunsaturated fats

Practical example to use them in kitchen is to mix 2.5 liters canola oil in 0.25litres soy bean oil.

Rice bran oil is relatively newer entry in the market and has excellent properties. It contains essential fatty acids and its smoke point is very high (2320C). Discourage coconut oil because it is a saturated oil. (See Table 4)

Table 5: Type of fats and it's recommendations

Type of fat	Recommendation [14]	Foods
Trans Fats	Trans fatty acids should be totally avoided as they cross the placenta and are associated with adverse maternal and fetal health outcomes [15]	Commonly available baked items (pastries, cookies), fried items (French fries), margarine, processed meats, food (chips packets) contain trans fats.
Good Unsaturated fats	Most of the fat requirement should be filled with this type	Plant / vegetable-based oils, seeds (pumpkin seeds, sunflower seeds, sesame seeds), nuts (almonds, walnuts, hazelnuts), fish
Omega -3	Type of polyunsaturated fat, the body cannot make this so food is the only source. Omega -3 fatty acids Very important for the visual and cognitive development of the fetus.	Fish, flax seeds, walnuts, canola oil
Saturated fat	Saturated fat intake should be less than 7% of the fat requirement.	Most fast-food items, Beef, cheese, ice-cream Plant sources of saturated fat: coconut oil, palm oil, coconut

Food containing long chain Omega 3 Fatty acids are Flax seed, nuts, sea food, Plant oils, Soy oil, Canola oil, rice bran oil and fish are recommended. [14] (but must-see Annexure 2 for consumption of fish, Mercury toxicity should be avoided). Minimize trans-fats and Advanced Glycation End-products (AGEs) in diet. [15] To achieve this goal following measure may be adopted to reduce (the risk of atherosclerosis and ischemic heart diseases). [16]

- Use water-based cooking [17]
- Cover the food while cooking to minimize oxidation
- Avoid deep frying
- Add vinegar/lemon juice/sour curd to meat before cooking (marination). Women who do not like sour taste, may wash for 20 min after marination before cooking.
- Saturated fat should be limited to less than 7% and dietary cholesterol to less than 200mg/dl which is almost same as cholesterol content of an egg yolk.

Nutritional supplements are same as in women with normoglycemic pregnancy

Miscellaneous:

FIBER:

- The recommendation for women with GDM is the same as for pregnant women without GDM i.e., 28 grams of fiber per day.
- Fiber helps slow the absorption of glucose and helps with improved glucose levels. It also helps prevent and reduce constipation.
- Beans, whole grain and nuts are some of the good sources of fiber.

MICRONUTRIENT:

The requirements of micronutrients are the same as that for pregnant women without gestational diabetes. Some key

micronutrients, the need of which cannot be met with diet alone, often have to be given in the form of a supplement. The daily supplements should have the following amounts of important micronutrients.

- Iron – 27 mg
- Calcium – at least 250 mg (elemental calcium 1000 mg/day)
- Folate – at least 0.4 mg (0.6 mg in the second and third trimesters)
- Iodine – 150 mcg
- Vitamin D – 200 to 600 international units (exact amount is controversial)
- In addition to these key ingredients, pregnant women should also be given vitamins A, E, C, B vitamins, and zinc. [18]

Caffeine/Chai intake:

Advise pregnant women to limit caffeine intake. Studies have shown problems with as low as 200mg of caffeine /day. [19]

Caffeine content of the following commonly consumed drinks are as under: [20]

- Chai: 240ml has 25 mg of caffeine.
- Espresso: 30ml has 40mg caffeine
- Tea: 235ml has 53mg caffeine
- Instant coffee :235ml has 93 mg caffeine
- Brewed coffee coffee:235 ml has 133mg caffeine

Concerns about tea, other than caffeine in it:

- Since the release of tannins in tea leaves could hinder iron absorption so advice the patient not to take tea with the meals. [21]
- Provide tips on a safer method of making tea/chai tea: Turning the flame off right after the water gets boiled and then adding tea leaves and letting it seep for several minutes would yield a nice flavorful cup of tea without releasing a lot of tannins.
- Consumption of tea/coffee might also negatively affect calcium absorption. Some studies have shown an inverse relationship between caffeine and bone mineral density. [22]
- Restrict tea intake to 2 cups/day, because black tea is also a rich source of oxalates which could lead to kidney stones. [23]

