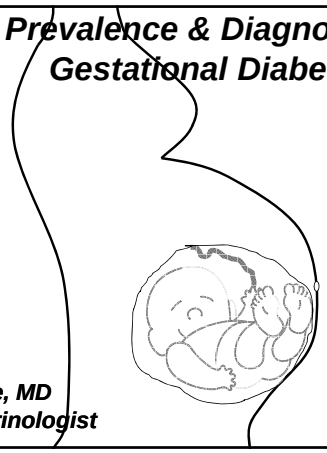
Prevalence & Diagnosis of Gestational Diabetes



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Gestational diabetes mellitus (GDM);

any degree of impaired glucose intolerance with onset or first recognition during pregnancy.

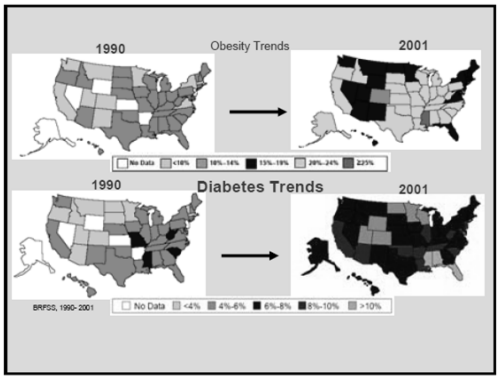
- whether insulin or only diet modification is used for treatment
- whether or not condition persists after pregnancy.

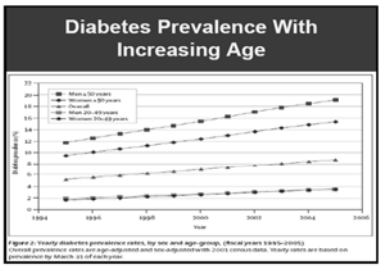
Prevalence ;

- ***7% of all pregnancies are complicated by GDM in US***
- ***prevalence range from 1- 14% of all pregnancies, depending on population studied & diagnostic tests employed.***

PREVALENCE of GDM—

- varies worldwide & among racial & ethnic groups.
- higher in black, Latino, Native American, & Asian women than white women.
- varies with testing method & diagnostic criteria.
- varied from 1.4 to 14% in different studies.
- increasing over time in women of diverse racial/ethnic backgrounds, possibly related to increases in mean maternal age & weight.





Population		year	Diagnostic method	Prevalence of GDM%
Chinese Melborne-Australia(Indian-born)				0.6
				15.0
IRAN				4.7-8.9
Larijani	Tehran	2003	50&100g GTT	4.7
Hadaegh	Bandar-abbas	2005	50&100g GTT	8.9
Keshavarz	Shahrood	2005	50&100g GTT	4.8
Maghbooli	Tehran	2007	50&100g GTT	7
Shirazian	Tehran	2008	75g GTT	6.1
Shirazian	Tehran	2009	75g GTT	7.4

Khoshnniat N, Iranian Journal of Diabetes and Lipid Disorders; 2009

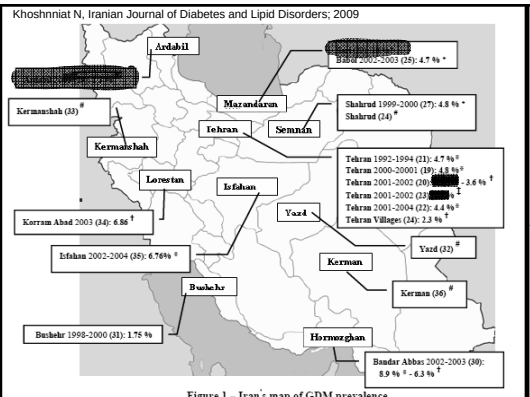


Figure 1 – Iran's map of GDM prevalence

(): The Reference Number , * Diagnosed with Iranian's SBMU Criteria , † Diagnosed with NDDG Criteria , ‡ Diagnosed with 75 gram Oral glucose Tolerance Test and ADA Criteria , # These articles due to not applying the standard methods eliminated.

