



# *CDAPP Sweet Success Guidelines for Care*

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## Chapter 7

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### Medical Nutrition Therapy



*Sweet  
Success*

California Diabetes and Pregnancy Program

## **California Diabetes and Pregnancy Program Sweet Success Guidelines for Care**

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# 7 Medical Nutrition Therapy

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## INTRODUCTION

Research has shown that Medical Nutrition Therapy (MNT) by registered dietitians is the primary intervention in the management of Gestational Diabetes Mellitus (GDM). It leads to improved perinatal outcomes<sup>1</sup>, and is a key component of glycemic control.<sup>2</sup> The focus of nutrition care is similar for pregnant women with diabetes as for all pregnant women. The goal for women with diabetes is also to meet all of the nutrition needs of the fetus and mother while additionally maintaining maternal normoglycemia.<sup>3</sup> Rationale for the meal plan includes achieving a preconception weight goal and optimal nutrient intake, maintaining normoglycemia and optimal nutrient intake throughout pregnancy, and attaining appropriate weight gain in each trimester.

A pregnant woman with type 1 diabetes, type 2 diabetes, or GDM is at high risk for adverse pregnancy outcomes.<sup>4-6</sup> A Registered Dietitian (RD) who specializes in perinatal and diabetes care is the indicated provider for the initial nutrition assessment and for the development of the medical nutrition therapy (MNT) plan. This plan should address the goals of normoglycemia and the nutrition needs of women before, during, and after pregnancy. It is recommended that a RD assess the woman's dietary needs, individualize the meal plan, and closely monitor food intake, exercise, and blood glucose levels to meet glycemic and nutrient intake goals<sup>7</sup> (see Table 1). An individualized MNT plan needs to be developed and implemented by a RD to thoroughly address the risks and/or complications that can result from diabetes. These maternal risks include hypertension, nephropathy, retinopathy and gastroparesis.<sup>8</sup>

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## MEDICAL NUTRITION THERAPY FOR PREGNANCY AFFECTED BY DIABETES

MNT includes<sup>9</sup>:

- ❖ The use of a patient nutrition assessment to determine treatment strategies
- ❖ A nutrition therapy plan that is initiated to treat an illness, injury or condition
- ❖ Evaluation of patient outcomes to determine the effectiveness of the treatment

The RD is also responsible for the following:

- ❖ Making recommendations on kilocalorie needs, distribution of carbohydrates, and meeting nutrient requirements before, during, and after pregnancy
- ❖ Integrating the MNT plan with overall medical management and education goals regarding euglycemia, weight gain, medications, exercise, and breastfeeding
- ❖ Advising team members of physical and/or psychosocial issues impacting nutrition practices and the necessary changes in the meal pattern and lifestyle to achieve the goals of the care plan

The basic objectives of MNT for diabetes in pregnancy are:

- ❖ Set appropriate weight goals
- ❖ Determine caloric needs
- ❖ Develop an individualized, nutritionally balanced meal plan
- ❖ Recommend vitamin/mineral supplementation as needed
- ❖ Provide education concerning nutrition-related issues
- ❖ Counsel on the importance of normoglycemia before, during, and after pregnancy
- ❖ Evaluate adherence to the meal plan
- ❖ Provide evidence-based recommendations
- ❖ Promote patient empowerment

### **Nutrition Assessment**

To develop an individualized MNT plan, a nutrition assessment must be completed by the RD.<sup>9</sup> A nutrition assessment includes, but is not limited to, the components found in Table 1.

The following high-risk conditions in women with diabetes may require more frequent and intensive nutrition intervention and counseling by the RD<sup>8</sup>:

- ❖ Poor blood glucose control
- ❖ History of frequent problems with diabetic ketoacidosis (DKA)
- ❖ History of frequent episodes of hypoglycemia
- ❖ Initiation of intensive diabetes management, either through multiple daily injections or insulin pump therapy
- ❖ Underweight, overweight, or obese
- ❖ Prediabetes
- ❖ Eating disorders
- ❖ Hypertension
- ❖ Renal dysfunction
- ❖ Celiac disease
- ❖ Significant weight increase with improving blood glucose control
- ❖ Dyslipidemia
- ❖ Inappropriate weight gain or loss

- ❖ Other conditions: infertility, hyperemesis, thyroid dysfunction, polycystic ovarian syndrome (PCOS), impaired vision, blindness, mental retardation
- ❖ Other nutrition risks: pica, multiple gestation, bariatric surgery, adolescence, low literacy, low income, psychosocial issues impacting diet, dietary beliefs that are either religious, cultural or philosophical

| <b>Table 1. COMPONENTS OF A NUTRITION ASSESSMENT<sup>9</sup></b>  |   |   |
|---|---|---|
| <b>Clinical Data</b>  | <b>Psychosocial History</b>   | <b>Dietary History</b>  |
| Determine:<br>- height/weight measurement<br><br>- weight history/Body Mass Index/Ideal body weight<br><br>- diabetes history, including:<br>history of GDM<br>duration of diabetes<br>hypoglycemia<br>diabetes complications<br>family history<br><br>- medication regimen for diabetes<br><br>- other prescription or over the counter medications in use<br><br>- previous obstetrical history<br><br>- medical test data pertinent to diabetes and pregnancy (hemoglobin A1c, self-monitoring blood glucose, creatinine clearance, thyroid function)<br><br>- hemoglobin/hematocrit/MCV<br><br>- blood pressure | Assess:<br>- learning needs, abilities, literacy level, education background<br><br>- language and culture background<br><br>- exercise pattern<br><br>- living situation<br><br>- financial and employment status<br><br>- family support<br><br>- ethnic or religious beliefs<br><br>- attitudes toward health including current diabetes knowledge<br><br>- daily schedule | Assess:<br>- usual food intake and pattern of intake with emphasis on micronutrient identification<br><br>- food allergies/intolerances<br><br>- alcohol, tobacco, caffeine, substance use<br><br>- vitamin and dietary supplement use<br><br>- use of natural remedies<br><br>- knowledge of nutrition and meal planning skills<br><br>- previous history of following a diet and adherence<br><br>- other nutrition risks (e.g. eating disorders, adolescence, low literacy, low income, psychosocial issues) |

### **Individualized Medical Nutrition Therapy Plan**

As a primary member of the health care team, the woman will take part in the development of goals that are individualized to accommodate her unique lifestyle.<sup>10</sup> On completion of the initial history and assessment, the individualized MNT plan should be developed and

implemented based on the woman's needs and abilities. The RD must be willing to negotiate with the woman to develop a plan that meets dietary goals and one that the woman will be able to follow.<sup>10</sup>

The results of the nutrition assessment and development of the MNT plan should be communicated to other team members and documented in the woman's medical record. Communicating the MNT plan to others will help ensure that the woman receives consistent messages, as well as support and reinforcement from the entire team. The MNT plan and carbohydrate distribution will need to be regularly reassessed.

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## PRECONCEPTION AND INTERCONCEPTION NUTRITIONAL CARE

Women who experience ongoing health issues, such as problems with weight or diabetes mellitus should be consistently receiving the proper care during the preconception and interconception periods, also known as internatal care. Dr. Michael Lu, Associate Administrator of Maternal and Child Health Bureau of the Health Resources and Services Administration, explains that the foundation of internatal care is comprised of “risk assessment, health promotion, and clinical and psychosocial interventions.”<sup>11</sup> Nutritional status can be addressed in each of these four basic components of preconception and interconception care. For example, in the risk assessment category BMI and dietary intake can be taken into consideration. To promote health, folate supplementation can be encouraged. A calorie-restricted diet or starting/altering an exercise program may be needed as a clinical intervention. Finally, behavior modification strategies can be taken into account if psychosocial interventions are needed.<sup>11,12</sup>

Refer to *Chapter 2: Preconception and Interconception Care for Preexisting Diabetes* for a description of the CDAPP Sweet Success model of diabetes preconception and interconception care.

### **Normoglycemia for Preconception**

The glycemic goal for women with preexisting diabetes, and pre-diabetes, both preconceptionally and after conception, is normoglycemia.<sup>13</sup> Pre-diabetes is a condition where blood glucose levels are higher than normal, but not high enough for a diagnosis of diabetes. The woman with preexisting diabetes, and pre-diabetes should have HbA1c within target range before attempting to become pregnant. Keep in mind that the HbA1c is an average blood glucose assessment and that a target HbA1c level can be achieved with suboptimal blood glucose swings. Frequent glucose monitoring, in conjunction with HbA1c level tests, is recommended to assess stability of blood glucose levels. The California Diabetes and Pregnancy Program follows the recommendations of the American Diabetes Association and recommends the plasma blood glucose values for the preconception and pregnancy period as depicted in *Chapter 2: Preconception and Interconception Care for Preexisting Diabetes* and *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy*.

For a woman with preexisting diabetes, normalization and maintenance of blood glucose levels requires a balance between medication, distribution of carbohydrate, kilocalories, and activity; as well as identification of individual glycemic response to specific foods. Self-monitoring of blood glucose is essential to evaluate how well goals are being met.<sup>8</sup>

### **Preconception Weight Goals**

Weight goals are dependent on a number of factors. Historically, a woman with preexisting diabetes has been encouraged to achieve an ideal body weight (IBW) before conception. Being obese or underweight may adversely affect fertility and pregnancy outcome.<sup>14</sup> Therefore, for an infertile woman who is not at her IBW, a plan for losing or gaining weight is necessary prior to conception.

Preconception overweight is an increasingly more common high risk obstetric complication and special care needs to be directed to these women. Galtier-Dereure et al have found that “Preconception counseling, careful prenatal management, tight monitoring of weight gain, and long-term follow-up could minimize the social and economic consequences of pregnancies in overweight women.”<sup>15</sup>

Maternal overweight and obesity increase the risk of birth defects, pregnancy complications, and adverse pregnancy outcomes.<sup>16</sup> MacNeill et al note that “Women whose prepregnancy weight at the start of the subsequent pregnancy was  $\geq 190$  lbs were 70% more likely to have a recurrence of GDM, adjusting for infant birth weight in the index pregnancy.”<sup>17</sup> If a woman’s BMI escalates prepregnancy regardless if she has been categorized as overweight or not, she still faces a higher risk for GDM and perinatal complications.<sup>18</sup> Therefore, preconception counseling for women with preexisting diabetes and prior GDM should address the issue of weight management.

