

Michigan Department of Community Health
Michigan Diabetes Prevention and Control Program
Michigan Diabetes Outreach Network
Nursing Management of Diabetes
Independent Study Module Series, 2006



Gestational Diabetes Mellitus

2 Contact Hours

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Instructions for Website-Based Independent Study Module

1. Go to www.diabetesinmichigan.org, click on Independent Study Modules to access to the Independent Study Module Home Page. Click on the Start link to access the web-based Independent Study Module Home Page, www.ed2diabetes.org.
2. Set-up your account before proceeding to the modules. Click on the Register A New User link. Enter your e-mail address as your user name and create a password. Your account will have a permanent record of all modules taken from now on.
3. When logged in, a list of the current ED2 modules will be provided. The list will show the modules that you have passed and the remaining modules that are available for you to complete.
4. Select the module you wish to complete and click on Take this Module.
5. Complete and Submit the pretest which allows you to access the Independent Study module instructions, objectives, and table of contents. After reviewing this information, scroll to the bottom of the page and, click on Continue to Module Content.
6. Steps To Complete Module:
 - Read through module
 - Click on Take Post Test
 - Take post test and click on Submit
 - Fill out Participation Evaluation and click on Submit
7. If you pass the post test, your certificate of completion is accessible by:
 - Clicking on Click Here to Download Your Certificate for an immediate print out of your certificate.
 - Waiting for the e-mail notice with the attached certificate that you can print
 - Going to www.ed2diabetes.org, logging in, and clicking on the certificate option listed for all modules that you have successfully completed
8. After completing a module, you have the option to return to the Home Page and select a new module or to Log out
9. Successful completion of an Independent Study Module is defined as:
 - Achieving 70% or above on the Post Test
 - Completion of the Registration Application
 - Completion of the Participation Evaluation
10. If you have further questions, please contact the local Diabetes Outreach Network office in your area.

Instructions for Independent Study Module Printed from the Web Site

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3. When logged in, a list of the current ED2 modules will be provided. The list shows the modules you have passed as well as the remaining modules that you may take.
4. Select the module you wish to complete and click on Take this Module.
5. Complete and Submit the module's pretest to access the module's instructions, objectives, and table of contents. The bottom of the page has options to print the pdf file of the module, appendices, and Post Test/Participation Evaluation. Click on all options available and print documents to take the module.
6. Steps to complete the printed module:
 - Read through module
 - Take post test
 - Fill out Participation Evaluation
 - Mail the Post Test and Participation Evaluation to the local DON Office in your region.
7. The DON Regional Office will send your printed certificate to the address listed on your Registration Application form.
8. Successful completion is defined as:
 - Achieving 70% or above on the Post Test
 - Completion of the Registration Application
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9. If you have further questions, please contact the local Diabetes Outreach Network office in your area.

Purpose/Objectives:

The purpose of this self-paced independent study module is to provide nurses, dietitians and other health care professionals up-to-date information on gestational diabetes mellitus. This information can be used to assess, plan, implement and evaluate care for those with gestational diabetes mellitus. Upon completion of this module, the participant will be able to:

1. Define gestational diabetes mellitus (GDM).
2. Describe the metabolic changes associated with the development of GDM.
3. List one potential risk of GDM on the fetus and one on the mother.
4. State the diagnostic criteria for the individual with GDM.
5. List one component of medical nutrition therapy for the individual with GDM.
6. State the criteria for initiating insulin as treatment for the individual with GDM.
7. State two recommendations for post-partum care for the individual with GDM.

This continuing nursing education activity was approved by the Michigan Nurses Association, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation. The Commission on Dietetic Registration, the credentialing agency for the American Dietetic Association, has approved this program for 2 continuing professional education (CPE) hours for RDs and DTRs.

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Gestational Diabetes Mellitus

I. Gestational Diabetes Mellitus

A. Introduction/Prevalence

Gestational diabetes mellitus (GDM) is a designation specifically for women with any degree of carbohydrate intolerance, which is first recognized or has its onset during pregnancy. This carbohydrate or glucose intolerance is characterized by increased risk of complications to the mother and the fetus. GDM complicates approximately 7% of all pregnancies in the U.S.; however, the prevalence rate ranges between 1% - 14% of pregnancies, depending on the population studied and the diagnostic tests used. Recent research indicates that the prevalence of GDM appears to be on the rise. Various racial and ethnic groups differ in susceptibility to this condition.