Pathogenesis

- **In normal pregnancy insulin resistance and hyper-insulinemia ensure that the fetus has an ample supply of fuel and nutrients at all times.**
- **Insulin resistance and hyperinsulinemia in pregnancy predisposition to develop diabetes during gestation**

Pathogenesis

- ***Etiology of insulin resistance in GDM:***
  - **Physiological insulin resistance of late pregnancy due to:**
    - **placental secretion of diabetogenic hormones including GH, CRH, Placental lactogen, progesterone**
    - **TNF-ά**
  - **More chronic form of insulin resistance that is present before pregnancy and is exacerbated by physiological changes that lead to insulin resistance during pregnancy include:**
    - **Increased Maternal adipose deposition**
    - **Decreased exercise**
    - **Increased caloric intake**

Pathogenesis

GDM occurs when pancreatic function is not sufficient to overcome the insulin resistance created by changes in diabetogenic hormones during pregnancy

RISK FACTORS —

1. family history of diabetes, especially in first degree relatives
2. Prepregnancy weight ≥110 % of ideal body weight or BMI > 30 kg/m2 or significant weight gain in early adulthood, between pregnancies, or in early pregnancy
3. Age > 25 years
4. Previous delivery of a baby > 9 pounds [4.1 kg]
5. Personal history of abnormal glucose tolerance
6. Member of an ethnic group with higher than background rate of type 2 diabetes (in most populations, the background rate is ~2 %)
7. Previous unexplained perinatal loss or birth of a malformed child
8. Maternal birthweight > 9 pounds [4.1 kg] or < 6 pounds [2.7 kg]
9. Glycosuria at first prenatal visit
10. Pcos
11. Current use of glucocorticoids
12. Essential hypertension or pregnancy-related hypertension

- ***There is little consensus worldwide regarding***

whom to test

or

how to test

for GDM.

screening

universal?

or

Selective?

Diagnosis of GDM identifies 2 people at increased risk

Crowther, CA, Hiller, JE, Moss, JR, et al. Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N Engl J Med 2005; 352:2477.

a trial of 1000 women with mild GDM
randomly assigned to receive treatment or routine care
clinicians & patients in control group not know results of GDM testing,
So increasing probability that control group actually received routine care.
Infants of women in the treatment group had ;
a significantly lower composite rate of **perinatal complications**
(eg, death, shoulder dystocia, bone fracture, nerve palsy)
(1 versus 4 %)
lower rate of macrosomia **(10 versus 21 %)**

American Diabetes Association,

- **Assess risk at first visit :**
  - Low risk
  - High risk
  - Average risk

•**Gestational diabetes mellitus. Diabetes Care 2004; 27 Suppl 1:S88**.

Low Risk group (all)

1. Age <25 years
2. Normal pre-pregnancy weight(BMI<25kg/m2)
3. Member of an ethnic group with a low prevalence of GDM
4. No known diabetes in first-degree relatives
5. No history of abnormal glucose tolerance
6. No history of poor obstetric outcome

requires no glucose testing

High risk group (any one);

1. marked obesity
2. a strong family history of type 2 diabetes
3. personal history of GDM, glucose intolerace
4. Glycosuria

perform GTT as soon as possible

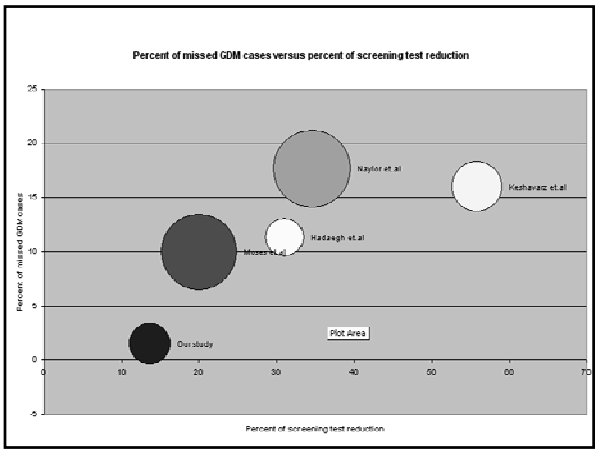
- Women of ***average risk*** should have testing undertaken at