Achieving an ideal body weight may be unrealistic for many women. Achieving a reasonable body weight may be a more appropriate goal.<sup>10</sup> A reasonable body weight is defined as a weight the woman can reach and maintain over an extended period of time. Weight goals should be developed in conjunction with the woman to increase the opportunity for successful achievement of the weight goal. Particularly in a non-pregnant woman with type 2 diabetes, a weight loss of 5% to 10% of current body weight could significantly improve glycemic control.<sup>19</sup>

### **Determining Preconception Energy Needs**

For a woman with preexisting diabetes, energy needs have to be calculated to meet her preconception weight goal. Kilocalorie levels may be calculated utilizing the method described below for the estimated energy requirement (EER). Reported dietary intake is used

along with clinical judgment to help assess the appropriateness of the calculated calorie level, and to provide a realistic calorie level for the woman. Weight loss, weight gain, weight maintenance, energy expenditure from activity, and other factors also influence energy needs. Maternal undernutrition during conception and early pregnancy can result in a poor pregnancy outcome and can affect the lifelong health of the child.<sup>20</sup> Maintaining an adequate diet well in advance of pregnancy will help to avoid a disruption of blood glucose control as a result of large changes in dietary composition in early pregnancy.

The Physical Activity Coefficients data as well as the Nonpregnant Estimated Energy Requirement data found below is used with permission from The National Academies Press (Institute of Medicine and the National Research Council).<sup>21</sup>

### Calculating Nonpregnant Estimated Energy Requirement (EER)<sup>21</sup>

- ❖ For women 14-18 years of age:  

$$\text{EER} = 135.3 - (30.8 \times \text{age in years}) + \text{Physical Activity (see below)} \times [(10.0 \times \text{weight in kilograms}) + (934 \times \text{height in meters})] + 25$$
- ❖ For women greater than or equal to 19 years of age:  

$$\text{EER} = 354 - (6.91 \times \text{age in years}) + \text{Physical Activity (see below)} \times [(9.36 \times \text{weight in kilograms}) + (726 \times \text{height in meters})]$$

### Determining Physical Activity Coefficients<sup>21</sup>

- ❖ Sedentary (e.g. typical daily living activities):
  - 14-18 years = 1.0
  - $\geq 19$  years = 1.0
- ❖ Low Active (e.g. typical daily living activities in addition to 30 - 60 minutes of daily moderate activity):
  - 14-18 years = 1.16
  - $\geq 19$  years = 1.12
- ❖ Active (e.g. typical daily living activities in addition to at least 60 minutes of daily moderate activity):
  - 14-18 years = 1.31
  - $\geq 19$  years = 1.27
- ❖ Very Active (e.g. typical daily living activities in addition to at least 60 minutes of daily moderate activity plus an additional 60 minutes of vigorous activity or 120 minutes of moderate activity):
  - 14-18 years = 1.56
  - $\geq 19$  years = 1.45

For example, a 26 year old, nonpregnant, moderately active woman weighing 54 kilograms and standing 1.7 meters in height, the calculation of EER would be as follows:

- ❖ 
$$\text{EER} = 354 - (6.91 \times 26) + 1.12 \times [(9.36 \times 54) + (726 \times 1.7)]$$
  - $354 - 179.66 + 1.12 \times 1,739.64$
  - $354 - 179.66 + 1,948.4$
  - $= 2,122.74$  kcal per day

**PREGNANCY CARE****Energy Needs During Pregnancy**

Energy needs for a woman with preexisting diabetes will increase during pregnancy. However, during the first trimester the woman's energy and nutrient needs remain the same as during the preconception period, unless there are complications of vomiting or hypoglycemia. Major changes in diet composition may disturb glycemic control and are not recommended in the first trimester. In the second and third trimesters, daily energy requirements gradually increase. See Table 2 to calculate energy needs in pregnancy.<sup>21</sup> Data from Table 2 is used with permission from The National Academies Press (Institute of Medicine and the National Research Council).<sup>21</sup>

**Table 2. ENERGY NEEDS FOR PREGNANCY BASED ON GESTATIONAL AGE**

The Institute of Medicine formulas for Estimating the Energy Requirements (EER) for pregnant women are as follows:

- 1<sup>st</sup> trimester                      EER = Nonpregnant EER + 0 kcal
- 2<sup>nd</sup> trimester                      EER = Nonpregnant EER + 340 kcal
- 3<sup>rd</sup> trimester                      EER = Nonpregnant EER + 452 kcal

\*See previous section to determine nonpregnant EER

Kilocalorie needs for a pregnant woman with diabetes vary depending on her BMI, activity level, whether the pregnancy has single or multiple fetuses, pregravid weight and other factors. The goal is to meet nutrition and energy requirements for normal fetal growth with appropriate maternal weight gain.<sup>21</sup> Energy needs may require adjustment during pregnancy based on blood glucose values, ketone levels and weight gain parameters.<sup>22</sup>

**Energy Recommendations for Multifetal Pregnancy**

The increased caloric needs for a multifetal pregnancy would average about 150 kilocalories per day over the needs of a singleton pregnancy.<sup>23</sup> Tracking prenatal weight gain is the recommended method of determining if caloric intake is adequate. Proposed weight gain recommendations are found in Table 5. Consistent weight gain with 1.5 lbs per week after the first trimester appears to reduce the risk of preterm and low birth weight deliveries.<sup>23</sup>

### Body Mass Index

Body Mass Index (BMI) is used to determine the woman’s preconception weight category. BMI is calculated based on pregravid weight using the equation in Table 3.

| <b>Table 3. CALCULATING BODY MASS INDEX *</b>  |   |
|--|---|
| <p>To calculate BMI using U.S. imperial units:<br/> <math display="block">\text{BMI} = 703 \times \frac{\text{Weight (lbs)}}{\text{Height (in)}^2}</math></p> <p><b>Example:</b> Woman is 5'6" and 155 lbs</p> $\text{BMI} = 703 \times \frac{155}{(66)^2}$ $\text{BMI} = 703 \times \frac{155}{4356}$ $\text{BMI} = 703 \times .036$ $\text{BMI} = 25$  | <p>To calculate BMI using metric units:<br/> <math display="block">\text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height (meters)}^2}</math></p> <p><b>Example:</b> Woman is 1.68 m and 70.5 Kg</p> $\text{BMI} = \frac{70.5 \text{ Kg}}{(1.68 \text{ m})^2}$ $\text{BMI} = \frac{70.5 \text{ Kg}}{2.82 \text{ m}}$ $\text{BMI} = 25$ |
| <p>* If the woman enters into the program during pregnancy, special efforts need to be made to determine her actual or most accurate pregravid weight. See BMI calculator link:<br/>                 ✓ <a href="http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html">http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html</a></p> |   |

### BMI Cut-Offs

The WHO Expert Consultation identifies BMI cut-off points as clinically relevant to “...identify high-risk individuals for screening; identify individuals for absolute risk assessment; determine the type and intensity of treatment; monitor individuals for effects of treatment over time; determine institutional policies on individuals...”<sup>24</sup>

Data from Table 4 below is used with permission from The National Academies Press (Institute of Medicine and the National Research Council).<sup>21</sup>

| <b>Table 4. IOM PREPREGNANT BMI CATEGORIES AND CUT-OFFS WITH RECOMMENDED WEIGHT GAIN<sup>21</sup></b> |                               |                                      |  |
|---|-------------------------------|--------------------------------------|--|
| Weight Category   | BMI                           | Recommended Total Weight Gain Ranges | Mean Weight Gain (lb/wk) 2nd & 3rd Trimester |
| Underweight   | < 18.5 kg/m <sup>2</sup>      | 28 - 40 lbs                          | 1 (1 - 1.3) lbs                              |
| Normal  | 18.5 - 24.9 kg/m <sup>2</sup> | 25 - 35 lbs                          | 1 (0.8 – 1) lbs                              |
| Overweight  | 25.0 - 29.9 kg/m <sup>2</sup> | 15 - 25 lbs                          | 0.6 (0.5-0.7) lbs                            |
| Obese   | ≥ 30.0 kg/m <sup>2</sup>      | 11 - 20 lbs                          | 0.5 (0.4-0.6) lbs                            |

There are no different IOM BMI cut-offs for women with diabetes compared to the nondiabetic population. Health care providers are encouraged to give women individualized recommendations on their weight gain in pregnancy and reduction of their body fat composition, if appropriate. In evaluating the woman's weight gain during pregnancy both total and rate of weight gain must be considered.

### **Determining Appropriate Weight Gain Based on Prepregnancy BMI Categories**

There are many publications addressing maternal and fetal complications in women who exceeded the 1990 IOM weight gain recommendations. These include a higher risk of primary cesarean section, preterm delivery, large for gestational age (LGA) infant and more need for medical therapy to control blood glucose levels.<sup>25,26</sup> Lower amounts of gestational weight gain may be more appropriate for women with insulin resistance<sup>27</sup>, especially if they are provided MNT which focuses on optimal nutrient intake and minimal use of discretionary calories.

The IOM does not have specific weight gain recommendations for pregnant women with diabetes. However, until further research is available, weight gain recommendations for women with diabetes in each BMI category should be in accordance with the 2009 IOM guidelines (see Table 4). Women whose weights are at the higher end of the 2009 overweight BMI category are encouraged to gain toward the lower end of that recommended weight gain range.

A position statement given by the American Diabetes Association in 2007 noted that "moderate caloric restriction (reduction of 30% of estimated energy needs) in obese women with GDM may improve glycemic control without ketonemia and reduce weight gain."<sup>28</sup> Sustained weight loss is not recommended during pregnancy. If weight loss is sustained, carefully evaluate food records for adequacy of the diet and monitor urine ketones. Restricting usual caloric intake by 30-33% in obese pregnant women has been demonstrated to prevent macrosomia.<sup>29,30</sup>

At the other end of the spectrum, women in the 1990 BMI underweight category of <19.8 who gained less than the IOM recommendations were at higher risk for a small for gestational age (SGA) infant.<sup>25,31,32</sup> It is very important for pregravid underweight women to gain 28-40 lbs to prevent growth restriction of the infant.

As more data about population-specific BMI cut-offs and risk factors become available, population-specific BMI cut-off points may need to be reconsidered for determining a weight category. The WHO suggests lower BMI cut-off points be added as points of public health action for Asians.<sup>24</sup> Women of Asian American and Pacific Islander descent have been identified as particularly at risk for GDM.<sup>33</sup> Asian American

ethnicity is recognized by the American Diabetes Association<sup>34</sup> and CDAPP Sweet Success as a risk factor for GDM. It may be prudent in developing individualized weight gain recommendations with a woman of Asian background to suggest that this woman gain at the lower end of the weight gain recommendation for their weight category.

