SCREENING FOR **HYPERGLYCEMIA IN PREGNANCY:** STANDARDIZING THE BREAKFAST CHALLENGE

by MELISSA AGRO AND HEIDI FILLMORE, CPM

Since the identification of gestational diabetes mellitus (GDM) in the 1950s, there has been a lack of consensus on how screening for GDM should be conducted and whether all pregnant women should be screened, or just those with risk factors. There also has been controversy over whether or not GDM screening is, in fact, useful. In other words, if practitioners screen women for gestational diabetes, can treatment improve outcomes?

Currently, nearly every pregnant woman in the United States is screened for GDM between 24 and 32 weeks gestation using a 50 g Glucose Challenge Test (GCT) followed by the diagnostic 100 g Oral Glucose Tolerance Test (OGTT) as recommended by the American College of Obstetricians and Gynecologists (ACOG). However, this two-step process is not consistent with the 2010 recommendations of the International Association of Diabetes and Pregnancy Study Groups (IADPSG) consensus panel that have been adopted by the American Diabetes Association (ADA) and many other organizations worldwide. The IADPSG recommends a one-step process using a 75 g OGTT.

Some Certified Professional Midwives (CPMs) diverge even more by making GDM testing optional, and by offering a food-based version of the OGTT in place of the prepared 50 g GCT administered using a bottled glucose solution (glucola). Midwives have widely adopted this breakfast test with neither clear rationale for its use nor a standard protocol for its administration, interpretation, and follow-up. However, in many ways this breakfast test mirrors the new IADPSG recommendation: it requires fasting, is a 2-hour test, and approximates the 75 g of glucose used in the 2-hour OGTT. With some standardization in its administration, and using the new IADPSG threshold recommendations, we believe midwives could align themselves with this new global standard and provide valuable screening to improve pregnancy outcomes and the overall health of the women they serve, all while maintaining a food-based option that some clients find more palatable than the glucose solution.

This article examines the history of GDM testing, reviews current research on GDM testing and diagnosis, and proposes a standardized protocol for CPMs to follow when offering a food-based GDM diagnostic test to their clients.

NORMAL GLUCOSE METABOLISM

Normal glucose metabolism begins while chewing. Simple carbohydrates like glucose, fructose (fruit sugar), and sucrose (table sugar made of glucose and fructose) are quickly absorbed in the mouth and move into the bloodstream where they are broken down into glucose. Insulin produced in the pancreas aids the movement of glucose molecules into the body's cells where it is broken down even further, releasing energy to fuel the work of the cell.

Simple carbohydrates provide the quick energy associated with a sugar rush. Complex carbohydrates must undergo the extra process of hydrolysis, or inserting a water molecule, in order to be absorbed and used to produce energy. Hydrolysis allows the body to prolong the rise in blood glucose levels as well as maintain lower levels overall. Any diabetic or pre-diabetic individual is advised to consume complex rather than simple carbohydrates, with a greater proportion of calories coming from fats and proteins. This allows for a slower release of glucose into the bloodstream, rather than the spike in blood glucose seen when simple carbohydrates are consumed. Typically, complex carbohydrates are found in whole, unprocessed foods such as whole grains and vegetables.

Blood glucose levels ebb and flow throughout the day in response to food consumption, with lower blood glucose levels triggering a hunger response that signals us to eat in order to maintain normal levels of glucose and avoid hypoglycemic symptoms. If the pancreas is responsive and secretes an adequate amount of insulin, blood glucose levels should remain in a normal range with cells receiving the fuel they need. Failure of the pancreas to meet the demands leads to hyperglycemia, which if chronic, becomes diabetes, bringing the host of symptoms accompanying this metabolic disorder.