Sugary beverages / fizzy drinks: Since social and cultural use of fizzy and sugary drinks is quite common and has bad impacts on maternal and fetal health, such beverages should be discouraged. The consumption of sugar sweetened beverages was significantly associated with an increased risk of incident gestational diabetes [24]

Women should be advised following eating pattern

1. Eat small and frequent meals.
2. Add small portions of snacks in between the major meals.
3. Add post dinner or Bedtime milk.
4. Add raw veggies or salads in diet.
5. Add soup as a mid-evening snack.
6. Take 2 fruits daily (but, avoid high sugary fruits)
7. Do not use simple carbs.
8. Avoid juices completely.
9. Do not skip breakfast, snacks and meals.
10. Avoid processed and packed foods.
11. Avoid desserts.
12. Avoid artificial sweeteners.
13. Avoid junk foods.
14. Avoid confectionary and bakery products.
15. Avoid cold drinks, soda.
16. Limit oil intake. (500ml/month).
17. Avoid fish that are high in mercury (For details see Annexure 2)

Easily Consumable food items during pregnancy

1. Fresh or frozen vegetables

2. Egg whites
3. Fresh fruit
4. Skinless chicken breasts
5. Baked fish
6. Steamed vegetables
7. Air-popped popcorn
8. Greek yogurt (Un-sweetened)

Important Considerations:

- Maintain good hydration
- Stop smoking

SAMPLE DIET MENU: (1600 Cal)

After having an understanding of glycemic index, caloric and carb content of some common food items, it would be easy to suggest a healthy and GDM friendly meal plan to women. (See Table 6A)

Table 6A: Sample food plan for a day

7:30am Breakfast	Chapatti 80g Boiled egg Skim Milk 1 cup
10:30am Morning snack	Half Apple Skim Milk 1 cup 2 Walnuts, 7 almonds, 10 peanuts
01:30pm Lunch	Chapatti (80g) Vegetable curry 1/4 Apple
04:30pm Afternoon snack	1/4 Apple Skim Milk 1 cup
07:30pm Dinner	Chapatti (80g) Vegetable Curry Salad 1 cup
10:00pm Night Snack	1/4 Apple Skim Milk 1 cup

Table 6B: Calory count for common dietary items as (given in table 5A)

7:30am	80g Chapatti	(136cal)	Boiled egg	(77 cal)	Skim Milk 1 cup	86 cal
10:30am	Half Apple	(36cal)	Skim Milk 1 cup	(86cal)	Walnuts 2 Almonds 7 10 peanuts	45 cal 50 cal 60 cal
01:30pm	Chapatti (80g)	136 cal	Vegetable Curry	95 cal	1/4 Apple	21cal
04:30pm	1/4 Apple	21cal	Skim Milk 1 cup	(86cal)		
07:30pm	2 small chicken breast	328 cal	Simple curry with half chapati	200 cal	Salad 1 cup	18cal
10:00pm	1/4 Apple	21cal	Skim Milk 1 cup	(86cal)		

(Download health application from google play store to analyze diet plan)

Nutrient content of above diet plan is: Carbs 180 g (55%), healthy Fat 40g (25%), Protein 115g (20%), Sodium 2300mg, Saturated fat 12g, Iron 5mg, Calcium 1700mg, Potassium 2900mg, Fiber 13g.

Annexure 1:

Rice:

- Advise to consume brown rice (unpolished) as it contains fiber and multi vitamins especially vitamin B1.
- In Pakistan, people use oils and banaspati to cook rice (Pulao, Biryani etc) which leads to increase in fat contents resulting in undesired weight gain (obesity). For preparation of rice for people with diabetes, brown boiled rice is better and heaped and full plates of rice may be avoided.
- Rice are carbohydrates which are equivalent to chapatti and

oiled rice (Biryani, Pulao etc) are equivalent to paratha (Chapatti with lot of oil contents)

Annexure 2:

Fish and Omega 3 Fatty Acid:

FDA recommends 8-12 ounces (1-ounce 28g) per week during pregnancy which is 2-3 serving^[2].