In a prospective study of over 1000 mother-child pairs utilizing the 1990 IOM Guidelines, researchers found that mothers with excessive gestational weight gain, independent of maternal BMI and maternal glucose tolerance, had children with more adiposity at 3 years of age. They concluded that “efforts to moderate weight gain during pregnancy may help to stem the rising tide of childhood obesity.”<sup>35</sup>

With the epidemic of obesity in this country, the risk of retaining extra pounds gained during pregnancy, and with increasing insulin resistance associated with gaining extra pounds, it seems prudent to avoid any extra weight gain in women with diabetes. CDAPP Sweet Success programs encourage regular physical activity which is associated with reduced risk for excessive gestational weight gain.

### **Monitoring Weight Gain**

Use the appropriate weight gain grid to monitor weight gain (refer to *Appendix A*). Follow the pattern of weight gain every two to four weeks and make changes in the exercise and MNT plan accordingly. If weight gain is inappropriate, consider causative factors such as lifestyle and possibly psychosocial and/or medical issues. Discuss these factors with the other team members and adjust the diet, exercise or medication plan as necessary.

### **Excess Weight Gain**

Excess weight gain is defined as a gain of 6.5 pounds (3 kilograms) or more per month for all women who are not underweight at the time of conception. In a normal prepregnancy weight woman with excessive weight gain during pregnancy, a slower rate of weight gain may be recommended. The rate of weight gain may slow down when the kilocalorie level is adjusted to meet actual needs. Factors that may cause excess weight gain are high kilocalorie intake relative to actual needs, decreased physical activity, or fluid retention. The meal plan should be carefully evaluated for all nutrients as well as kilocalories.<sup>22,36</sup>

Rapid weight gain in the second and third trimesters, accompanied by edema, may indicate the onset of pregnancy-induced hypertension or preeclampsia. In some cases, a woman may experience polyhydramnios (excess amniotic fluid production). Either of these may result in an increase in weight unrelated to an excess intake of kilocalories. Blood pressure evaluations and checking a urine dipstick for the presence of protein can be used to help identify the need for special tests and medical intervention.

### **Inadequate Weight Gain**

Slower weight gain may occur due to improved diet as a result of nutrition counseling. Inadequate weight gain is defined as a gain of less than 0.5 pounds (0.23 kilograms) per week or less than 2 pounds (0.9 kilograms) per month during the second and third trimester. Slower than expected weight gain may be adequate if the woman is in the obese category at the time of conception or has already gained excess weight.<sup>22</sup>

Weight loss can occur for a number of reasons, including the woman's fear of increasing blood glucose levels by eating, psychosocial issues influencing the ability to eat, or lack of access to an adequate food supply. A review of food and blood glucose records can often provide clues to the cause of weight loss or inadequate gain.

Initial weight loss may represent a diuresis. This fluid loss is often seen in a woman with GDM and could be due to a shifting of the balance of carbohydrates and protein in the meal plan or to the elimination of extra calories following CDAPP Sweet Success nutrition counseling.

To assess the effectiveness of MNT, monitor weight gain carefully for the first few weeks after MNT has begun. Weight should begin to increase once the fluid shifts have subsided within 1-2 weeks of MNT. By the second follow-up visit, appropriate weight gain or weight maintenance should be established. If weight loss continues or urine ketones are persistently present, review the food diary, and consider increasing kilocalorie and/or carbohydrate intake. If the increased kilocalorie and carbohydrate intake results in hyperglycemia, initiation of medication management may be necessary.

### **Multiple Gestation Weight Gain**

Optimal maternal weight gain for twin pregnancies is higher than that for singletons.<sup>21</sup> BMI-specific weight gain recommendations have been proposed by the Institute of Medicine<sup>21</sup> and Luke et al.<sup>37</sup> The Institute of Medicine notes insufficient information was available to make a weight gain recommendation for underweight (BMI <18.5).<sup>21</sup> In a large, retrospective analysis, women who gained 45-65 pounds had improved birthweights. Research regarding outcomes for twin pregnancies demonstrates that women who have met recommended weight gain goals have optimal fetal growth and birth weights.<sup>37</sup> In addition, the rate of weight gain is important: appropriate weight gain prior to 28 weeks of pregnancy strongly contributes to rates of fetal growth.<sup>37</sup>

Few studies are available for maternal weight gain during triplet pregnancies. In one study of 194 triplet pregnancies, maternal weight gains of <36 pounds by 24 weeks gestation resulted in lower birth weights for women with BMI <19.8 and women with BMI 19.8 - 26.<sup>38</sup>

Table 5 provides a retrospective view of ranges of weight gain among women of differing prepregnancy weight categories who had term twins of normal birth weight.<sup>21</sup> Data from Table 5 below is used with permission from The National Academies Press (Institute of Medicine and the National Research Council).<sup>21</sup>

| <b>Table 5. WEIGHT GAIN DURING TWIN PREGNANCY*<sup>21</sup></b> |                               |              |
|---|-------------------------------|--------------|
| Women’s Weight Category   | 2009<br>Institute of Medicine |              |
|   | Pregravid BMI:                | Weight Gain: |
| Underweight   | No data reported              |              |
| Normal weight   | 18.5 - 24.9                   | 37 - 54 lbs  |
| Overweight  | 25 - 29.9                     | 31 - 50 lbs  |
| Obese   | ≥ 30                          | 25 - 42 lbs  |
| *37-42 weeks with average birth weight > 2,500 g                |                               |              |

**NUTRITION NEEDS  
FOR PRECONCEPTION  
AND PREGNANCY**

Nutrition recommendations during the preconception period for women with type 1 diabetes or type 2 diabetes are based on the American Diabetes Association guidelines. Maintenance of euglycemia is important to reduce the risk of congenital anomalies. The goal is also to emphasize the importance of healthy food choices for a lifetime.

Nutrient and dietary care guidelines for preconception and pregnancy for the woman with diabetes can be found in Table 6.

| <b>Table 6. DIETARY CARE GUIDELINES FOR PRECONCEPTION AND PREGNANCY</b> |  |
|---|--|
| Kilocalories  | <p><b>Preconception:</b> Provide adequate kilocalories for attaining a healthy weight before pregnancy. Prior to conception provide adequate kilocalories for weight maintenance. The equation for calculating the estimated energy requirement (EER) for normal weight women is depicted on page 7.</p> <p><b>Pregnancy:</b> Prepregnant BMI, maternal age, rate of weight gain, physiological growth spurt and appetite must be considered in tailoring the caloric recommendation to the individual. The Daily Food Choices for Pregnant Women<sup>39</sup> is a guide for recommended amounts of food for pregnant women and may not be appropriate for all individuals. Strong scientific evidence suggests that the energy cost of pregnancy is less than previous theoretical estimations.<sup>40</sup> Energy estimates must be individualized based on a nutrition assessment, physical activity and weight gain patterns in pregnancy.</p> |
| Protein   | <p><b>Preconception:</b> The Recommended Daily Allowance (RDA) is 0.8g/kg/day</p> <p><b>Pregnancy:</b> Requirements do not increase until the second half of pregnancy to 1.1 g/kg (or an additional 25 g/day). The pregnancy RDA for protein is 71 g/day.<sup>41</sup></p>  |
| Carbohydrate  | <p><b>Preconception:</b> The contributions of CHO to energy intake should be individualized based on nutrition assessment, metabolic profiles, and treatment goals.</p> <p><b>Pregnancy:</b> The RDA is a minimum of 175g CHO/day.<sup>41</sup></p>  |
| Fat   | <p><b>Preconception and Pregnancy:</b> Less than 7% of energy intake should be derived from saturated fats and &lt;1% trans fats.<sup>42</sup> Polyunsaturated fat intake should be ~ 10% of energy intake. The rest of fat intake should come from monounsaturated fat. Pregnant women should consume 2 - 3 servings of DHA rich foods weekly to meet the suggested intake of 200 - 300 mg/day.</p>   |
| Nonnutritive Sweeteners   | <p><b>Preconception and Pregnancy:</b> Consumption of acesulfame potassium, aspartame, saccharin, sucralose, and neotame within acceptable daily intakes (ADI) is safe during pregnancy.<sup>43</sup> Stevia-derived sweeteners, including stevia glycosides and rebaudioside A (Reb A), are on the Generally Recognized as Safe (GRAS) list<sup>44</sup> and are therefore considered safe when used in moderate amounts during pregnancy. However, there is insufficient evidence to use stevia in its whole herb form during pregnancy, such as herbal tea, supplements, or crude extracts according to Natural Medicines Comprehensive Database.<sup>45,46</sup> The Academy of Nutrition and Dietetics Evidence Analysis Library notes, "...only FDA-approved non-nutritive sweeteners should be consumed and moderation is encouraged." They go on to say, "Research in this area is extremely limited."<sup>47</sup></p>                      |
| Fiber   | <p><b>Preconception and Pregnancy:</b> Adequate Intake (AI) of total fiber for women 19- 50 years is 25 g/day.<sup>41</sup> For pregnancy the AI is 28g/day and for lactation 29g/day. A high quantity of fiber in the diet (25g/1000Kcal) slows gastric emptying time and results in a significant reduction in postprandial serum glucose and insulin levels.<sup>48</sup> Fiber also is effective for relief of constipation as long as it is coupled with adequate fluid intake.</p>   |
| Sodium  | <p><b>Preconception and Pregnancy:</b> AI for women under 50 years is 1.5 g/day. Sodium is not routinely restricted in pregnancy and restriction has not been proven effective in preventing or delaying preeclampsia. Tolerable Upper Intake Level (UL) is 2.3 g/day.<sup>49</sup></p>  |