24–28 weeks of gestation

- *Moses RG et al;* ***Gestational diabetes: do lean young Caucasian women need to be tested?*** *Diabetes Care 1998; 21:1803*

2907 Women , Low risk(white,age<25,BMI<25) ,
prevalence of GDM (defined as 2-h PG ≥144 mg/dL) in low-risk group was 2.8 %; these women had pregnancy outcomes similar to other women with GDM.

- ***If screening had been selective, 80% of women would still have been screened***
- ***10% of women with GDM would have been missed.***



- **American College of Obstetricians & Gynecologists (ACOG);**
- **universal screening is the most sensitive and more practical approach**
- **screening may be omitted in low risk women (as defined by ADA)**

- **United States Preventive Services Task Force (USPSTF) &**
- **Canadian Task Force on Preventive Health Care;**
- both; **there was insufficient evidence to recommend for or against universal screening for GDM**

The Hyperglycemia & Adverse Pregnancy Outcome (HAPO) trial

universal screening

is the best method to improve a pregnancy outcome
because hyperglycemia can affect fetus
even if the gravida has not met the ADA criteria
for diagnosis of GDM.

One-step Approach

- Perform a diagnostic oral GTT without prior plasma glucose screening
- May be cost-effective in high-risk patients or populations (e.g., some Native-American groups).

Two-step approach

1. Initial screening by measuring plasma glucose 1 h after a 50-g oral glucose load
2. Diagnostic OGTT on that subset of women exceeding glucose threshold value on GCT

50-g oral glucose challenge test

- ACOG & ADA suggest GCT for screening
- 50-g oral glucose load
- without regard to the time of last meal
- Plasma glucose one hour later

GCT,

abnormal **?**

≥130

≥ 140

threshold	test is positive	sensitivity
130 mg/dL	20-25%	90 %
140 mg/dL	14-18 %	80%

Brody, SC, Harris, R, Lohr, K
. Screening for gestational diabetes: a summary of the evidence for the U.S. Preventive Services Task Force.
Obstet Gynecol 2003; 101:380.

GCT (mg/dl cut-off)	Subjects requiring OGTT	Sensitivity (% GDM detected)	Specificity (%)
130	**100 (24.3%)**	**96%**	**81**
140	**70 (17%)**	**88**	**88**

M. Keshavarz et al. / Diabetes Research and Clinical Practice 73 (2006) 98–99

Dodd, JM, Crowther, CA, Antoniou, G, et al. Screening for gestational diabetes:The effect of varying blood glucose definitions in the prediction of adverse maternal and infant health outcomes. Aust N Z J Obstet Gynaecol 2007; 47:307.

threshold	sensitivity	percent of women screened required a GTT	the cost per case diagnosed was
130 mg/dL	100 %	25%	$249
140 mg/dL	90 %	15%	$222.

these studies did not take all of the costs associated with missing or diagnosing GDM into account. EX, the risk of adverse maternal and infant pregnancy outcomes (preeclampsia, cesarean delivery, shoulder dystocia, neonatal hypoglycemia) increases with increasing levels of glucose impairment

Table 1— Diagnosis of GDM with a 100-g oral glucose load

	mg/dl	mmol/l
Fasting	**95**	5.3
1-h	**180**	10.0
2-h	**155**	8.6
3-h	**140**	7.8

2 or more must be met or exceeded for a positive diagnosis. Test should be done in the morning after an overnight fast (8-14 h & after at least 3 days of unrestricted diet (150 g carbohydrate per day) & unlimited physical activity. Carbohydrate loading is probably not necessary The subject should remain seated and should not smoke throughout the test.

Moses, RG, Moses, M, Russell, KG, Schier, GM.
The 75-g glucose tolerance test in pregnancy: a reference range determined on a low-risk population and related to selected pregnancy outcomes.
Diabetes Care 1998; 21:1807.