GLUCOSE METABOLISM IN PREGNANCY

Since glucose is transferred to the growing fetus through the placenta, the body must keep maternal blood glucose plentiful in order to share with the fetus. The placenta produces hormones that inhibit the function of insulin, including human placental lactogen, estrogen, and progesterone, and insulin-destroying enzymes. These metabolic changes usually can be seen by the end of the first trimester, at which time insulin secretion slowly increases to overcome the glucose challenges of the advancing pregnancy.[1] These metabolic changes enable glucose to remain available in the mother's bloodstream for longer periods of time, allowing more glucose to reach the fetus.

A woman who has mildly impaired glucose metabolism – such as a pre-pregnancy tendency towards hyperglycemia or hypoglycemia – is more susceptible to developing gestational diabetes. If her pancreas had difficulty producing adequate insulin prior to the pregnancy or if her cells exhibit insulin resistance, pregnancy may stress her pancreas enough that she will no longer be able to maintain normal blood glucose levels. It is important to remember that, unlike type 2 diabetes, gestational diabetes mellitus cannot cause congenital anomalies since glucose metabolism remains within non-pregnant norms in the first half of pregnancy when fetal systems are developing.[2]

CAUSES AND IMPLICATIONS OF GDM

Gestational diabetes mellitus, defined as diabetes that develops during pregnancy, has become more common in the past few decades, paralleling the pandemic of obesity and type 2 diabetes. Rates of diabetes increased 128% in the US from 1988 to 2008 and have been linked to obesity, sedentary lifestyles, and diets high in simple carbohydrates.[3] GDM, using current diagnostic criteria, occurs in approximately 6% to 7% of pregnancies in the US, with increased prevalence among Hispanic, African American, Native American, Asian, and Pacific Islander women.[4]

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Because a strong family history of diabetes can be a risk factor for GDM, it is presumed to have a genetic component; however, it can often be prevented or treated by making lifestyle improvements such as diet changes, increased exercise, and stress reduction. The Midwifery Model of Care, which is time-generous and focuses on nutrition and healthy lifestyle, is ideal for preventing and managing clients who have problems with glucose metabolism. GDM can usually be managed without the need for insulin injections, and within the context of a CPM's practice.

Hyperglycemia has been associated with significant increases in adverse pregnancy outcomes, including fetal macrosomia, gestational hypertension, pre-eclampsia, cesarean section, shoulder dystocia, birth injury, neonatal hypoglycemia, premature delivery, and hyperbilirubinemia.[5] Later in life, women with GDM are at increased risk for developing type 2 diabetes and other long-term metabolic complications, such as metabolic syndrome and cardiovascular disease. It is projected that up to 50% of women with GDM will develop type 2 diabetes within 28 years of pregnancy. Children of mothers with GDM also have an increased risk of childhood obesity and diabetes later in life.[4]

THE DEVELOPMENT OF CRITERIA FOR DIAGNOSING GDM

Gestational diabetes was identified and defined in 1957, and was initially diagnosed using the standard 100 g oral glucose tolerance test (OGTT) that was used for diagnosing diabetes in the US at the time. Over the next decades, researchers John B. O'Sullivan and Claire Mahan adjusted the threshold values for the 100 g test for pregnancy. A 50 g glucose challenge screening tool was developed, and in 1982, a two-step protocol using a 50 g screen and a 100 g diagnostic test with corresponding plasma values were adopted and have been in use ever since.[6]

The O'Sullivan criteria and diagnostic thresholds of the 1960s were validated solely on their ability to predict subsequent diabetes in the mother. It became clear that criteria validated by the prediction of adverse pregnancy outcomes would be preferable. Recent studies have questioned whether or not universal screening for and treatment of GDM improves pregnancy outcomes, and the threshold at which treatment should be initiated.