|                                      |  |
|--------------------------------------|--|
| Folic Acid                           | <p><b>Preconception:</b> RDA recommendation is that all women of child bearing age should consume 400 mcg/day of synthetic folic acid from fortified foods, supplements or both, in addition to consuming folate from food in a varied diet.<sup>50</sup> If a woman is not consuming folic acid, supplementation should start at least one month prior to conception. Women with a history of neural tube defects should increase their daily supplement to 4 mg/day one month prior to conception and through the first three months of pregnancy.<sup>51,52</sup></p> <p><b>Pregnancy:</b> RDA recommendation is that women should consume 600 mcg/day of dietary folate equivalents.<sup>50</sup> Most prenatal supplements have at least 600 mcg of folic acid, an amount that will assist pregnant women in reaching the RDA recommendation.</p> |
| Iron, Zinc, Copper                   | <p><b>Preconception:</b> RDA for iron is 18 mg/day.</p> <p><b>Pregnancy:</b> RDA for iron is 27 mg/day. A low-dose iron supplement (30mg/day) is recommended beginning at the first prenatal visit. When a low Hgb or Hct is confirmed by a repeat test, an oral dose of 60-120mg of iron/day should be prescribed.<sup>53,54</sup> For women taking supplements &gt;30 mg/day of iron, 15 mg of zinc and 2 mg of copper as supplements are recommended.<sup>54</sup> These amounts are found in many prenatal vitamin-mineral supplements.</p>  |
| Calcium                              | <p><b>Preconception:</b> RDA for ages 14 - 18 years is 1300 mg/day; ages 19 - 50 years is 1000mg/day; and greater than 50 years of age is 1200 mg/day.</p> <p><b>Pregnancy:</b> UL is 3000 mg/day for ages 14 - 18 years and 2500 mg/day for ages 19 - 50 years.<sup>55</sup></p>  |
| Magnesium                            | <p><b>Preconception:</b> RDA for ages 14 - 18 years is 360 mg; ages 19 - 30 years is 310 mg; and ages 31 - 50 is 320 mg.<sup>56</sup></p> <p><b>Pregnancy:</b> RDA for ages 14 - 18 years is 400 mg; ages 19 - 30 years is 350 mg; and ages 31 - 50 is 360 mg. UL for added Mg is 350 mg.<sup>56</sup></p>   |
| Vitamin D                            | <p><b>Preconception:</b> RDA is 600 IU (15 mcg)/day and UL is 4000 IU (100 mcg)/day.<sup>57</sup></p> <p><b>Pregnancy:</b> Same as preconception above.</p>  |
| Multivitamin and Mineral Supplements | <p><b>Pregnancy:</b> Multivitamin/mineral supplements are recommended for women with multiple gestations, iron deficiency anemia, poor quality diets, and vegan diets. Supplements are also recommended for women who smoke or use or abuse alcohol or drugs. Avoid excessive supplementation of Vitamin A. Vegans need to supplement their diet with 600 IU Vitamin D and 2.0 mcg Vitamin B12.</p>  |
| Herbal & Botanical Supplements       | <p><b>Pregnancy:</b> Pregnant women should be advised to consider herbal treatments as suspect until their safety during pregnancy can be ascertained. Limit herbal teas.<sup>58</sup> To keep abreast of new information consult The Academy of Nutrition and Dietetics and go to the American Pregnancy web site.<sup>58</sup></p>   |
| Alcohol                              | <p><b>Preconception:</b> Avoid if planning pregnancy. May reduce fertility.<sup>59</sup></p> <p><b>Pregnancy:</b> No alcohol. A safe level of alcohol intake has not been established for any stage during pregnancy.</p>  |

| <b>Table 6. DIETARY CARE GUIDELINES FOR PRECONCEPTION AND PREGNANCY, Continued</b>  |   |
|---|---|
| Caffeine  | <p><b>Preconception:</b> Some evidence suggests high intake (&gt; 500mg/day) may delay conception.<sup>60</sup></p> <p><b>Pregnancy:</b> Some adverse effects on pregnancy outcomes have been linked to high caffeine intakes. Prudent advice would be to discourage &gt;200 mg caffeine/day (i.e. limit to two 6 ounce cups of coffee/day).<sup>61</sup></p> |
| Twin Gestations   | A study conducted by Goodnight and Newman found that, “micronutrient and macronutrient supplementation specific to the physiology of twin gestations, and carbohydrate-controlled diets are recommended for optimal twin growth and pregnancy outcomes.” <sup>62</sup>  |
| <p><b>Acronyms:</b></p> <p>ADI - Acceptable Daily Intake - the maximum amount of any substance that can be safely ingested by human.</p> <p>AI - Adequate Intake - A DRI component used where there is inadequate scientific evidence to establish requirements and reference intakes for a nutrient.</p> <p>BMI- Body Mass Index</p> <p>CHO - Carbohydrate</p> <p>DHA - Docosahexaenoic Acid</p> <p>DRI - Dietary Reference Intake - Nutrient reference values set by the National Academy of Sciences</p> <p>RDA - Recommended Dietary Allowance - the RDA is one of the DRI components used for assessment of an individual and is not to be used to assess intakes of groups. Usual intake at or above this level has a low probability of inadequacy.</p> <p>UL - Tolerable Upper Intake Level</p> |   |

### Omega-3 Fatty Acids

Omega-3 fatty acids are important in human nutrition and during the perinatal period although no recommended Dietary Allowance is presently set. Omega-3 polyunsaturated fatty acids include docosahexaenoic acid (DHA), elcosapentaenoic acid (EPA), and alpha-linolenic acid (ALA). ALA is converted into DHA and EPA in animals. Fish and seafood are the highest sources of DHA and EPA, while leafy green vegetables, walnuts, flaxseeds and their oils, as well as algae are the richest sources of ALA. The conversion of ALA to EPA and DHA is very low in humans, although it improves during pregnancy and is higher overall in women compared to men. Currently, research indicates that the actual conversion is influenced predominately by the absolute amount of ALA and Linoleic Acid (LA) which is an omega-6 fatty acid in the diet, and not by the ratio of LA to ALA.<sup>63</sup>

Researchers have shown a positive association between DHA in infants and improved neural and visual development. Researchers have also demonstrated that higher intakes of ALA do not increase DHA levels in pregnant mothers or infants. However, higher intakes of DHA by the mother do positively influence the DHA levels in their infants via a transfer from placental circulation and breast milk.<sup>63</sup>

The current recommendation to improve the intake of omega-3 fatty acids in the perinatal period is for women to consume up to 12 ounces per week of low-mercury and preferably fatty fish.<sup>64</sup>

According to the Environmental Protection Agency (EPA) website, the EPA recommends the following<sup>64</sup>:

1. Do not eat Shark, Swordfish, King Mackerel, or Tilefish because they contain high levels of mercury.
2. Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
  - Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish.
  - Another commonly eaten fish, albacore (“white”) tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
3. Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but don’t consume any other fish during that week.

For California, local advisories can be found at the California Office of Environmental Health Hazard Assessment (OEHHA):

- ✓ <http://www.oehha.ca.gov/fish/preg/index.html>

Fish oil supplements are not routinely recommended during pregnancy.<sup>63</sup> A food based approach is recommended to improve the omega-3 fatty acid profiles during pregnancy.

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## MEAL PLAN DESIGN

### Meal Plan Recommendations

Throughout pregnancy, placental hormones and cytokines such as human placental lactogen, progesterone, prolactin, cortisol, and TNF- $\alpha$  continue to increase.<sup>65</sup> The increasing levels of these hormones and cytokines cause changes in metabolism and blunts the effectiveness of insulin to lower blood glucose levels.<sup>66</sup> Most pregnant women with preexisting diabetes or GDM are very sensitive to carbohydrates. The meal pattern of three meals and 2 to 4 snacks addresses this sensitivity.<sup>28</sup> Carbohydrates are carefully spaced among several meals and snacks.<sup>67</sup> This meal pattern is designed to prevent episodes of hyperglycemia and to control postprandial blood glucose values. The

amount and type of carbohydrate within a single meal can also influence postprandial blood glucose values.<sup>68</sup> The meal and snack pattern may be individualized based on the treatment plan.

The first meal of the day is, physiologically, the meal where women show the greatest insulin resistance. Better blood glucose management may be achieved if carbohydrates are more limited at this meal.<sup>29</sup>

To manage the increased carbohydrate sensitivity seen during pregnancy and achieve euglycemia, total carbohydrate intake should be a minimum of 175 grams per day and less than 45% of energy.<sup>47</sup> The total daily carbohydrate levels and distribution should be individualized to tolerance and preference. If the woman must restrict her intake below this level in order to achieve glycemic control, insulin or medication therapy should be considered. It is also important to mention that careful attention should be given to the nutrient composition during pregnancy to assure that the diet does not become unbalanced as emphasis shifts from exchange food groups to counting carbohydrates.

Factors that affect individual responses to foods (week of gestation, amount of insulin or glyburide, exercise after the meals, and timing of meals) need to be considered along with glycemic results from self-monitoring of blood glucose. These factors are discussed in the following paragraphs.

### **Carbohydrate Sources to be Limited**

These guidelines may be useful when counseling a woman on the carbohydrate content in the meal plan. Eating a diet with high glycemic index food when pregnant with GDM may result in the need for treatment with insulin.<sup>69</sup> The following foods are rapidly absorbed and can raise the blood glucose more than desired. The initial meal plan should not contain these items. Their use can be individualized and needs to be based on a woman's ability to maintain blood glucose control and weight gain goals, while consuming a nutritionally adequate prenatal diet. In general, limit:

- ❖ Refined sugars such as honey, sugar, molasses, corn sweeteners and sugary desserts.
- ❖ Fruit juices, regular sodas, energy drinks, sports drinks, sweetened coffee drinks, and refined starches such as highly processed breakfast cereals, instant potatoes and instant noodles.

## Recommended Carbohydrate Sources

- ❖ Slowly digested carbohydrate sources from the Starch/Bread exchange group, specifically those that have a low glycemic index and are high in fiber and less dense are the best choices. These include old-fashioned oatmeal, whole grain breads, legumes (dried cooked whole beans, peas, lentils), and pasta.
- ❖ Fresh fruits are included in limited amounts, with no more than one exchange per meal or snack. Avoiding fruit at the first meal of the day may improve post breakfast glycemic control.
- ❖ Fresh vegetables are recommended in liberal amounts, especially broccoli, spinach, and greens.
- ❖ Milk may be included as either 1% fat or fat-free in portion sizes of 4-8 ounces per meal or snack. Many women find that excluding milk (lactose) from the breakfast meal improves postprandial glycemic control.

### Breakfast

- ❖ For most pregnant women with diabetes, insulin resistance is greater in the morning.<sup>70,71</sup> Therefore, the breakfast carbohydrate load may need to be restricted to 15 - 30 grams of carbohydrate.<sup>70</sup>
- ❖ Fruit juices, fruits, milk, ready-to-eat or instant cereals, bagels, croissants and rice porridge are usually excluded from the breakfast meal. Self-monitoring of blood glucose is recommended to determine individual tolerance.