Universal screening,75 g-oGTT;

- ***The test not only was an excellent screening test, but also a cost-effective diagnostic test to identify high-risk pregnancies.***

GDM screening high risk group

Table 6—*Screening for and diagnosis of GDM*

Carry out diabetes risk assessment at the first prenatal visit.

Women at very high risk should be screened for diabetes as soon as possible after the confirmation of pregnancy. Criteria for very high risk are:

- Severe obesity
- Prior history of GDM or delivery of large-for-gestational-age infant
- Presence of glycosuria
- Diagnosis of PCOS
- Strong family history of type 2 diabetes

Screening/diagnosis at this stage of pregnancy should use standard diagnostic testing

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Low risk group

All women of greater than low risk of GDM, including those above not found to have diabetes early in pregnancy, should undergo GDM testing at 24–28 weeks of gestation. Low-risk status, which does not require GDM screening, is defined as women with ALL of the following characteristics:

- Age <25 years
- Weight normal before pregnancy
- Member of an ethnic group with a low prevalence of diabetes
- No known diabetes in first-degree relatives
- No history of abnormal glucose tolerance
- No history of poor obstetrical outcome

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Table 6—*Screening for and diagnosis of GDM*

Perform a 75-g OGTT, with plasma glucose measurement fasting and at 1 and 2 h, at 24–28 weeks of gestation in women not previously diagnosed with overt diabetes.

The OGTT should be performed in the morning after an overnight fast of at least 8 h.

The diagnosis of GDM is made when any of the following plasma glucose values are exceeded:

- Fasting ≥92 mg/dl (5.1 mmol/l)
- 1 h ≥180 mg/dl (10.0 mmol/l)
- 2 h ≥153 mg/dl (8.5 mmol/l)

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Shirazian N, Fadaki F, Fathollahi A; **Screening practices for gestational diabetes mellitus by obstetricians in Tehran;** [abstract]. In: Scientific program and abstracts of the 13th Asia-Oceania Congress of Endocrinology (AOCE); May 10-12, 2006; Tehran, Iran.

Only **2** of respondents use one-step 75g GTT.

Hyperglycemia & adverse pregnancy outcomes.

- **Primary outcomes** ;
  birth weight > 90th percentile for gestational age, primary cesarean delivery, clinically diagnosed neonatal hypoglycemia, &
  cord-blood serum C-peptide level > 90th percentile.
- **Secondary outcomes** ;
  delivery< 37 w,
  shoulder dystocia or birth injury,
  need for intensive neonatal care,
  hyperbilirubinemia, &
  preeclampsia.

Significance of early diagnosis and treatment

- **Prevention of several adverse outcome:**
- ***Maternal:***
  - **Short- acting:**
    - **operative delivery**
    - **Premature delivery**
    - **preeclampsia**
    - **Polyhydramnios**
    - **pyelonephritis**
  - **Long-acting:**
    - **development of DM (10%/yr)**

UTD-15.2

Adverse outcome

- ***Fetal and neonatal:***
  - **Short-acting:**
    - **fetal macrosomia,**
    - **birth trauma,**
    - **perinatal mortality,**
    - **neonatal metabolic complication**
    - **Congenital anomaly**
  - **Long-acting:**
    - **obesity,**
    - **diabetes during childhood,**
    - **impaired fine and gross motor function,**
    - **higher rate of inattention and hyperactivity**

UTD-15.2

Diabetic embryopathy

- Related to ***degree of hyperglycemia*** (in early pregnancy) as well as ***other factors,*** Include:
  - ***Spontaneous abortion***
  - ***Major malformation due to yolk sac failure:***

2/3
- Cardiovascular anomalies (8.5/100 live birth)
- CNS anomalies (5.3/100 live birth)
- Genitourinary anomalies (renal anomalies)
- Gastrointestinal anomalies (small left colon syndrome)
- skeletal defects (caudal regression syndrome)