Women with gestational diabetes mellitus are usually asymptomatic; therefore, the diagnosis must be sought by the physician caring for the woman. Undetected or inadequately controlled GDM can result in maternal and fetal complications. However, with tight blood glucose control, pregnancy outcomes are improved. Medical nutrition therapy, blood glucose monitoring, physical activity and sometimes insulin are used to treat gestational diabetes mellitus. The goal is to keep the blood glucose levels in the target range.

A great deal of research continues in the field of gestational diabetes. Focus is now turning on the offspring, both males and females, of women with gestational diabetes.

B. Metabolic Changes

The effects of GDM are most evident in the last half of pregnancy as the fetus grows and the mother's weight increases. By the third trimester of pregnancy, the mother's insulin will need to increase by two to three times her pre-pregnancy levels due to insulin resistance. When the maternal pancreas is not able to produce enough insulin to balance these changes, hyperglycemia and gestational diabetes mellitus occur.

The exact cause of why this can occur is unknown. It may be due to genetic factors, as well as the hormones produced by the placenta (progesterone, estrogen, human placental lactogen {HPL}, and human chorionic somatotropin {HCS}). Even though insulin production is increased, its effect is diminished which is indicative of insulin resistance. These symptoms mimic type 2 diabetes, with hyperinsulinemia and poor insulin response. The insufficient insulin produced by the mother allows glucose to circulate in the bloodstream and be passed to the fetus.

When the mother controls her diabetes, she provides conditions that will help the pregnancy have a successful outcome.

II. Screening Recommendations

The 2006 American Diabetes Association (ADA) Clinical Practice Recommendations for screening for gestational diabetes mellitus include identifying risk status at the **first prenatal visit** and immediate screening for some.

A. Risk Assessment:

1. **LOW Risk Status** includes all of the following characteristics:

- Age less than 25 years
- Weight normal before pregnancy
- Not a member of an ethnic group with a high prevalence of GDM. (High risk groups include Hispanic/Latino, African American, Asian American, Pacific Islanders, Native American and Alaska Natives)
- No known diabetes in first-degree relatives
- No history of abnormal glucose tolerance
- No history of poor obstetric outcome

If a woman is of low risk, no blood glucose testing is required; however, this category is limited to those women meeting all of the above characteristics. Recently, some literature suggests that if a woman was small for gestational age at birth, her physician may want to screen her for gestational diabetes at 24-28 weeks gestation, even if she is otherwise at low risk.

2. **HIGH Risk Status** includes any of the following characteristics:

- Marked obesity
- Personal history of GDM
- Glucosuria
- Strong family history of diabetes
- Member of an ethnic group with a high prevalence of type 2 diabetes

If a woman is of high risk, she should undergo glucose testing as soon as feasible. If she is found not to have GDM at that initial screening, she should be retested between 24 - 28 weeks of gestation.

3. **AVERAGE Risk Status:** Women who do not meet criteria for either low risk or high risk are to be considered average risk status and should be tested between 24 and 28 weeks gestation.

B. Diagnostic Criteria

A fasting blood glucose greater than or equal to 126 mg/dl or casual plasma glucose greater than or equal to 200 mg/dl meets the threshold for the diagnosis of diabetes, if confirmed on a subsequent day. If not diagnosed with diabetes, evaluation for GDM in women with average or high-risk characteristics should follow one of two diagnostic approaches.

Approaches:

1. **One-Step approach:** Perform an oral glucose tolerance test (OGTT). The test should be done in the morning after an overnight fast of at least 8 hours but no more than 14 hours, and after three days of an unrestricted carbohydrate intake of greater than or equal to 150 grams of carbohydrate per day and unlimited activity. While being tested, the woman must remain seated and must not smoke. This approach may be more cost effective in high-risk populations.

Diagnosis for GDM with an oral 100 gram glucose load:

Fasting	≥ 95 mg/dl
1-hour	≥ 180 mg/dl
2-hour	≥ 155 mg/dl
3-hour	≥ 140 mg/dl

Two or more of these venous plasma concentrations must be met or exceeded for a positive diagnosis.