Particularly influential in this debate was the 2008 Hyperglycemia and Pregnancy Outcomes (HAPO) study of 23,316 pregnant women at 15 centers in 9 countries.[5] The purpose of the study was to determine whether hyperglycemia in pregnant women that was less severe than that of overt diabetes was associated with an increased risk of adverse pregnancy outcomes. The data from the HAPO study showed a strong continuous linear association between increasing maternal glucose levels, and birth weight >90th percentile and cord blood serum C-peptide >90th percentile, which is an indicator of fetal hyperinsulinemia. There was a weaker yet significant association between maternal hyperglycemia and preeclampsia, primary cesarean section, birth injuries, and neonatal hypoglycemia. The odds ratios for these adverse outcomes when fasting plasma glucose was increased 1 standard deviation (6.9 mg/dL) from the mean, but remained below GDM diagnostic levels, were found to be 1.38 for birth weight >90th percentile; 1.55 for cord blood serum C-peptide >90th percentile; 1.21 for preeclampsia; 1.18 for shoulder dystocia or birth injury; 1.11 for primary cesarean section; and 1.08 for neonatal hypoglycemia. The odds ratios were also calculated for 1-hour and 2-hour plasma glucose levels, and the frequency of each of adverse outcome increased as maternal glucose levels increased. (See sidebar on odds ratios.)

The HAPO study was the first to clearly show the association between mild maternal hyperglycemia and adverse outcomes, demonstrating the potential benefit of screening for and treating gestational hyperglycemia. However, the study did not determine the threshold levels at which treatment should begin.

CONTEMPORARY CONTROVERSY OVER GDM CRITERIA: IADPSG VERSUS ACOG

After the publication of the HAPO study, The International Association of Diabetes In Pregnancy Study Groups (IADPSG) was called upon to oversee a process in which data were presented to, and feedback solicited from, a broad range of experts from around the world regarding GDM diagnostic criteria. The resulting IADPSG recommendation for diagnosing GDM was a single-step approach already used in many parts of the world, and consisting of a 75 g, 2-hour Oral Glucose Tolerance Test done between 24 and 28 weeks gestation. The panel agreed on new threshold levels (see Table 1) very similar to the 100g OGTT criteria already in use in the US, based on when the odds ratio reached 1.75 for most of the adverse outcomes. When these new thresholds were applied to the HAPO data, 16% to 18% of pregnant women would have been diagnosed with GDM, a result that has been controversial largely because of the implications for healthcare delivery. The panel also recommended criteria for diagnosing overt diabetes early in pregnancy (see Table 4).[7] The American Diabetes Association (ADA), World Health Organization, and many other organizations worldwide endorsed the IADPSG recommendations. The hope was to have consistent thresholds for evaluation of hyperglycemia in pregnancy to help standardize best practices and compare research outcomes.

In March, 2013, a National Institutes of Health (NIH) Consensus Development Conference was held in the US to assess the available scientific evidence and address a series of questions regarding GDM diagnostic criteria. The conference's expert panel drafted a report recommending that the two-step GDM screening protocol and criteria be continued in the US.[8] In summary, when they compared the single- and two-step approaches, they did not find enough benefit in adopting the IADPSG recommendations to outweigh the logistical, financial, and emotional hardships that the expected significant increase in diagnosed GDM cases might create. Following the panel's recommendation, ACOG upheld the 1982 GDM guidelines in its August, 2013 Practice Bulletin on Gestational Diabetes Mellitus, and continues to recommend the two-step approach to diagnosis.[4]

The inter- and intra-professional dialog in the wake of the IADPSG panel was lively, and ACOG's decision to reject the recommendations was the minority position within the global maternity care community. Dr. Coustan, one of the authors of the 1982 GDM diagnostic criteria still in use today, endorsed the IADPSG recommendations:

"Critics of the recommendations in the United States who say it is unreasonable and too expensive for such a large proportion of pregnant women to be identified as having a disease – 16%-

ODDS RATIOS

The odds ratio (OR) reflects the odds of a particular outcome (birth weight >90th percentile) in an exposed group (women with elevated plasma glucose levels), compared to the odds of that same outcome occurring in an unexposed group (the odds of a baby whose birth weight is >90th percentile being born to a woman who does not have hyperglycemia).