### Snacks

- ❖ Be aware that having both fruit and milk for the same snack may lead to between meal hyperglycemia that goes unchecked.
- ❖ Allow a 2-3 hour interval between meals and snacks (except for someone who is on glyburide). Snacks should contain a lower amount of carbohydrate than lunch and dinner.
- ❖ A bedtime snack of approximately 7 grams of protein and 15-30 grams of carbohydrate is recommended for women to prevent starvation ketosis and potential middle of the night hypoglycemia, especially for women on glucose-lowering medication.<sup>72</sup>
- ❖ Allow no more than 10 hours between bedtime snack and breakfast the following morning.<sup>29</sup>
- ❖ Inclusion of protein in the snack increases satiety.

Women taking rapid-acting insulin to cover a higher carbohydrate breakfast may notice that they experience low blood glucose levels in the mid-morning as the morning insulin resistance wears off and the residual rapid-acting insulin continues to work. Mid-morning carbohydrate snacks may prevent this occurrence. For women using insulin pump therapy, it will be necessary to cover snacks with an insulin bolus based on the carbohydrate content of the snack. A period

of frequent blood glucose monitoring is recommended to determine insulin-to-carbohydrate ratios for these snacks. As long as the diet is adequate, women using insulin pump therapy may be allowed increased flexibility regarding inclusion or exclusion of snacks.

### **Glycemic Index in the Management and Prevention of Diabetes**

The glycemic index (GI) is a ranking system for carbohydrates based on their effect on blood glucose levels in the first two hours. It compares carbohydrates, gram for gram, in individual foods, to provide a numerical index of postprandial (post-meal) glycemia. Carbohydrates that break down rapidly during digestion have the highest glycemic indices. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index.

The use of low-glycemic index diets for the management of diabetes is controversial. The findings of randomized controlled trials have been mixed: some studies have shown statistically significant improvements, whereas other studies have not.<sup>73-75</sup>

The European Association for the Study of Diabetes recommends the substitution of low-GI foods. However, the American Diabetes Association (ADA) asserts that there is not sufficient evidence of long-term benefit to recommend their use as a primary strategy, but does acknowledge that use of low-GI foods may reduce postprandial hyperglycemia. The American Diabetes Association's 2007 position statement on Nutrition Recommendations and Interventions for Diabetes, explains that "the use of the glycemic index and [glycemic] load may provide a modest additional benefit [for glycemic control] over that observed when total carbohydrate is considered alone" for individuals with diabetes.<sup>28</sup>

The glycemic load (GL) is a ranking system for carbohydrate content in food portions based on their GI and the portion size. Glycemic load is calculated by multiplying the GI by the amount of available carbohydrate (grams of carbohydrate not including fiber) provided by a food and dividing by 100.<sup>76</sup>

$$GL = \frac{GI \times \text{grams of available carbohydrate}}{100}$$

In addition to using the individualized meal plan for a woman with diabetes, it may then be prudent to advise her to use her own blood glucose results to determine the effect of various foods on her own blood glucose levels and make modifications in her diet as necessary.

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**USE OF DIABETES  
MEDICATIONS****Women Using Insulin**

Meal plan recommendations for women with type 1 diabetes are based on the type of insulin therapy used. For women using insulin-to-carbohydrate ratios, premeal and postmeal blood glucose monitoring will be necessary for adjusting these ratios as pregnancy progresses. A thorough understanding of carbohydrate counting is essential when using insulin-to-carbohydrate ratios. The insulin-to-carbohydrate ratio may be different at the breakfast meal due to the increased insulin resistance at this time. For example, the breakfast ratio may be 1 unit of insulin to 10 grams carbohydrate whereas the lunch and dinner ratio is 1 unit of insulin to 15 grams carbohydrate.

For a woman using multiple daily injections or intensive forms of insulin therapy, such as an insulin infusion pump, insulin-to-carbohydrate ratios can be calculated to allow flexibility in carbohydrate intake without sacrificing the tight glycemic control needed during pregnancy. See *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy* for more information regarding insulin resistance and duration of insulin action.

**Glyburide and Meal Planning**

Since the landmark study of Langer et al<sup>77</sup>, glyburide use during pregnancy has become more widespread. Glyburide is a second generation sulfonylurea with a long half-life, and consequent high risk for hypoglycemia. Due to its slow rate of absorption and onset of action, glyburide may not restore first phase insulin release when initially prescribed.<sup>78</sup> As a result, postprandial blood sugars after breakfast may continue to be elevated, and hypoglycemia may occur before lunch unless a snack is introduced on time. Clinicians have reported that the optimal snack time may be as early as 1.5 hours after the initiation of breakfast. Patients who have been prescribed pre-breakfast glyburide need to be educated about the potential for midmorning hypoglycemia. Similarly, with bedtime dosing of glyburide, it is imperative to recommend a bedtime snack to avoid overnight hypoglycemia.

In summary, with the initiation of glyburide, patients need to strictly adhere to a 3 meal, 3-4 snack meal plan in order to avoid hypoglycemia.

**Metformin**

Using metformin along with diet and exercise does not pose a risk for hypoglycemia. The basic GDM meal plan can be used.

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## NUTRITION EDUCATION

A woman who plans to be, or is, pregnant and has diabetes may need guidance on specific nutrition issues based on the type of diabetes she has, her current knowledge about nutrition and diabetes, and her specific concerns during pregnancy. Education should include the following issues as appropriate:

- ❖ Rationale for the meal plan includes achieving a preconception weight goal and optimal nutrient intake, maintaining normoglycemia and optimal nutrient intake throughout pregnancy, and attaining appropriate weight gain in each trimester
- ❖ Spacing of meals and snacks to avoid hypoglycemia and hyperglycemia
- ❖ Limitation of foods with high glycemic index such as highly processed breakfast cereals, fruit juices and instant starch products (instant potatoes and instant noodles)
- ❖ Utilization of self-monitoring of blood glucose (SMBG) and food records to problem solve and/or identify blood glucose excursions related to food intake
- ❖ The need for insulin, glyburide, or metformin and adjustments to their dosages
- ❖ The role and timing of exercise to improve blood glucose levels
- ❖ Different methods of carbohydrate counting and meal plan flexibility
- ❖ Use of sugar substitutes
- ❖ Use of herbs
- ❖ The way to read food labels and grocery shopping guidelines
- ❖ Appropriate treatment and prevention of hypoglycemia
- ❖ Menu ideas and restaurant ordering skills (asking for substitutions, salad dressing on the side, etc.)
- ❖ Ways to handle sick days, hyperemesis, and carbohydrate replacement if on glyburide or insulin therapy
- ❖ Long term healthy eating habits to avoid type 2 diabetes or its complications

### Education Materials

For access to nutrition education materials including the California MyPlate for Gestational Diabetes resource, please refer to the CDAPP Sweet Success Resource and Training Center website:

- ✓ <http://www.cdappsweetsuccess.org/Resources/FreePatientEducationMaterial.aspx>
- ✓ <http://www.cdph.ca.gov/programs/NutritionandPhysicalActivity/Documents/MO-NUPA-MyPlateforGestationalDiabetes.pdf>

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## GESTATIONAL DIABETES MELLITUS

Currently the International Association of Diabetes and Pregnancy Study Groups (IADPSG) recommends using a 75 gram 2 hour Oral Glucose Tolerance Test (OGTT) to test for gestational diabetes at 24 -28 weeks gestation.<sup>79</sup> Based on the previously recommended 3 hour OGTT, a study by Langer and colleagues<sup>80</sup> showed that women with one abnormal OGTT value who did not receive treatment had higher incidence of metabolic complications and larger infants. The women

who received treatment had significantly better neonatal outcomes. In addition, rates of hypertension and caesarean sections were also higher in women with one abnormal glucose value.<sup>81</sup> Therefore, it is clear that women with one abnormal glucose value during pregnancy should be treated similarly to women with GDM.

Research has shown that MNT is the primary intervention in the management of GDM.<sup>2</sup> Similarly, the Academy of Nutrition and Dietetics nutrition practice guidelines for GDM utilized by registered dietitians in obstetric clinics resulted in improved perinatal outcomes.<sup>1</sup>

The blood glucose goals are the same for a woman with GDM as for a pregnant woman with preexisting diabetes. Some women will be able to achieve these goals through medical nutrition therapy and exercise while others will need MNT and exercise plus insulin, glyburide or metformin. Self-monitoring of blood glucose levels is essential in this group of women to demonstrate continued maintenance of normoglycemia as the pregnancy progresses.

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## OPTIMIZING GLYCEMIC CONTROL

Here are some summary points from the previous discussion to help with maximizing optimal glycemic control.

- ❖ Emphasize a consistent schedule of daily meals and snacks. For a woman with preexisting diabetes, it would be beneficial to help her develop eating habits that can be carried over into pregnancy so that only minimal diet adjustment is required during the first trimester. As pregnancy progresses, add incremental kilocalories, as needed, to maintain optimum weight gain.
- ❖ Suggest that the woman distribute food intake over three meals and several snacks for prevention of hypoglycemia (especially for women taking glyburide or multiple daily injections of insulin).
- ❖ If a woman is using insulin or glyburide, ask her to keep her carbohydrate intake consistent in order to establish the correct insulin or glyburide dose needed. Daily food records plus premeal and postmeal blood glucose values are very useful for evaluating how to adjust insulin or glyburide and/or meals.
- ❖ Identify individual glycemic responses to foods by reviewing the woman's daily food records. Synchronize food intake with insulin or glyburide action, exercise and other variables.
- ❖ Determine the cause of aberrant blood glucose values which can be due to changes in food intake (extra carbohydrate, snacks too close to meals, skipped snacks), exercise, insulin or glyburide, or illness. Other variables such as increased pregnancy hormone levels could explain gradually increasing blood glucose levels.
- ❖ Share recommendations with the health care team regarding changes in the MNT plan that may affect the dosage of insulin or glyburide, or the need to initiate insulin or glyburide therapy.

- ❖ Help the woman with preexisting diabetes, especially a woman with type 1 diabetes, develop a plan for using carbohydrate-to-insulin ratios so insulin can be adjusted to the diet.<sup>82</sup> This involves more intensive education about carbohydrate counting and nutrient management provided by the RD and other members of the health care team.