2. **Two-Step approach:** Measure plasma or serum glucose concentration 1 hour after a 50-gram oral glucose load (glucose challenge test-GCT). If the one-hour value exceeds the glucose threshold value on the GCT, perform an oral glucose tolerance test on the client (see above). When the two-step approach is employed, a glucose threshold value ≥ 140 mg/dl identifies approximately 80% of women with GDM and the yield is further increased to about 90% by using a cutoff of ≥ 130 mg/dl.

III. Complications

A. Fetal

If the maternal blood glucose is not controlled, excess glucose will cross the placenta to the fetus. This increase in glucose stimulates the fetal pancreas to produce greater amounts of insulin to maintain a normal fetal blood glucose level. Insulin acts as a growth hormone that stimulates amino acid uptake and protein synthesis, which may lead to a large for gestational age (LGA) infant. The increase in size (macrosomia) can cause difficulty during labor and delivery, with possible birth trauma, such as shoulder dystocia, brachial plexus injury or subdural hematoma.

The baby will not be born with diabetes mellitus. Often neonatal hypoglycemia (a blood glucose level less than 40 mg/dl) occurs within the first hour after birth. Therefore, close monitoring of the neonate in the first 24 hours of life is necessary. Commonly, either IV glucose or early feeding of glucose water or formula is used to treat hypoglycemia. Respiratory distress syndrome (RDS) can occur from immature lung tissue and inadequate lecithin/sphingomyelin (L/S) ratios. GDM with onset in later pregnancy does not have an increased risk of congenital malformation. GDM

diagnosed with a fasting plasma glucose > 120 mg/dl may indicate pre-existing diabetes and a higher rate of anomalies than the general population.

Children of women with GDM are at increased risk of obesity, impaired glucose tolerance and type 2 diabetes later in life, even in adolescence and early adulthood. Clearly, the detection and appropriate treatment of GDM provides the opportunity to prevent adverse outcomes for both mother and child.

B. Maternal

The short-term maternal complications can be serious. Hyperglycemia can contribute to urinary tract infections, pre-eclampsia, polyhydramnios and hypertension during the pregnancy. Difficult labor and delivery can be a result of a macrosomic infant.

If the woman has been able to maintain good metabolic control and all antepartum parameters are normal, including fetal size by ultrasound (U/S), then vaginal delivery is planned. GDM is not an indication for delivery before 38 weeks gestation. However, gestation past 38 weeks increases the risk of fetal macrosomia without reducing cesarean rates. Therefore, delivery at 38+ weeks' gestational age may be recommended unless obstetric considerations dictate otherwise.

The possibility of cesarean delivery must be discussed with the woman and her support person. This should be done prior to the expected time of labor, in the event that there is premature labor or other early problems necessitating hospitalization before term. Long-term complications include postpartum hyperglycemia and an increased risk of developing type 2 diabetes mellitus later in life.

IV. Interventions

Treatment will include self-testing of blood glucose, nutritional assessment and counseling with appropriate meal plan, physical activity, and insulin, if needed. Medical nutrition therapy and physical activity are the primary interventions or management strategies for GDM. The goals of meal planning during pregnancy are to provide adequate nutrition throughout pregnancy for the baby and mother, to assist in maintaining appropriate gestational weight, and to attain blood glucose levels within target range.

A. Medical Nutrition Therapy (MNT)

MNT is the cornerstone of treatment, and is the only therapy for 40-85% of women with gestational diabetes. All pregnant women with diabetes should see a registered dietitian for an **individualized** diabetes meal plan within 48 hours of diagnosis.

1. Weight Gain:

Weight gain by women who give birth to healthy infants varies. Obese women have heavier babies independent of weight gain. Recommended weight gain is

approximately 1 lb per week during the second and third trimester. Overweight women should gain 0.5 lb per week. A weight gain of more than 6.5 lb. per month for normal weight woman may need further evaluation. Weight gain shouldn't be an issue if the woman is consuming a nutritionally adequate meal plan and her blood glucose levels along with the maternal/fetal parameters are within the normal ranges. See below for recommended total weight gain for pregnancy based on Body Mass Index (BMI).