If OR=1, then the outcome is the same for the exposed and the unexposed groups. If OR>1, outcomes are elevated for the exposed group. If OR<1, outcomes are lower for the exposed group. If OR=1.38 for birth weight >90th percentile, this means that when the fasting plasma glucose of a woman is elevated 6.9 mg/dL from the mean (1 standard deviation), her baby is 0.38 more likely to have a birth weight >90th percentile. For example, if we assume the overall population rate of large babies (>4500g) is 1/10 births, then the OR of 1.38 above would mean that on average, for every 1000 births, 138 large babies will be born to women with hyperglycemia, as opposed to 100 large babies born to women without hyperglycemia.

TABLE 1

ONE-STEP PROTOCOL (IADPSG CONSENSUS)[7]

Perform a 75 g OGTT in the morning after an overnight fast of at least 8 hours at 24-28 weeks gestation. Measure plasma glucose while fasting and at 1 and 2 hours after glucose load. Diagnosis of GDM is made when any of the following plasma glucose values are exceeded:

- *Fasting: ≥92 mg/dL*
- *1 h: ≥180 mg/dL*
- *2 h: ≥153 mg/dL*

18% in the HAPO population – need to look at the big picture. Among women in the United States aged 18-44 years, 5% had diabetes and 26% had prediabetes from 2005 to 2008. Why, then, is 16%-18% called outrageously high, when the rate of prediabetes/diabetes outside of pregnancy is almost twice as high? Undoubtedly, an increase in the number of mild GDM cases will increase costs – just as the broader epidemic of diabetes and prediabetes is increasing health care costs. Cost and resource issues are insufficient reasons, however, not to identify high-risk pregnancies in which adverse outcomes can be prevented with relatively simple interventions."[9] Although difficult to factor in to a cost analysis, the long-term health benefits and cost savings realized through the prevention of type 2 diabetes in women and their children is most likely significant.

IADPSG PROTOCOL

The IADPSG recommendations suggest screening women for overt diabetes at their initial prenatal visit, either routinely or only if they are high-risk. Table 4 reviews the threshold levels. If a woman exceeds any one value she is considered to have overt diabetes. If her fasting plasma glucose (FPG) is more than 92 mg/dL but less than 126 mg/dL, then early GDM is diagnosed. If her FPG is below the thresholds in Table 4, a 75g, 2-hour OGTT should be administered between 24 and 28 weeks gestation after an overnight fast. The thresholds for this test are found in Table 1; one abnormal value is diagnostic of GDM.[7]

ACOG PROTOCOL

ACOG currently recommends first trimester screening for undiagnosed type 2 diabetes for women with risk factors, including those with a prior history of GDM, severe obesity, or a strong family history of type 2 diabetes. We would also suggest including women with a diagnosis of PCOS in this high-risk category. The routine screening test on all but very low-risk women consists of a 50 g, 1-hour glucose challenge test (GCT) between 24 and 28 weeks gestation (see Table 5). The GCT can be done at any time and should not follow a fast. There is no single agreed-upon threshold level for the GCT test; ACOG recommends each practice choose a level between 130 mg/dL and 140 mg/dL and use it consistently. If a woman's plasma glucose levels fall at or above the chosen threshold, she then goes on to do a 100 g, 3-hour OGTT after an overnight fast. Two abnormal values from this test are diagnostic for GDM. As with the GCT, there is no consensus threshold for OGTT interpretation, and either the Carpenter/Coustan or National Diabetes Data Group (NDDG) thresholds should be used consistently (see Table 2).[4]

TREATMENT AND MONITORING

Despite the controversy surrounding GDM diagnosis, there seems to be general agreement on the management once a woman is diagnosed. Since the goal of treatment is simple – maintaining blood glucose in a normal range – it is most often successfully addressed through dietary changes and daily exercise. This involves intensive education, diet counseling, and home monitoring of blood glucose levels 4 times daily: fasting/upon waking, and 1 or 2 hours after each meal (see Table 3). Providers must have both the time and skill to educate and counsel a client who is motivated to make the necessary changes.