## EVALUATION OF MEDICAL NUTRITION THERAPY GOALS

Evaluation of the MNT goals should be reviewed and adjusted at least once a month after the meal plan is in place according to the parameters found in Table 7. Glucose intolerance worsens as pregnancy progresses due to increased hormone production. The RD should reassess the woman's adherence to her meal and exercise plan as well as other nutrition related issues. If review of food records indicates adherence to the meal plan and if glucose intolerance continues, the RD should collaborate with the health care team regarding initiating or adjusting insulin, glyburide or metformin.

| <b>Outcome</b>  | <b>Process</b>   |
|---|--|
| Adequate nutrient intake                                  | Review food records for adequate nutrient intake to meet the Daily Reference Intakes (DRI - formerly RDA). The California MyPlate for Gestational Diabetes can be used to educate patients regarding sufficient nutrient intake. Refer to: <a href="http://www.cdph.ca.gov/programs/NutritionandPhysicalActivity/Documents/MO-NUPA-MyPlateforGestationalDiabetes.pdf">http://www.cdph.ca.gov/programs/NutritionandPhysicalActivity/Documents/MO-NUPA-MyPlateforGestationalDiabetes.pdf</a> |
| Appropriate weight gain                                   | Check weight and plot on a grid. Address excess or inadequate weight gain by reviewing food records to estimate amount of kilocalories. Adjust meal plan as needed.  |
| Blood glucose in target range                             | Review blood glucose records and food records to identify reasons for elevated blood glucose levels after meals. Assess the woman's ability to follow her meal plan and make appropriate food choices. Assess whether insulin orders need to be requested.   |
| Limit episodes of hypoglycemia in women requiring insulin | Review prevention and treatment of hypoglycemia. Assess woman's ability to identify reasons for hypoglycemic episodes and ability to prevent re-occurrence (e.g. skipped meal or snack, excessive insulin dose, or extra exercise).  |

Pregnant women with diabetes may have complicating conditions that require specialized nutrition assessments (e.g. renal disease, eating disorders). These women should be referred to a RD specializing in these areas of dietetics.

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**SPECIAL NUTRITION  
ISSUES IN DIABETES  
AND PREGNANCY****Dyslipidemia**

Women with GDM and type 2 diabetes often have dyslipidemia and a high risk for cardiovascular disease (CVD). In general, limiting total fat is a good recommendation for persons at high risk for CVD. Limiting total fat may not be best for patients with high triglycerides and/or low High Density Lipoprotein (HDL). Therefore, a diet lower in carbohydrates and higher in monounsaturated fats is recommended.<sup>83</sup> Additionally, limiting saturated fats to no more than 7% of the total fat intake is helpful in controlling dyslipidemia.<sup>84</sup>

**Chronic Hypertension**

Although no evidence exists regarding the effectiveness of diet modifications to prevent preeclampsia, dietary modifications have been shown to lower blood pressure in the nonpregnant state.<sup>85</sup> For women previously identified with chronic hypertension, it would seem prudent to incorporate the nutrition principles that have been recognized to lower blood pressure. The Dietary Approaches to Stop Hypertension (DASH) study demonstrated a decrease in diastolic and systolic blood pressures within 2 weeks of making dietary changes.<sup>85</sup> The DASH diet averages 7-8 servings of grains, 4-5 servings of fruits, 4-5 servings of vegetables and 2-3 servings of low fat dairy foods daily. Fish, poultry and nuts were also included; red meat, sweets and sugar-sweetened drinks were limited.<sup>86</sup>

**Post-Bariatric Surgery**

Nutrition considerations related to pregnancy after bariatric surgery are directly related to the type of bariatric surgery performed. Types of bariatric surgery fall into two main classifications: restrictive surgery and malabsorptive surgery.

Restrictive bariatric surgery slows the emptying time of the stomach portion of the gastrointestinal tract and may reduce the size of the stomach. Two common forms are adjustable gastric banding (AGB), also known as lap band, and vertical banded gastroplasty (VBG). AGB creates a small pouch of stomach that holds approximately 1 ounce of food. A constrictive hollow band is placed at the low end of the small pouch and is inflated with saline solution. Patients can usually eat up to  $\frac{3}{4}$  cup of food before they begin to feel full. The VBG works in a similar manner; however, a combination of a hollow band and staples is used to achieve the same result.

Two common malabsorptive surgeries are Roux-en-Y gastric bypass (RGB) and biliopancreatic diversion (BPD). These surgeries bypass all or part of the small intestine resulting in food restriction and

malabsorption. Not only is the volume of food and nutrients reduced but so is the absorption of important protein, vitamins and minerals. There is a higher risk of nutritional deficiencies with malabsorptive bariatric procedures.

❖ **Planning Pregnancy after Bariatric Surgery**

Approximately 83% of bariatric surgery patients are women and many are of childbearing age. Pregnancy after bariatric surgery should not be attempted until weight loss and nutritional intake have been stabilized. Therefore, it is highly recommended that women who have had bariatric surgery wait at least 18 months before attempting pregnancy.<sup>87</sup> Foods that can be difficult to tolerate during the year post surgery include fruits, vegetables and protein source foods, all of which are essential for a healthy pregnancy.

Although future studies are warranted, one study by Sheiner et al has found that “previous bariatric surgery in patients with gestational diabetes mellitus is not associated with adverse perinatal outcome.”<sup>88</sup> However, standard testing for gestational diabetes can become problematic for some pregnant women after bariatric surgery. A glucose tolerance test can bring on symptoms of dumping syndrome with nausea, abdominal cramps, diarrhea, and heart palpitations. It is recommended to perform self-glucose monitoring with individualized MNT and not use the Glucose Tolerance Test.

After bariatric surgery, women who are contemplating becoming pregnant should be strongly encouraged to undergo preconception nutritional assessment and counseling. Laboratory data will assist in this assessment. Ideally, the time to correct nutritional problems is preconception, making pregnancy planning the most sensible approach. Taking multivitamins in the chewable or liquid form improves ingestion and prevents blockage for individuals who have undergone bariatric surgery. Prenatal vitamins should be given in addition to the women’s usually prescribed vitamin and mineral supplementation and not instead of that supplementation.<sup>89</sup> In an article on pregnancy post-bariatric surgery, Edwards explains that “Poststabilization, patients can usually ingest as much as 1200 calories/day.” She continues by saying, “Wise selection of proteins, complex carbohydrates and healthy fats is imperative.”<sup>89</sup> Vitamins and minerals are of particular importance during pregnancy after bariatric surgery and include<sup>89,90</sup>:

- ❖ **Calcium:** In reference to calcium, Edwards continues to explain that “Postbariatric pregnant women many require between 1,200-1,500 mg of calcium in order to meet personal skeletal needs and needs for mineralization of the fetal skeleton. Calcium citrate with Vitamin D is the optimal form of calcium for bariatric patients since it does not require an acidic environment for metabolism to take place.”<sup>89,90</sup>

- ❖ **Folic Acid:** Reaching the levels for enough folate absorption in an individual after bariatric surgery is a subject of concern. Often foods that are high in folic acid are poorly tolerated such as enriched breads or cereals, broccoli, lentils, peanuts, spinach, orange juice and asparagus. Some of these foods may also circumvent the duodenum. To ensure nutritional folate needs are reached, serum blood levels should be evaluated.<sup>89,90</sup> Homocysteine may be the most sensitive marker of folic acid status in conjunction with erythrocyte folate.<sup>91</sup> Supplementation of 1 mg/day of folic acid will treat and/or prevent a deficiency. Greater than 1 mg/day is not recommended unless there is a medical indication, such as having a past pregnancy with a baby with a neural tube defect.
- ❖ **Iron:** Two possible causes of iron deficiency after bariatric surgery is malabsorption and decreased nutritional intake. Edwards notes that “Iron in the form of ferrous fumarate, [at a dose of] 40 to 64 mg, is best tolerated and absorbed because the iron has already been broken down from the ferric state making absorption more effective.”<sup>89,90</sup> Patients who have undergone restrictive bariatric surgery do not always need as much iron supplementation. Regardless, to establish sufficient iron intake, intermittent hemoglobin levels should be measured.<sup>89,90</sup>
- ❖ **Vitamin B12:** Vitamin B12 absorption is greatly affected by the malabsorptive form of bariatric surgery due to lack of intrinsic factor. Early pregnancy loss is correlated with raised serum homocysteine levels which can be a result of Vitamin B12 deficiency. For women, 350 mcg of crystalline Vitamin B12 should be daily taken. To establish sufficient Vitamin B12 intake, serum cobalamin levels should be intermittently measured and evaluated.<sup>89,90</sup>
- ❖ **General Guidelines for Post-Bariatric Surgery**  
Within the medical community, standardized and science-based guidelines encircling nutrition for patients after bariatric surgery do not exist.<sup>92</sup> However, here are some recommended general guidelines that pertain to pregnant women who have had bariatric surgery.
  - Protein should be eaten prior to fats and carbohydrates, in the amount of 60-80 grams of protein per day.
  - Each meal should take 20-30 minutes to eat, to avoid bolus eating and to allow the individual to feel full.
  - Food should be eaten in small amounts and thoroughly chewed.
  - Liquids should be avoided during meals. Ingest liquids 30-60 minutes before or after meals.
  - Drink only sugar-free, caffeine-free or decaffeinated, non-carbonated beverages.
  - Eat three to six small meals per day.
  - Avoid chewing gum, as an obstruction can occur if swallowed.

## Ketosis

Ketones in the urine may be the result of inadequate kilocalorie and/or carbohydrate intake or over-exercising. This occasionally occurs when the woman restricts foods to control blood glucose levels in order to avoid the use of glyburide or insulin therapy. Other reasons for the presence of urine ketones might be a misunderstanding of the meal plan pattern, carbohydrate food choices, and/or inappropriate portion sizes. Checking the fasting urine for ketones may be a rapid method for the RD to assess whether the woman is knowingly or unknowingly restricting her intake of kilocalories and/or carbohydrate.<sup>93</sup>

In normal pregnancy, ketones will be present in the urine after a 14-hour fast. This state is referred to as ketosis. The goal is for the fasting urinary ketone levels to be none or trace. If moderate or large amounts of urine ketones are found, the RD needs to refer the patient for medical management.

In the case of gestational diabetes, routine urine ketone testing is not recommended unless there is persistent weight loss or a particular need to identify whether the woman is consuming adequate kilocalories and/or carbohydrates.