Weight Classification	Recommended Weight Gain
Underweight (BMI < 19.8)	28-40 lbs
Normal weight (BMI 19.8-26)	25-35 lbs
Overweight (BMI 26-29)	15-25 lbs
Obese (BMI > 29)	~ 15 lbs
Twin	35-45 lbs
Triplet	45-55 lbs

Franz et al (2003). Core Curriculum. Diabetes in the Life Cycle and Research. p. 114

2. Nutrient Needs of Pregnancy:

- **Calories:** It is important to provide calories sufficient to promote adequate weight gain and avoid ketonuria. A minimum of 1700-1800 calories is needed to prevent ketosis. *Weight loss should be avoided during pregnancy.* For obese women (BMI > 30), restricting calories 20-33% can reduce blood glucose. While maternal weight gain is the preferred way to assess adequacy of caloric intake, the following table may be useful for determining caloric needs of a woman based on pregravid weight:

Weight classification	Calorie needs
Underweight	36-40 calories/kg pregravid weight
Normal weight	30 calories/kg pregravid weight
Overweight	24 calories/kg pregravid weight
Obese	12-18 calories/kg pregravid weight

ADA (2000). Medical Management of Pregnancy Complicated by Diabetes. p. 74.

- **Protein:** Generally provides 20-25% of total calories, accounting for an additional 10 grams daily needed to support the maternal metabolic changes and fetal growth.
- **Carbohydrate:** Although the amount of carbohydrate recommended is based on the effect of intake on blood glucose levels, it is generally limited to 40-45% of total calories. For obese women (BMI \geq 30), restricting carbohydrates to 35-40% of calories has been shown to decrease maternal glucose. A reduction in carbohydrate intake may be needed for breakfast if blood glucose levels are elevated due to the hormones of pregnancy (cortisol and growth hormone).
- **Fat:** Generally provides 30-40% of total calories.

Other Nutrients:

- 1200 mg of **calcium** per day is needed to calcify fetal bones and teeth.
- 30 mg of **iron** per day is recommended in the second and third trimesters.
- **Folate** needs more than double from 180 to 400 ug per day.
- **Sodium** is generally not restricted as sodium needs increase during pregnancy.
- **Caffeine** should be limited to < 300 mg per day.
- **Alcohol** should be avoided.

3. Artificial (Non-caloric) Sweeteners:

Saccharin (Sweet 'N Low) can cross the placenta, although there is no evidence that it is harmful to the fetus. Aspartame (Equal), Acesulfame K (Sunett) and Sucralose (Splenda) and neotame are all deemed safe for pregnancy. Sugar alcohols (polyols) are nutritive sweeteners. They do contain carbohydrates, but are only partially absorbed. Excessive use can cause diarrhea, so moderation is advised.

4. Meal Planning:

Women with GDM should keep food diaries, noting types and amounts of food eaten and the times of each meal/snack. This, along with self-monitoring of blood glucose, will determine if the meal plan is working.

Suggestions for meal planning include:

- Eat a consistent amount of carbohydrate at each meal and snack. May need less carbohydrate (15-30 grams) at breakfast.
- Eat meals and snacks around the same times daily. The number of meals and snacks depends on the individual's lifestyle and blood glucose levels.
- Space meals 4-5 hours apart.
- A snack at bedtime may be beneficial to prevent overnight starvation, ketonuria.
- Choose lean meats and high fiber foods.
- Portion control. It is recommended to measure foods for two weeks to become familiar with portion sizes.

B. Monitoring

1. Blood Glucose:

Self-monitoring of blood glucose (SMBG) is used to monitor blood glucose levels and the efficacy of the meal plan. After diagnosis of GDM, SMBG should include a daily fasting blood glucose and either 1 or 2 hour postprandial. It is important for the woman to record blood glucose levels. Most women with GDM are encouraged to monitor at least six times per day. Optimal blood glucose levels for GDM are listed below:

Plasma Blood Glucose Goals		
Time	American Diabetes Association (ADA)	American College of Obstetricians and Gynecologists (ACOG)
fasting	<105 mg/dl	<95 mg/dl
1 hr. postprandial	<155mg/dl	<130 mg/dl
2 hrs. postprandial	<130mg/dl	<120 mg/dl

Boucher, J et al (2005). *Guide to Medical Nutrition Therapy and Education*. p. 193.

2. Ketones:

Ketonuria is the signal for meal plan alteration. The most common causes of ketone production include: low carbohydrate intake, inadequate calorie intake, skipped meals or snacks, nausea/vomiting, or an interval over 10 hours between bedtime snack and breakfast. A small amount of ketones in the urine in the morning may indicate nocturnal hypoglycemia. The mother should report this to her health professional. She may need additional calories taken at bedtime or at 3:00 a.m., as directed. If moderate to high amounts of ketones are found in the urine, the physician should be notified immediately. The woman's insulin level may need to be adjusted to prevent the breakdown of fats for energy, with resultant ketone production.