BY USING THE IADPSG RECOMMENDATIONS AND A MORE STANDARDIZED VERSION OF THE BREAKFAST CHALLENGE, MIDWIVES CAN ALIGN WITH THE NEW GLOBAL STANDARD AND **PROVIDE VALUABLE SCREENING TO IMPROVE PREGNANCY OUTCOMES AND THE OVERALL HEALTH** OF THE WOMEN THEY SERVE.

Diet changes should begin with the elimination of high glycemic foods such as sweeteners (honey, sugar, maple syrup, corn syrup), desserts, and soft drinks. Fruit, juices, potatoes and white flour should be eaten sparingly. Carbohydrates should not exceed 30% to 40% of the total daily caloric intake, and quality fats and proteins should make up the caloric difference. The pattern of eating should also be altered to spread out the total carbohydrate intake over the course of the day. This is accomplished through smaller, more frequent meals.

TABLE 2

TWO-STEP PROTOCOL (NIH CONSENSUS)[8]

STEP 1: *Perform a nonfasting 50 g GCT with plasma glucose measurement at 1 hour after glucose load at 24-28 weeks gestation. If the plasma glucose level measured at 1 hour is ≥140 mg/dL, proceed to 100 g OGTT.*

STEP 2: *The 100 g OGTT should be performed after an overnight fast of at least 8 hours. The diagnosis of GDM is made when at least 2 of the following 4 plasma glucose levels (measured fasting, 1 h, 2 h, 3 h) are met or exceeded.*

	Carpenter/Coustan	or NDDG*
• Fasting	95 mg/dL	105 mg/dL
• 1 hour	180 mg/dL	190 mg/dL
• 2 hour	155 mg/dL	165 mg/dL
• 3 hour	140 mg/dL	145 mg/dL

*National Diabetes Data Group

IT IS PROJECTED THAT UP TO 50% OF WOMEN WITH GDM WILL **DEVELOP TYPE 2 DIABETES WITHIN 28 YEARS OF PREGNANCY**. CHILDREN OF MOTHERS WITH GDM ALSO HAVE AN INCREASED RISK OF CHILDHOOD OBESITY AND DIABETES LATER IN LIFE.

The other important component of GDM treatment is physical exercise for at least 40 minutes daily, preferably divided into 2 to 3 sessions per day. Exercise can come in the form of brisk walking, weight training, swimming, bicycling, or physical work such as gardening. Exercise facilitates the body's use of blood glucose and increases lean muscle mass, which improves tissue sensitivity to insulin.

It is the rare pregnant woman who does not respond to these treatments and maintain her blood glucose in a healthy range with these efforts alone. She feels empowered and receives immediate feedback in the form of actual data as she monitors her own glucose levels. Blood glucose levels respond almost immediately to changes in diet and exercise, and she can notice the effects of certain foods on her levels as soon as she takes the next post-prandial blood glucose test. The extent of her diet restrictions will depend on her level of glucose intolerance. For example, if her challenge test revealed very high blood glucose levels, she will need to restrict her carbohydrate intake more than someone whose levels were just above the threshold.

Once she has determined through trial and error the diet pattern she needs to follow to maintain normal blood glucose levels, home monitoring can be relaxed and gradually stopped after 2 weeks of normal levels, provided she adheres to the diet. Periodic checks should be scheduled for the remainder of the pregnancy to ensure glucose control, and "women with GDM with good glycemic control and no other complications can be managed expectantly."[4] If reducing simple carbohydrates and adding some physical activity eliminates hyperglycemia for a client, then she does not have diabetes from that point on, provided she maintains those lifestyle improvements.

If the client is unable to follow a diet and exercise regimen that maintains her glucose levels in the normal range, she will need to be referred to a physician for medical treatment with metformin, glyburide, or insulin.