- Some types of sea foods particularly large predatory (i.e. sharks, swordfish, king mackerel, cobia (sanghra) and tilefish) contain high levels of mercury. Carp (like rahu), mahi mahi can be used once per week. Pregnant women should avoid these types of fishes because of high mercury content, which may be toxic to developing brain and nervous system of fetus^[5].
- Advise to eat a variety of seafood that is low in mercury
 - o Catfish (Khagga)
 - o Fresh water trout
 - o Pomfret (Butterfish)
 - o Salmon
 - o Anchovies
 - o Herring (kerli)
 - o Shrimp
 - o Pollock
 - o light tuna
 - o sardines
 - o canned tuna
- Pregnant women should avoid uncooked fish and shellfish as they contain viruses and bacteria, therefore seafood should be cooked at 145°F.
- Other ways to get Omega-3 fatty acids.
 - o Flaxseed --- ground seed or oil
 - o Canola oil
 - o Walnuts
 - o Sunflower seeds
 - o Soy beans

Annexure 3:

Fruits:

- Half orange (50gm)
- Half apple (50gm) with apple peels for fiber content.
- Half guava (50gm)
- Half banana
- 1 date (2 inch)

Annexure 4:

Skim Milk:

The skimmed milk available in the market should have < 1% of fat. The method of conversion from fresh milk to skimmed milk is as follows:

- Take 1 kg milk and bring it to boil
- Let milk cool down then remove cream on top
- Refrigerate the milk overnight then remove cream again
- Shake milk for 5 minutes
- Keep the milk in the refrigerator again for 1 hour and then remove the cream

Annexure 5:

Greek Yogurt:

Greek Yogurt is available in the market. If it is not available then method of conversion is as follows:

- Take 1 quarter kg (250gm) Yogurt remove the cream the top few mm

- Pour it in a muslin (mulmal) cloth to squeeze out the whey/water
- Add a little amount of water and shake it in juicer machine till butter is separated
- Remove butter
- According to taste add mint leaves, red chilies and cumin seeds etc

TABLE 7: EXERCISE PROGRAM FOR PEOPLES WITH DIABETES IN PREGNANCY

When to start	As soon as possible
When to end	Until delivery / as tolerated
Best Exercise	Walk with correct posture
Duration	30-60 minutes
Number of days/weeks	Daily (at least 3-4 days)
Intensity of exercise	A. Less than 60-80% of age predicted maximum maternal heart rate (usually not exceeding 140bpm) B. Talk test C. Self-reporting intensity Borg scale* ----- moderate 12-14
Environment	Smoke-free well-ventilated temperature-controlled area is recommended. Prolong exposure to heat /extreme cold must be avoided
Footwear	Air filled joggers, cotton socks
Guidance and supervision	Preferred if available

***Talk Test:**

Another way to measure exertion. As long as woman can talk during exercise (talkative conversation), she is not over exerting.

****BORG SCALE:** ^[25]

Table 8: BORG rating of perceived exertion to measure physical activity intensity level

6	
7	Very, very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	hard
16	
17	Very hard
18	
19	Very very hard
20	

EXERCISES FOR WOMEN ON BED REST:

These exercises are meant to improve circulation in lower limb to prevent deep vein thrombosis (DVT). The following recommendations should be given:

1. Lie on Left lateral position.
2. Alternate flexion and extension of both legs at knee and hip joints 10 times/hour whilst awake.
3. Do full flexion at ankle joint and toes and hold for 10seconds followed by full extension of ankle and toe and hold for 10seconds. Alternate this movement 10 times/hour

whilst awake

4. If you combine the movements of the arms at the shoulder joint with the exercises of the lower limbs (as detailed above), it will help in glycemic control in addition to preventing DVT. A general discussion with a pregnant woman about safe handling and preparing food:

Since pregnant women are more prone to certain infections, they should be advised to follow these important points

- Frequent hand washing
- Thoroughly washing meat, fish and poultry before cooking
- Before eating, rinse fruits and vegetables with running water for at least 30seconds.
- Avoiding unpasteurized juices and dairy products including soft cheese.
- Meat, chicken, eggs and fish should be fully cooked before consuming.
- Staying watchful about cleanliness of cutting boards and countertops.
- Not to consume edibles that need to be put in the fridge, if left out for more than 2 hours
- Avoiding dining out and consuming street foods.

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