Urine ketone testing can be used to detect insufficient calories or carbohydrate intake. Ketones are known to cross the placenta and sustained ketonuria may be related to decreased intelligence scores in children. The woman needs to understand that ketones are toxic to the body. Testing is recommended every morning, as well as when ill, if nausea or vomiting is present, if blood glucose levels are greater than 200 mg/dl, when under stress, or if signs or symptoms of ketosis are present. Symptoms of ketosis include abdominal pain, nausea, vomiting, rapid breathing or fruity-smelling breath.

3. Fetal Monitoring

Fetal monitoring should include assessing kick counts at 28 weeks. Counting the fetal kicks is an easy way to assess fetal activity. A non-stress-test should be performed at 34 weeks and then weekly until the end of the pregnancy. Additional monitoring (including amniocentesis to test for lung maturity) may be necessary in some women.

C. Physical Activity

Physical activity can be helpful in lowering blood glucose levels and reducing stress. Activity, combined with an appropriate meal plan, may be adequate in treating GDM. All pregnant women should receive medical clearance before beginning an activity program. For women requiring insulin, care must be taken so that the activity will not induce hypoglycemia.

It is recommended to be active one to two hours after meals and have a snack available for hypoglycemic emergencies (i.e. if on insulin). Appropriate activities are those that

utilize upper body muscles or place little stress on the trunk region. Walking is a safe exercise for most women. It is advisable to have women monitor their heart rate (goal <140 bpm) and avoid becoming dehydrated or overheated. Blood glucose should be tested before and after the activity and should be greater than 100 mg/dl. Teach the symptoms, treatment and prevention of hypoglycemia. Blood glucose can continue to decrease for up to 24 hours after the activity, so self-testing of blood glucose post activity is recommended, especially for the woman taking insulin injections.

D. Medications

For some women with GDM, meal plan and activity are not able to adequately control their glucose levels and medication is needed to control their diabetes. During pregnancy, human insulin has been the gold standard medication recommended to lower blood glucose. In general, oral hypoglycemic agents are not recommended for the treatment of GDM. However, while not FDA approved, some studies indicate that using glyburide after the first trimester may be safe. Further studies are needed.

If blood glucose goals are not met through medical nutrition therapy, insulin therapy should be considered. General guidelines are: if blood glucose values are outside target goals on two or more occasions within a one to two week period, insulin therapy should be initiated. A recent German study published in *Diabetes Care* used fetal growth (measured by ultrasound) rather than maternal blood glucose monitoring as an indication for insulin use.

There is no one insulin regimen shown to be most effective in women with GDM. The insulin regimen, like the meal plan, should be individualized to achieve desired blood glucose goals. Insulin requirements are estimated based on current weight, gestational age, blood glucose monitoring results, and caloric intake. Insulin needs often increase as the pregnancy progresses. Obese women tend to require more insulin.

The insulin analogs (Lispro and Aspart and now the newer Glulisine) have a rapid onset, earlier peak, and shorter duration. Recent studies demonstrate improved blood glucose control in women with GDM using insulin analogs versus regular insulin (only Lispro and Aspart have been studied). At the 2005 Fifth International Workshop Conference on Gestational Diabetes, Jovanic stated that Lispro and Aspart appear to be as safe and effective as regular human insulin in women with GDM and achieve better postprandial glucose concentrations with less late prandial hypoglycemia. However, the long-acting analogs (Glargine and Detemir) have not yet been adequately studied.

Educational principles should be discussed with the woman when on insulin therapy:

- Onset, peak and duration of insulin
- Storage and administration of insulin
- Recognition, treatment and prevention of hypoglycemia
- Need for additional blood glucose monitoring

V. Postpartum Recommendations

After delivery, only 5-10% of women with gestational diabetes do not return to normal blood glucose levels and are found to have type 2 diabetes. A fasting blood glucose level should be evaluated at six to twelve weeks postpartum to assess glucose tolerance. If glucose levels are normal, then reassessment of glycemia is done annually. If impaired glucose tolerance (IGT) is identified (fasting level of 100-125 mg/dl), then the client should receive intensive medical nutrition therapy and be placed on an individual activity program, due to their high risk of developing diabetes in the future.