TABLE 3

POST-DIAGNOSIS HOME MONITORING[3,4]

Following a diagnoses of GDM, clients will monitor blood glucose at home using a portable glucometer. Blood should be collected by finger lancet 4 times daily: fasting, and either 1 h or 2 h after 3 meals. The following glucose levels should not be exceeded:

- *Fasting: 95 mg/dL*
- *1 h: 140 mg/dL*
- *2 h: 120 mg/dL*

TABLE 4

IADPSG DIAGNOSTIC CRITERIA FOR OVERT DIABETES MELLITUS IN PREGNANCY[7]

Measure of Glycemia	*Threshold*
Fasting plasma glucose (FPG)	*>126 mg/dL*
A1C	*>6.5%*
Random plasma glucose (RPG)	*200 mg/dL confirmed*

POSTPARTUM FOLLOW-UP FOR CLIENTS WITH GDM

Due to the significant risk of developing type 2 diabetes in the postpartum period and later in life, screening for women diagnosed with GDM at 6 to 12 weeks postpartum is recommended. The 75 g, 2-hour OGTT (Table 1) is the standard test for diagnosing glucose intolerance and overt diabetes. If FPG or the 1- or 2-hour thresholds are exceeded, glucose intolerance is diagnosed and diet and lifestyle modifications should be initiated. If any of the thresholds in Table 4 are exceeded, overt diabetes is diagnosed and referral for treatment indicated. It is also recommended that diabetes testing be repeated every 3 years for all women with a pregnancy affected by GDM.[4]

A FOOD-BASED SCREENING PROTOCOL

The standard product used in the glucose challenge tests in the US is a bottled drink called glucola, made from corn dextrose and containing colors, flavors, and preservatives. Dextrose is a plant form of the monosaccharide glucose, and it is quickly absorbed into the blood, making it a good tool for measuring a person's ability to metabolize a large and rapid influx of glucose. Many clients who choose out-of-hospital midwifery care find this test unpalatable and prefer to use a more natural form of carbohydrate for the test. While midwives have been offering a breakfast challenge test in lieu of glucola for many years with apparent success, this option could be improved through a more standardized and measured approach that would bring it in line with the current IADPSG recommendations.

In 2004, a preliminary feasibility study comparing a standardized breakfast to the 75 g OGTT was published in ***The British Journal of Diabetes and Vascular Disease.***[10] It addressed the question of whether food could be substituted for the glucose solution when assessing postprandial hyperglycemia for both diagnostic and follow-up evaluations after treatment. The study was small in size, with 42 participants, 32 with preexisting type 2 diabetes (diet-controlled), and 10 healthy volunteers. Plasma glucose levels were measured in all subjects after a standardized breakfast and a 75 g OGTT on different days. For the group with type 2 diabetes, the study found a strong correlation (r=0.80) between the 75 g OGTT plasma glucose levels and the standardized breakfast levels at all points between 0.5 and 2 hours. The correlation for the healthy group's results was lower (r=0.47). The researchers concluded that "the standardized continental breakfast is a physiologic and simple approach for assessing PPG [postprandial glucose] in both healthy subjects and patients with Type 2 diabetes." They also proposed that "a mixed meal approach to glucose monitoring might be associated with better reproducibility than the OGTT since gastric emptying of solids is more reproducible than liquids, [and] intragastric fat infusion more reproducibly stimulates gastroduodenal motor activity than glucose alone."[10] Although more rigorous studies are needed to confirm this conclusion, it does suggest

that a standardized breakfast may be an effective substitute for the oral OGTT when evaluating glucose metabolism.