UTD-15.2

Cardiovascular abnormality

- ***Prevalence:*** 8.5/100 live birth
- ***Including:***
  - transposition of great vessels
  - Ventricular septal defect (VSD)
  - Atrial septal defect (ASD)
  - Situs inversus

Jostlin-2005

Nervous system anomalies

– Anencephaly (13 times)
– Spina bifida (20 times)
– Hydrocephalus

Jostlin-2005

Prematurity and perinatal survival

- ***Prematurity*** occurs with greater frequency in IDM, especially when diabetes is complicated by renal disease
- In most cases preeclampsia or fetal distress with or without IUGR is present.
- Pregnant women in class F or RF:
  - Delivery before 34th week of gestation in 25%
  - Delivery before 37th week of gestation in 50%
- ***Morbidities*** occur in 20% of pregnancies, including:
  - predelivery IUGR
  - Postdelivery RDS

Jostlin-2005

Medical Nutrition Therapy

(cont')

Goals:

- Achieve normoglycemia

Recommended treatment targets

Test	Gestational Diabetes (mg/dl)
Fasting plasma glucose	65-95
I hr postprandial	<140
2 hr postprandial	<120

Dr. Mirmiran / SBMU ADA.2004

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Medical Nutrition Therapy (cont')

- Providing the required nutrients for normal fetal growth and maternal health
- Prevent excessive maternal weight gain, particularly in women who are overweight or have gained excess weight in pregnancy.
- Prevent ketosis

Medical Nutrition Therapy
(cont')

Include:

- Nutrition therapy
- Exercise
- Self-monitoring of blood glucose (SMBG)
- Pharmacologic therapy
- Education

Nutrition therapy

Efficacy of dietary therapy for GDM

Nutrition intervention for GDM has been recognized as the cornerstone of therapy

In patients receive diet therapy:

- Fewer patients require insulin therapy
- Decrease HbA1c
- lower serious perinatal complications among the infants:
  - ✓lower birth weight
  - ✓ lower % large-for-gestational-age
  - ✓Less macrosomia

Dr. Mirmiran / SBMU Crowther ,2005 , Reader,2006 , Cheung,2009 49

Nutrition therapy (cont')

- All women should receive **individualized counseling**
- Food plan should be individualized & culturally appropriate

to provide adequate calories & nutrients to meet the needs of pregnancy and consistent with the blood glucose goals

Dr. Mirmiran / SBMU Cheung,2009 50

Nutrition therapy (cont')

weight-gain recommendations based on prepregnancy BMI

BMI (kg/m2)	weight-gain
normal **19.8 –26.0**	**11.4 –15.9 kg**
overweight 26.1–29.0	6.8–11.4 kg
Obese >29	kg7

Dr. Mirmiran / SBMU (Institute of Medicine's Nutrition for Pregnancy 1990) 51

Nutrition therapy (cont')

- Calorie formulas have been suggested in articles and guidelines for GDM:

  - 35–40 kcal/kg for underweight
  - 30 –35 kcal/kg for normal weight
  - 25–30 kcal/kg for overweight
  - 23–25 kcal/kg (pregravid weight) for obese

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Nutrition therapy (cont')

Macronutrient intake

- **Carbohydrate (CHO) : 50 to 55%** kcal intake
- **Protein: 20-25 %** kcal intake
- **Fat: 25-30%** kcal intake

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Nutrition therapy (cont')

Fiber :

- Soluble (legumes, oats, fruits)
- Insoluble (whole grain breads, cereals and some vegetables)

Both:

- ✓ increase satiety
- ✓ slowing absorption time
- ✓ lower glycemic index

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Fetal Biophysical Profile

- Nonstress test
- Fetal breath movements
- Fetal body movements
- Fetal reflex movements
- AFV
- Either acute hypoxia (NST, breathing, or movement) or chronic hypoxia (reflex activity, AFV) could alter parameters
- False-negative rate of 0.6/1000and a false-positive rate of 50%
- Timing of the initiation of the BPP has varied, although most data come from testing after 30 weeks gestation