All women with GDM should be taught signs and symptoms of diabetes, and instructed on their increased risk of developing GDM in future pregnancies and type 2 diabetes later in life. Up to fifty percent will develop type 2 diabetes mellitus within 5 to 10 years, but this can be reduced if the woman returns to an ideal weight for height with regular aerobic activity and maintains that over the years. Risk factors for subsequent GDM include insulin use during the pregnancy, obesity and weight gain between pregnancies. However, recent evidence suggests that vigorous exercise can significantly reduce the onset of GDM in future pregnancies. Pre-conception counseling is vital if type 2 develops and the woman plans more pregnancies. Ideally, tight blood glucose control for three months prior to a planned pregnancy is recommended to significantly reduce the likelihood of congenital malformations. As with all women, folic acid supplementation is recommended prior to conceiving and during early pregnancy to prevent neural tube defects.

The postpartum period is considered a “teachable” time to initiate a weight loss program. Women with prior GDM should be counseled on a healthy eating and activity plan to reduce their risk for future diabetes. Strongly encourage the mother to breastfeed. Up to 50% of women with GDM are obese, and breastfeeding mobilizes fat stores. Women who breastfeed their infants are reported to have lower glucose levels postpartum and lower rates of future diabetes than those who bottle-fed. She should be taught the same dietary instructions for lactation as a woman without diabetes.

Options for birth control and family planning are important to discuss to prevent an unexpected pregnancy when maternal glucose levels are not normal. Low-dose estrogen-progesterone oral contraceptives and intrauterine devices may be used in women with prior histories of GDM, as long as no medical contraindications exist. The progesterone-only oral contraceptive (mini pill) should not be used in breastfeeding mothers with GDM as it may triple the risk of developing type 2 diabetes.

It is essential that all health care professionals working with pregnant women have a basic understanding of the pathophysiology and management of GDM. With this basic understanding, the health care professional will then be able to educate their clients on appropriate self-management principals that will help ensure a healthy outcome for both the mother and the baby

References

- American Diabetes Association, (2004) "Gestational Diabetes Mellitus," *Clinical Practice Recommendations 2004: Diabetes Care*, 27(1), S88-S93.
- Boucher, J., O'Connell, B., Ross, T. (2005). American Dietetic Association *Guide to Diabetes Medical Nutrition Therapy and Education*. Chicago, IL: American Dietetic Association.
- California diabetes & pregnancy Program, (2005), (Online), Retrieved 4/25/06.
www.regionalperinatalsystem.org/programs/mrc/pdfs/NewInsulin2005.pdf
- CDC, 2005. National Diabetes Fact Sheet. (Online), Retrieved 4/15/06.
<http://www.cdc.gov/diabetes/pubs/factsheet.htm>
- Fifth International Workshop-Conference On Gestational Diabetes, (November 11-13, 2005), (Online), Retrieved 4/15/06.
<http://www.diabetes.org/for-health-professionals-and-scientists/gdm.jsp>
- Franz, M. (2003) *Core Curriculum, Diabetes in the Life Cycle and Research 5th Ed.* Chicago, IL.
- Jacobson, G., Ramos, G., Ching, J., Kirby, R., Ferrara, A., & Field, R. (2005) Comparison of Glyburide and Insulin for the Management of Gestational Diabetes in a Large Managed Care Organization *Am J Obstet Gynecol*, 193, 118-24.
- Jovanovic, L (Ed). (2000) *Medical Management of Pregnancy Complicated Diabetes*, 3rd Ed. Alexandria, VA: American Diabetes Association.
- Marcason, W. (2005) What Is the Appropriate Amount and Distribution of Carbohydrates for a Woman Diagnosed with Gestational Diabetes Mellitus? *J Am Diet Assoc*, 105, 1673.
- Position of the American Dietetic Association. Nutrition and lifestyle for a healthy pregnancy outcome. (2002) *J Am Diet Assoc*, 102, 1479-1490.
- Position Statement, American Diabetes Association, Gestational Diabetes Mellitus (2004) *Diabetes Care*, 27, S88-S90.
- Schaefer-Graf, U. (2004). A Randomized Trial Evaluating a Predominately Fetal Growth-Based Strategy to Guide Management of Gestational Diabetes in Caucasian Women, *Diabetes Care*, 27. 297-302.
- U.S. Dept. of Health and Human Services, The Office of Minority Health, (April 25, 2006), *History of Gestational Diabetes Raises Lifelong Diabetes Risk In Mother and Child*, (Online), Retrieved 5/3/06.
<http://www.omhrc.gov/templates/content.aspx?ID=4250&lvl=2&lvlID=40>
- Zhang, C., Solomon, C., Manson, J., & Hu, F. (2006) A Prospective Study of Pregravid Physical Activity and Sedentary Behaviors in Relation to the Risk for Gestational Diabetes Mellitus, *Arch Intern Me*, 166:543-548.