Ketone testing is recommended in women with type 1 diabetes who are poorly controlled or newly diagnosed. Stress hormones or illness will aggravate insulin resistance. According to Kitibachi et al, diabetic ketoacidosis (DKA) “consists of the biochemical triad of hyperglycemia, ketonemia and acidemia.”<sup>94</sup> DKA can occur with blood glucose levels as low as 180 to 200mg/dL in pregnancy.<sup>95</sup> DKA in pregnancy is usually associated with type 1 diabetes but there have been cases of DKA diagnosed in women with GDM as well.<sup>96</sup> DKA is a medical emergency, one of the most serious acute complications of diabetes. Any suspicion of DKA should be referred to the healthcare provider immediately. For more information, refer to *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy*.

## Sick Day Nutrition Management

Any woman with diabetes, who becomes ill during pregnancy, and especially one using glyburide or insulin, needs to be instructed on substituting easily digested carbohydrate foods as a replacement for the carbohydrates in her prescribed meal plan. Sick day nutrition management instructions for the pregnant woman who requires glyburide or insulin therapy are:

- ❖ Continue consumption of regularly scheduled meal plan and drink plenty of fluid if tolerable.<sup>97</sup>
- ❖ If unable to follow the regularly scheduled meal plan, eat or drink to stay hydrated and maintain euglycemia. Include small amounts of carbohydrate containing foods or liquids as tolerated

to equal 15 grams of carbohydrate every 2 to 3 hours.<sup>97</sup> Tolerated foods often include: 6 saltine crackers, 1 slice of toast, 2/3 cup chicken noodle soup, 1/2 cup serving of regular gelatin, applesauce, juice, custard, pudding, ice cream, sherbet, frozen yogurt or regular soda.

- ❖ If vomiting, diarrhea or fever is present, add sugar-free and caffeine-free liquids to the tolerated foods to prevent dehydration. Examples of these liquid choices are: water, sugar-free Kool-Aid, Crystal Light, and caffeine-free/sugar-free tea or soda. A sodium-rich choice such as bouillon can be substituted for this liquid every third hour.
- ❖ Blood sugar levels need to be checked more often (at least every 2- 4 hours).<sup>97</sup>
- ❖ Women with type 1 diabetes may be advised to test for urine ketones every 4 hours or until negative.<sup>97</sup>
- ❖ Contact the health care provider if: unable to retain food or liquids for 1/2 hour in a 2 hour period, temperature > 100° F, blood glucose values are elevated above 200 mg/dL<sup>98</sup>, or urine ketones are moderate to large or blood ketones are >0.6 mmol/L.<sup>95,97</sup>
- ❖ If a woman is on glyburide or insulin therapy, contact the health care team when ill for more than one day. Insulin therapy should continue and insulin doses often need to be adjusted during this time.

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## POSTPARTUM NUTRITION ISSUES

### Postpartum Nutritional Issues for Women with GDM

Several studies were analyzed by the Academy of Nutrition and Dietetics Evidence Analysis Library in which weight-loss following a pregnancy with GDM was associated with a reduced risk of developing type 2 diabetes.<sup>47</sup> The children of women with a history of GDM are also at an increased risk for obesity and diabetes.<sup>99</sup>

Type 2 diabetes may be prevented through lifestyle changes. In the Diabetes Prevention Program, a high percentage of study participants lost 7 percent of their body weight by following a low-fat, low-calorie meal plan and doing 150 minutes of moderate physical activity each week. The study participants, which included several hundred women with a history of GDM, were able to reduce their risk for type 2 diabetes by 58 percent.<sup>100</sup> For early detection, it is crucial that women who have had GDM have an annual screen for diabetes.

Emphasis on the following guidelines may delay or prevent the later onset of diabetes in this group of high-risk women:

- ❖ Eat a nutritionally balanced diet by including a variety of food groups in each meal.
- ❖ Adjust kilocalorie intake to achieve a reasonable body weight.
- ❖ Include aerobic exercise daily.
- ❖ Limit animal fats, saturated fats, and trans-fats in the diet.

For the woman who no longer has diabetes after the birth of her baby, nutrition guidelines can be based on the Dietary Recommendations for Americans, the California MyPlate for Gestational Diabetes and the Academy of Nutrition and Dietetics guidelines. These guidelines encourage inclusion of a variety of foods and emphasize lower fat and higher fiber intake. A woman's culture and personal food habits should be taken into consideration to individualize the recommendations. A postpartum visit offers an opportunity to counsel the woman on the importance of healthy eating habits and exercise to lower the risk of developing diabetes.

A woman who had prediabetes prior to pregnancy or gestational diabetes during pregnancy requires diagnostic testing during the 6 weeks postpartum period to assess whether she has converted to type 2 diabetes. If this has occurred, she will need medical counseling and a MNT plan.

### **Preexisting Diabetes**

A woman with preexisting type 1 diabetes or type 2 diabetes, regardless of her choice to breastfeed, needs a MNT plan for postpartum use to meet nutrition and glycemic goals. It is recommended that the plan focus on the woman's goals for a healthy lifestyle, such as gradual weight loss if needed, blood glucose control, and exercise. The American Diabetes Association nutrition guidelines can be used to help set postpartum targets and to develop a meal plan that meets required changes in kilocalories, medication and activity.<sup>7,10</sup> Self-monitoring of blood glucose can provide feedback to the RD and the woman on how these changes are meeting the MNT. The RD, as part of the team, should reinforce the importance of planning future pregnancies and encourage optimal blood glucose control before conception to reduce the risk of congenital anomalies.

### **Pre-diabetes**

Pre-diabetes is a condition where blood glucose levels are higher than normal, but not high enough for a diagnosis of diabetes. Perinatal mortality rate increases with pre-diabetic pregnancies, and this rate increases steadily until the time of diagnosis of diabetes. Wood et al conclude that “insulin resistance, coupled with the added burden of pregnancy, leads, in some subjects, to the inability of pancreatic beta cells to maintain glucose homeostasis, and ultimately to hyperglycemia.”<sup>101</sup>

The nutrition guidelines for women with pre-diabetes planning pregnancy are:

- ❖ Follow a healthy, low-fat diet that includes small portions of starchy foods and more of the high fiber foods.
- ❖ Minimum of 30 minutes of exercise every day
- ❖ If overweight, lose at least 5-10% of current weight
- ❖ Maintain A1c values <6.0%

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**HEALTHY EATING  
DURING  
LACTATION**

Postpartum nutrition guidelines for women with diabetes who are breastfeeding are outlined in this section.

Encourage the woman with either preexisting diabetes or GDM to breastfeed for both the maternal and infant benefits which are outlined in *Chapter 8: Breastfeeding*. Nutrition requirements for a woman during lactation following a diabetic pregnancy are discussed below. Whether a woman with diabetes chooses to breastfeed or not, she will need nutritional guidance and a MNT plan during the postpartum period to meet her changing needs.

The energy requirements of lactating women are met primarily from the diet but may also be met by the mobilization of tissue stores.<sup>102</sup> The average milk production is 0.78 L/d from birth to 6 months and 0.6 L/d from 7 through 12 months.

Average weight loss during the first six months postpartum is 0.8 kg/month or 170 kcal/day. Milk energy output is estimated at 500 kcal/day in the first 6 months and 400 kcal/day in the second 6 months.

The minimum caloric intake of 1800 kcal/day will usually meet the requirements for energy during lactation while promoting a weight loss of 1-2 lbs/month.<sup>103</sup> A folic acid supplement with 500 mcg either in the form of a vitamin pill or fortified cereal is recommended during lactation as with all women of child bearing age.

Additional protein is necessary during lactation for conserving skeletal muscle. The RDA for protein is the same for diabetic and non-diabetic women; which is 1.1 g/kg/day or +15-20 g/day of additional protein over non-pregnant requirements.<sup>104</sup> This is the same as during the last half of pregnancy.

The requirement for carbohydrate (CHO) is increased during lactation. Additional CHO is necessary to prevent utilization of the endogenous proteins for lactose synthesis. The RDA for CHO during lactation is 210 g/day.<sup>41</sup>

Table 8 summarizes recommendations for healthy eating while lactating.

| <b>Table 8. GENERAL SUGGESTIONS FOR HEALTHY EATING WHILE LACTATING</b>  |
|---|
| <ul style="list-style-type: none"> <li>❖ Follow the meal plan for pregnancy: three small meals and three or more snacks every day.</li> <li>❖ Drink water and other sugar-free, non-caffeine containing beverages for thirst – including, but not limited to, milk.</li> <li>❖ Choose foods low in fat and high in fiber, such as vegetables, fruits, whole grain cereals or breads, and beans or legumes.</li> <li>❖ Choose smaller portions and limit second helpings.</li> <li>❖ Choose whole grains instead of white processed grains.</li> <li>❖ Avoid sweetened drinks and juice.</li> <li>❖ Avoid alcohol.</li> <li>❖ Use low-fat and nonfat dairy products such as fat-free milk, 1% milk, part-skim mozzarella cheese and nonfat yogurt. Choose pasta and sauces without fats or cheese.</li> <li>❖ Avoid processed food, especially those made from partially hydrogenated oils such as baked products (cakes, pies, etc.), crackers and doughnuts.</li> <li>❖ Choose lean meats. Limit the amount of lean meats you eat to 3 ounces per meal (size of a deck of cards).</li> <li>❖ Follow guidelines for fish as mentioned under “Omega-3 Fatty Acids.”</li> <li>❖ Use less oil, margarine, lard and butter when you cook and add less to foods.</li> <li>❖ Use healthy oils such as canola and olive oil to replace shortening and butter.</li> <li>❖ Measure the fat you use. For example: one teaspoon is equal to 5 grams of fat, one tablespoon is equal to 15 grams of fat.</li> <li>❖ Consume one source of 500 mcg of synthetic folic acid daily, in addition to a diet rich in natural folate.</li> </ul> |

When breastfeeding is not an option use preconception dietary guidelines found in Table 6.

### **Weight Loss to Attain a Normal BMI**

Gradual weight loss at the rate of one to two pounds per month (approximately 1.0 kg per month) appears to be consistent with maintaining adequate milk volume in a normal weight woman who is working on losing the extra weight she gained during pregnancy. An overweight woman can lose up to 4.5 pounds per month (approximately 2 kg per month) without adversely affecting milk volume.<sup>105</sup> Rapid weight loss greater than 4.5 pounds or 2 kg per month is generally not recommended for a breastfeeding woman. The metabolic cost of producing human milk is similar to the energy cost of the third trimester of pregnancy. To ensure adequate nutrition during the early postpartum period, meal plans should be individualized. Kilocalories should come from appropriate food choices that have a high nutrient density and be individualized to meet actual energy needs and weight goals.