In this article, we are proposing the use of a 2-hour breakfast challenge after an 8-hour fast using either a measured smoothie or pancake breakfast as a replacement for the 75 g dextrose solution. In creating an equivalent glucose dose in the form of food, we could not simply design a breakfast with equal grams of carbohydrates and glucose (i.e. 75 g of carbohydrates substituted for the 75 g glucola test), because food is metabolized more slowly than pure dextrose. Instead, we calculated the glycemic load of each breakfast option using the International Tables of Glycemic Index and Glycemic Load.[11] The glycemic index (GI) estimates how much each gram of available carbohydrate in a food raises a person's blood glucose level in the 2 hours following consumption on a scale of 0 to 100, with 100 being the increase caused by pure glucose. The glycemic load (GL) is a number that estimates how much a defined serving of food will raise a person's blood glucose level after eating it. One unit of GL approximates the effect of consuming 1 gram of glucose. Glycemic load is defined as the grams of available carbohydrate in the food multiplied by the food's GI, and divided by 100.

Table 6 outlines two possible menus for a standardized breakfast challenge that provides the same glycemic load as 75 g of glucola. Table 7 is a food-based alternative to the 50 g GCT for midwives who would like to offer this option in their practice.

TABLE 5

GDM RISK ASSESSMENT

Low Risk Criteria[7]	*High Risk Criteria*[4]
Age less than 25 years old	*Previous medical history of GDM*
No history of abnormal glucose tolerance	*Known impaired glucose metabolism*
Normal prepregnancy weight (BMI≤25)	*Obesity (BMI ≥ 30)*
No known diabetes in first degree relatives	*Strong family history of diabetes*
Member of an ethnic group with low prevalence	*History of PCOS*
No history of poor obstetric outcome	

TABLE 6

STANDARDIZED 75G BREAKFAST CHALLENGE OPTIONS

STRAWBERRY BANANA SMOOTHIE RECIPE

Ingredient	*Total Carbs/serv*	*Glycemic index*	*Glycemic load*
8 oz whole milk plain yogurt	*11 g*	*36 GI*	*4 GL*
2 med. bananas (240 g)	*50 g*	*62 GI*	*31 GL*
1 c frozen strawberries	*3 g*	*40 GI*	*1 GL*
8 oz OJ (not from conc.)	*25 g*	*46 GI*	*11.5 GL*
4 T. honey	*45.6 g*	*61 GI*	*28 GL*
	134.6 g total carbs		***75.5 Total GL***

PANCAKE BREAKFAST

2/6" (4/4") plain pancakes	*52 g*	*66 GI*	*34 GL*
2 oz (1/4 c) real maple syrup	*56.7 g*	*54 GI*	*31 GL*
8 oz OJ (not from conc.)	*25 g*	*46 GI*	*11.5 GL*
	132.7 g total carbs		***76.5 Total GL***

Values taken from the International Tables of Glycemic Index and Glycemic Load Values: 2008 (11)

TABLE 7

STANDARDIZED SMOOTHIE FOR 50G GCT RECIPE

8 oz whole milk plain yogurt	*11 g*	*36 GI*	*4 GL*
1 med. banana (120 g)	*25 g*	*62 GI*	*15.5 GL*
1 c frozen strawberries	*3 g*	*40 GI*	*1 GL*
6 oz OJ (not from conc.)	*18.7 g*	*46 GI*	*8.6 GL*
3 T. honey	*34.2 g*	*61 GI*	*21 GL*
	91.9 g total carbs		***50.1 Total GL***

Values taken from the International Tables of Glycemic Index and Glycemic Load Values: 2008 (11)

GDM MANAGEMENT IN THE MIDWIFERY MODEL OF CARE

The strength of the Midwifery Model of Care becomes obvious when considering the screening and treatment of GDM. As autonomous midwives, CPMs are not constrained by the structural, financial, and logistical barriers to the implementation of the new global standard for GDM in pregnancy. The education, counseling, and follow-up required are simple to incorporate into appointments that are 30 to 60 minutes long, and in which a culture of shared responsibility with clients is the norm. Since hyperglycemia in pregnancy usually is corrected through diet changes and exercise, often management can be done entirely within the context of a CPM's practice.