Post Test

Independent Study Module Gestational Diabetes Mellitus 2006

Directions: Using the answer sheet provided, write the letter of the one best answer that completes each of the following statements.

1. Which of the following statements is TRUE regarding gestational diabetes mellitus (GDM)?
 - a. Women with gestational diabetes frequently have diabetes-related symptoms.
 - b. GDM is any degree of carbohydrate intolerance that is first recognized or has its onset during pregnancy.
 - c. The prevalence of GDM in the U.S. appears to be decreasing due to recent health interventions.
 - d. GDM affects all ethnic and racial groups evenly.

2. The metabolic changes that lead to GDM:
 - a. Are in part caused by the marked insulin resistance that occurs in the latter part of pregnancy.
 - b. May have a genetic basis.
 - c. Include the production of placental hormones.
 - d. All of the above.

3. All of the following are possible fetal complications of GDM EXCEPT:
 - a. Neonatal hypoglycemia in the first 24 hrs of life.
 - b. Likely diagnosis of diabetes mellitus at birth.
 - c. Congenital malformations if hyperglycemia occurs early in pregnancy.
 - d. Macrosomia and possible birth trauma.

4. Based on the following oral glucose tolerance test (OGTT) results, which individual with the following results would NOT be diagnosed with GDM?
 - a. Fasting: 98 mg/dl; 1 hour: 178 mg/dl; 2 hour: 158 mg/dl; 3 hour: 135 mg/dl.
 - b. Fasting: 84 mg/dl; 1 hour: 188 mg/dl; 2 hour: 160 mg/dl; 3 hour: 140 mg/dl.
 - c. Fasting: 94 mg/dl; 1 hour: 170 mg/dl; 2 hour: 150 mg/dl; 3 hour: 135 mg/dl.
 - d. Fasting: 126 mg/dl; 1 hour: 178 mg/dl; 2 hour: 158 mg/dl; 3 hour: 140 mg/dl.

5. The following are possible maternal complications of GDM:
 - a. Urinary tract infections.
 - b. Pre-eclampsia.
 - c. Difficult labor and delivery.
 - d. All of the above.

6. Which of the following statements is TRUE regarding medical nutrition therapy (MNT) for GDM?
- MNT is recommended to help the obese mother lose weight during pregnancy.
 - All pregnant women with diabetes should see a registered dietitian for an individualized meal plan.
 - MNT can be accomplished by providing the mother with a tear-off diet sheet from a pharmaceutical company.
 - MNT teaches women with GDM how to limit carbohydrate as much as possible.
7. Which of the following statements is TRUE regarding sweeteners?
- Sweeteners are not safe to use during pregnancy.
 - Sugar alcohols do not cause diarrhea with excessive use.
 - Equal, Sunett, and Splenda are all deemed safe for pregnancy.
 - Saccharin does not cross the placenta.
8. Insulin therapy in GDM should:
- Be considered only as a last resort.
 - Be initiated when blood glucose goals are outside target values on two or more occasions within a week or two.
 - Be individualized to achieve desired glucose goals.
 - Both b and c.
9. After pregnancy, post-partum recommendations include which of the following:
- Counseling against any future pregnancies.
 - A fasting blood glucose test within the first week after delivery as the only necessary testing.
 - Counseling on healthy eating and regular physical activity for life.
 - Reassurance that the mother's GDM has resolved and is no longer a concern.
10. The following statements regarding medications during pregnancy are all true EXCEPT:
- Human insulin is the gold standard recommended medication for GDM.
 - Women on insulin therapy should be taught recognition, treatment and prevention of hypoglycemia.
 - Accumulating research indicates the rapid-acting analogs Lispro and Aspart show improved glucose control over regular insulin.
 - For women who refuse insulin injections, most oral hypoglycemic agents are safe to use during pregnancy.

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