Gestational Diabetes Diagnosis and Blood Glucose Targets

Leona Dang-Kilduff, RN, MSN, CDE
Stanford University
Mid-North Coastal and East Bay California, Regional Perinatal Program Director

Overview of Metabolism
Non-pregnant                 Non-diabetic

<table>
<thead>
<tr>
<th>Diet</th>
<th>Fuels (oxid.)</th>
<th>Storage of Excess Fuels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>Glucose</td>
<td>Glycogen</td>
</tr>
<tr>
<td>Protein</td>
<td>Amino Acids</td>
<td>Protein</td>
</tr>
<tr>
<td>Fats</td>
<td>Fatty acids</td>
<td>Triglycerides</td>
</tr>
</tbody>
</table>

Effects of Insulin on:
- **Promotes**
  - Glycogen storage
  - Triglyceride synthesis
- **Inhibits**
  - Glycogenolysis
  - Gluconeogenesis
**Hormonal Changes: Early Pregnancy**

- ↑Estrogen, progesterone → Hyperphagia
- ↑HPL, prolactin → Fat deposition
- ↑Progesterone, Growth hormone
- ↑HPL (human Placental Lactogen) → ↑Insulin secretion

(acompanied by relatively normal hepatic and peripheral insulin sensitivity, prevents glycogenolysis, proteolysis, and lipolysis, leading to energy storage in early pregnancy)


What Happens with High Glucose and Insulin Levels?

- High glucose levels:
  - Before 8 wks: Birth Defects
  - After 8 wks: Poor Placental Implantation

- Excess = Fetal Growth Requirement of O2 increase:
  - Stimulates fetal insulin secretion
  - Hypoxia - intolerance of labor - ? Demise

- Insulin Resistance:
  - Stimulates lumen of blood vessels
  - Stimulates RBC production
  - Stimulates Glucagon deposits in placenta
  - Poor placental transfer of O2 and nutrients
  - Polycythemia
  - Hyperbilirubinemia
  - Delayed organ maturation
  - Poor placental transfer of O2 and nutrients

- Insulin Resistance:
  - Poor placental transfer of O2 and nutrients
  - Triggers genes and response and function - reprogramming obesity and diabetes, etc...

- Poor fetal growth

- Poor fetal organ maturation

- Hypoxia - intolerance of labor - ? Demise

- Excess = Fetal Growth Requirement of O2 increase:
  - Stimulates fetal insulin secretion
  - Excess = Fetal Growth Requirement of O2 increase

- What Happens with High Glucose and Insulin Levels?

- How is the pancreas stimulated to produce more insulin?

- How does insulin help the body use glucose?

- What are the long-term effects of having high glucose levels during pregnancy?
Two GDM Screening Options

- Early A1c
- One step--75gram OGTT

*Above are the “Sweet Success Guidelines for Care” 2012 Recommendations (7)

Or

- Two Step
  - 50 gram Load if +
  - 100 gram OGTT

Gestational Diabetes Screening and Diagnosis

- Early Screen if:
  - Previous History of:
    - Gestational diabetes
    - Macrosomia history
    - Unexplained still birth
    - Malformed infant
  - History of overt DM in parents, siblings, children (1st °)
  - Body weight with BMI > 25
  - Age > 25
  - Heavy glucoseuria (>2+)
  - Medications that increase glucose intolerance

Age-Adjusted Prevalence of Obesity and Diagnosed Diabetes Among U.S. Adults Aged 18 Years or older (this includes GDM)

Gestational Diabetes Screening and Diagnosis

**Early screen if:**
- High risk ethnic group:
  - African American
  - American Indian
  - Hispanic/Latina
  - Asian Pacific Islander
  - Southeast Asian
  - Indigenous Australian
- All women at 24-28 weeks gestation

Diagnosis by A1c

<table>
<thead>
<tr>
<th>A1c</th>
<th>Diagnostic Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5.7</td>
<td>No diabetes</td>
</tr>
<tr>
<td>5.7-6.4</td>
<td>Pre-diabetes</td>
</tr>
<tr>
<td>6.5 +</td>
<td>Diabetes</td>
</tr>
</tbody>
</table>

A1c drops approximately 0.5% in pregnancy


Critical Periods of Development

<table>
<thead>
<tr>
<th>Weeks gestation from LMP</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Nervous System</td>
<td>Heart</td>
<td>Arms</td>
<td>Eyes</td>
<td>Legs</td>
<td>Teeth</td>
<td>Palate</td>
<td>Ears</td>
<td>External genitals</td>
<td></td>
</tr>
</tbody>
</table>

Missed Period

Mean Entry into Prenatal Care

California Diabetes and Pregnancy Program: Guidelines for Care 1994
Screening in Unusual Cases

- Bariatric surgery clients- Most will not tolerate a glucose load
- Hyperemesis

**Fasting and 1 hour postprandial blood glucose level**
- Fasting and 1 hour postprandial blood glucose level checked at 22-24, 28-32, and 34 weeks gestation
- Obtain fasting and 1 hour post-meal blood glucose for 1 week with a blood glucose meter while she continues her usual diet.