The benefits of diagnosing and treating even mild to moderate glucose intolerance in pregnancy not only include improved pregnancy outcomes, but, perhaps more importantly, also include an overall positive impact on the lifelong health status of both mother and baby. Pregnancy can be a powerful motivator for permanent changes in diet and lifestyle that will help avoid future diabetes and its related health issues that manifest later in life, including obesity and heart disease for both mothers and their children.

For years, CPMs have offered a non-standardized food-based test for GDM that in many ways mirrors the IADPSG recommendations. By using a more measured and standardized version of the breakfast challenge, and supporting ongoing data collection to refine best practices, CPMs can align with the new global standard and fulfill an important primary care role that will have significant health benefits for mothers and their babies. ◉

Melissa Agro is an aspiring midwife from Yarmouth, Maine. She began her midwifery education at Birthwise Midwifery School in 2011 with the hopes of empowering women through the birth process. Melissa believes that one of the many ways women can take charge of their health is by doing research and advocating for evidence-based medicine. Melissa is currently taking a break from midwifery school and is focusing on her doula practice at Willow Tree Doula. She hopes to one day complete her midwifery training with Birthwise and join the wonderful group of midwives serving Maine.

Heidi Fillmore is a CPM and the executive director of Birthwise Midwifery School. She has been attending home and birth center births in Maine and New Hampshire since 1987.

GDM SCREENING PROTOCOL FOR MIDWIVES

INITIAL SCREENING

Screen all women, or women with risk factors (see Table 5), at the initial visit to rule out overt diabetes.

a. Initial screen can be done via fasting plasma glucose, A1C, or random plasma glucose (see Table 4 for values).
b. If she meets or exceeds these values, treat as if she had diabetes prior to pregnancy.
c. If she is below the threshold for overt diabetes, but more than 92 mg/dL, early gestational diabetes is diagnosed and should be managed accordingly.
d. If she is below either threshold, continue on to screen at 24-28 weeks gestation.

SECONDARY SCREENING

Screen all women, or all except those at low risk (see Table 5), at 24-28 weeks gestation.

a. Have her fast overnight before the screen (at least 8 hours). Water is okay.
b. Draw fasting plasma glucose levels, or you may choose to do the finger prick method. If this value is above 92 mg/dL it is diagnostic of GDM and the breakfast challenge is not necessary.
c. She may choose to either drink the 75 g dose of glucola, or do the Standardized Breakfast Challenge (see Tables 6 and 7 for menu options).
d. Now is the perfect time to continue on with the routine prenatal visit.
e. Draw her blood (or prick her finger) 1 hour after she had her first bite of food.
f. Draw her blood (or prick her finger) 1 hour after you last drew her blood (2 hours after her first bite of food).
g. One or more values above normal is considered diagnostic for GDM with this screening method (see Table 1 for values).

TREATMENT

If GDM is diagnosed with the above test, follow-up and treat.

a. Counsel on diet changes involving eliminating simple carbohydrates from the diet, increasing intake of complex carbohydrates, good fats, and protein, and eating small frequent meals.
b. Make an exercise plan with at least 40 minutes of exercise daily.
c. Make a plan for home monitoring of blood glucose levels 4 times daily (fasting and 1- or 2-hour postprandial checks after 3 main meals) with instructions to record all values and check in with you daily about the results (see Table 3 for values).
d. If plasma glucose levels drop into the normal range and remain there for 2 weeks, home monitoring can be relaxed and more infrequent checks can be scheduled for the remainder of the pregnancy as the client continues with the diet and exercise plan.
e. If plasma glucose levels remain above the threshold values despite attempts described above, refer client to medical care for evaluation and medical treatment for GDM.

FOLLOW-UP CARE

Follow up with all clients diagnosed with GDM in pregnancy in the postpartum period.

a. Provide the 75 g breakfast challenge at 6-12 weeks postpartum.
b. With any abnormal values, refer to medical care for evaluation and treatment.

Recommend repeat diabetes screening every 3 years.

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