75 Gram OGTT

**ONE STEP TEST**

- Fasting test

<table>
<thead>
<tr>
<th>FBS</th>
<th>1 hour</th>
<th>2 hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 92</td>
<td>&gt; 180</td>
<td>&gt; 153</td>
</tr>
</tbody>
</table>

1 value = positive screen

What do we TEACH?

- What is GDM?
- What does it do to a pregnancy?
- What can be done?
  - Self Blood Glucose Testing
  - Medical Nutrition Therapy (MNT)
  - Monitoring - Maternal and Fetal
  - Antepartum/Intrapartum/Postpartum care
  - Newborn care
  - Long-term prevention

Diabetes is:

Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting in defects in insulin secretion, insulin action or both. (ADA. Diagnosis and classification of diabetes Mellitus. Diabetes Care 2010;33(Suppl 1):S62- S69)

Either don’t make enough insulin or
Can’t effectively use what is made

Overt or pre-existing:
(0.1-0.3% all pregnancies)

Type 1 - Insulin dependent, Ketone prone
Type 2 - Non-insulin dependent
  - Accounts for 90% of all Diabetics 80% are obese

IGT or Pre-Diabetes
Polycystic Ovary Syndrome/Metabolic Syndrome
GDM (~90%)
  - Diagnosed during pregnancy
  - (~1-14% of all pregnancies)
Why Treat => To have a healthy baby...

Blood Glucose Testing
- All clients start with a minimum testing schedule of FBS and 1 (or 2) hours after meals
- Premeal blood glucoes if suspected elevations between meals or if utilizing algorithm
- HS and overnight blood sugars are used if suspected overnight hypoglycemia

Blood Glucose Monitoring
- Additional testing as needed for suspected hypo or hyperglycemia
- Decrease testing if well controlled with diet only clients
- Recommend testing meter accuracy once a trimester
- Recommend using memory meters
  *Clients with meters that do not match record should have blood glucoes done during office visits
What is Normal? Pregnancy and CGMS

Ben-Haroush et al. in 2004 and Yogev et al. in 2007 looked at non-diabetic pregnancies with the CGMS—>

- Average was 83.7 ± 18
- Fasting 75 ± 12
- Pre-meal 78 ± 11
- 1 hour Post meal was 110 ± 16
- 2 hour 97 ± 11
- Peak post meal time was 70-90 minutes
- The mean over night Glucose was 68 ± 10

Blood Glucose Targets

<table>
<thead>
<tr>
<th>Time</th>
<th>Plasma Glucose mg/dl California (7)</th>
<th>Plasma Glucose mg/dl ACE (9)</th>
<th>Plasma Glucose mg/dl ACOG (10,11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting and pre-meal</td>
<td>65 - &lt; 90</td>
<td>60-90</td>
<td>&lt; 95</td>
</tr>
<tr>
<td>Post-meal 1 hour</td>
<td>100 - &lt; 130</td>
<td>&lt; 120</td>
<td>&lt; 130 to 140</td>
</tr>
<tr>
<td>Post-meal 2 hour</td>
<td>&lt; 120</td>
<td></td>
<td>&lt; 120</td>
</tr>
<tr>
<td>2-6AM</td>
<td>65-120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpartum</td>
<td>70-110</td>
<td>&lt; 100</td>
<td></td>
</tr>
</tbody>
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Blood Glucose Monitors

- I counted 32 different home blood glucose meters at just one pharmacy
- Of these 25 had the capacity to download
- Memory varied from none to 1000
- Hematocrit ranges were from 0-70%
- Time for testing ran from 5 to 50 seconds
- Blood glucose range from 20-600 mg/dl
- Temperature readings
- Sizes, colors, and cases varied significantly

SO What should we be looking for?

So what do we want in a Meter?

- Accuracy
  - Hematocrit range
  - Ease of use
  - Blood glucose range
  - Temperature ranges
- Memory
  - Ability to download
  - Ability to reapply more blood
  - Alternate testing capacity
  - Size of displays
  - Battery required
  - Alarms…

Computer Downloading

- Every company has their own programs
- All require some data port and computer access
- All have print outs
- All have the ability to program desired ranges
- All the companies I have encountered will give free software and often the data cables too
What Affects Blood Glucose

- Pregnancy
- Food choices
- Exercise and Activity
- Stress
- Medications
- Timing
- Other…
References


Contact Information

Leona Dang-Kilduff, RN, MSN, CDE
650-498-5347
or leonad@stanford.edu