### **Snacks**

Since glucose is preferentially shunted towards production of breast milk, women with diabetes (and especially women with type 1 diabetes) are more prone to hypoglycemia during lactation. Snacks may be needed to prevent hypoglycemia in the early postpartum period and

throughout lactation. The woman should be counseled to eat snacks during or before breastfeeding and before naps to avoid hypoglycemia. Suggested snacks should contain:

- Carbohydrate: 1-2 exchanges (15-30 grams)
- Protein: 1 exchange (7 grams)

If the infant is night feeding, a snack of 1 carbohydrate exchange (15 grams) can be added. Other snacks may be added if hypoglycemia is a problem.

### **Alcoholic Beverages**

Because the consumption of alcoholic beverages has been associated with hypoglycemia, increased insulin response<sup>106</sup>, possible impairment of milk ejection reflex and the baby's sleep-wake pattern, avoidance of alcohol for the duration of lactation is suggested. Alcohol is transferred into breastmilk.

### **Nonnutritive Sweeteners**

The nonnutritive sweeteners saccharin, acesulfame-K and aspartame cross into breast milk.<sup>102</sup> The effect of these sweeteners on the infant is unknown. Stevia-derived sweeteners, including stevia glycosides and rebaudioside A (Reb A), are generally considered safe in pregnancy and lactation when used in moderation.<sup>44</sup> As with any herbal medications and dietary supplements that have not yet been approved by the FDA, patients should be cautious with the use of stevia in its whole herb form in pregnancy and lactation, especially when taking anti-diabetic and/or anti-hypertensive drugs (See Table 6). A woman who has phenylketonuria (PKU) or who has an infant with PKU, should not use aspartame as a nonnutritive sweetener.

### **Supplements**

The Dietary Reference Intake of iron for lactating mothers 18 years or less is 10 mg/day. For mothers 19-50 years, 9 mg/day are recommended.<sup>53</sup> If dietary intake does not meet this recommended level, supplementation may be necessary. The additional iron found in prenatal supplements is not recommended during lactation unless a woman is anemic (Hgb 11, 10.5 and 11g/dL for the first, second and third trimesters, respectively).

The Dietary Reference Intake of folate for all lactating mothers is 500 mcg/day.<sup>53</sup> A folic acid supplement with 400 mcg either in the form of a vitamin pill or fortified cereal is recommended as long as she is of childbearing age.

### **Use of Herbs and Other Supplements**

Health care providers should assess a woman's dietary supplement intake for safety and learn more facts about the dietary supplements a woman may be using. Dietary supplements may include vitamins, minerals, herbs, other botanicals, and amino acids.

Although herbs are considered a component of complementary and alternative medicine, they are not always safe, especially for pregnant or breastfeeding mothers. The Food and Drug Administration (FDA) and other professional organizations have recommended limiting the use of herbal supplements by women during pregnancy because the potential risks of most herbs in pregnancy have not been carefully examined.<sup>107</sup> Consult with a licensed health care professional who is trained in using herbs before making any recommendations on the use of natural medicine or herbs during pregnancy and/or lactation. To stay up with the newest information consult:

- ✓ <http://ods.od.nih.gov/>.

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**APPENDICES**

A - Prenatal Weight Gain Grids

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Appendix A 1

**PRE-PREGNANCY NORMAL WEIGHT RANGE**  
 Prenatal Weight Gain Grid (1)  
 Recommended Weight Gain (2): Single 25-35 lbs; Twins 37-54 lbs

NAME: \_\_\_\_\_

EDC: \_\_\_\_\_

| DATE | WEIGHT | WEEKS GESTATION | INITIALS |
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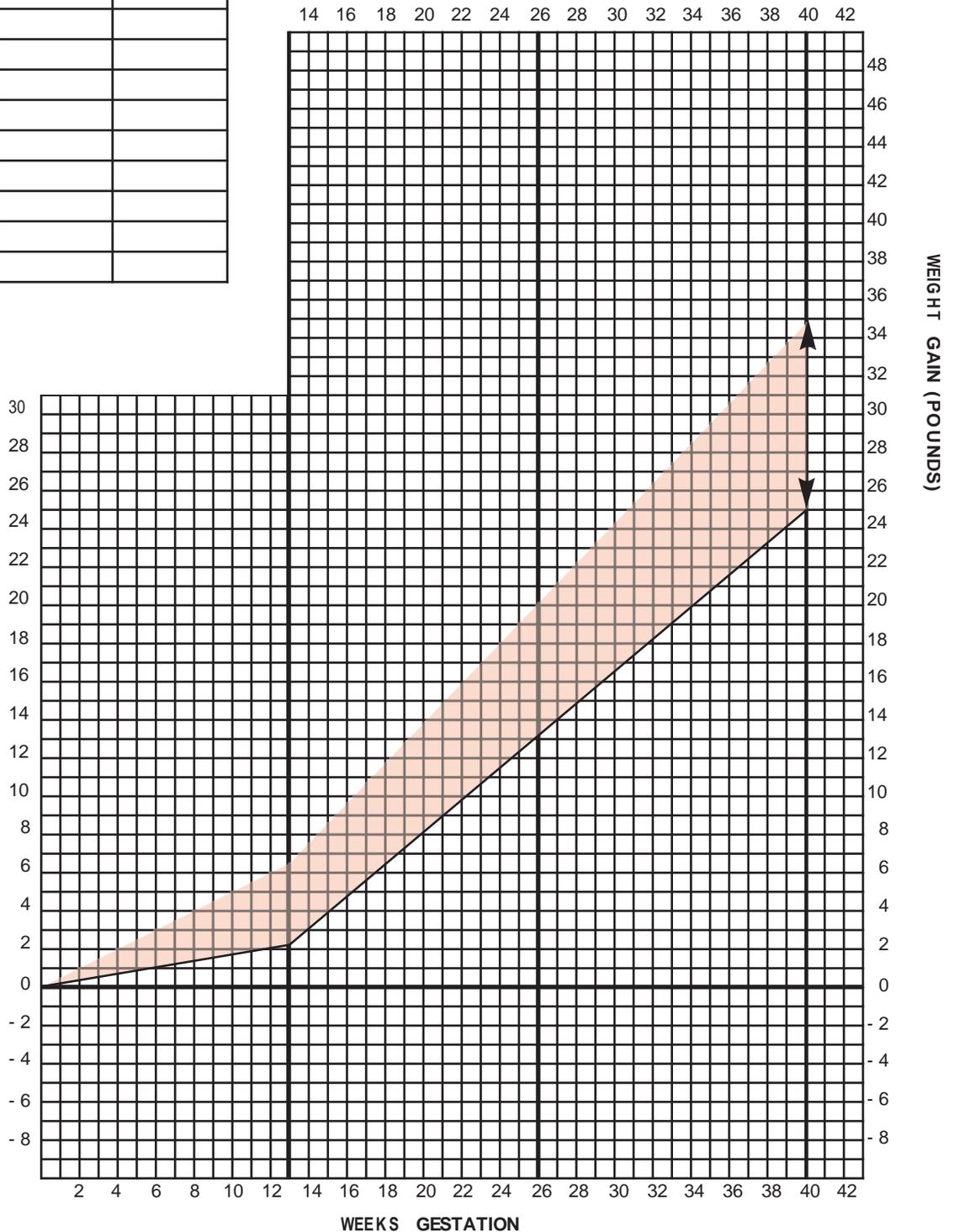
| Height | Under Weight (BMI < 18.5) | Normal Weight (BMI 18.5-24.9) | Over Weight (BMI 25-29.9) | Obese (BMI ≥ 30) |
|--------|---------------------------|-------------------------------|---------------------------|------------------|
| 4'7"   | <80                       | 80-107                        | 108-128                   | >128             |
| 4'8"   | <83                       | 83-111                        | 112-133                   | >133             |
| 4'9"   | <86                       | 86-115                        | 116-138                   | >138             |
| 4'10"  | <89                       | 89-119                        | 120-143                   | >143             |
| 4'11"  | <92                       | 92-123                        | 124-148                   | >148             |
| 5'     | <95                       | 95-127                        | 128-153                   | >153             |
| 5'1"   | <98                       | 98-132                        | 133-158                   | >158             |
| 5'2"   | <101                      | 101-136                       | 137-163                   | >163             |
| 5'3"   | <105                      | 105-140                       | 141-169                   | >169             |
| 5'4"   | <108                      | 108-145                       | 146-174                   | >174             |
| 5'5"   | <111                      | 111-149                       | 150-179                   | >179             |
| 5'6"   | <115                      | 115-154                       | 155-185                   | >185             |
| 5'7"   | <118                      | 118-159                       | 160-191                   | >191             |
| 5'8"   | <122                      | 122-164                       | 165-196                   | >196             |
| 5'9"   | <125                      | 125-168                       | 169-202                   | >202             |
| 5'10"  | <129                      | 129-173                       | 174-208                   | >208             |
| 5'11"  | <133                      | 133-178                       | 179-214                   | >214             |
| 6'     | <137                      | 137-183                       | 184-220                   | >220             |
| 6'1"   | <140                      | 140-189                       | 190-227                   | >227             |
| 6'2"   | <143                      | 143-194                       | 195-233                   | >233             |
| 6'3"   | <148                      | 149-199                       | 200-239                   | >239             |

BMI = Weight (lbs)/Height (inches)<sup>2</sup> X 703

PREPREGNANCY

WEIGHT: \_\_\_\_\_

HEIGHT: \_\_\_\_\_



1. Per personal communication with the Committee to Reexamine IOM Pregnancy Weight Guidelines.
2. Institute of Medicine and National Research Council, Rasmussen KM, Yatkin AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press; 2009.

Appendix A2

**PRE-PREGNANCY UNDERWEIGHT RANGE**  
 Prenatal Weight Gain Grid (1)  
 Recommended Weight Gain (2): Single 28-40 lbs; Twins N/A

NAME: \_\_\_\_\_

EDC: \_\_\_\_\_

| DATE | WEIGHT | WEEKS GESTATION | INITIALS |
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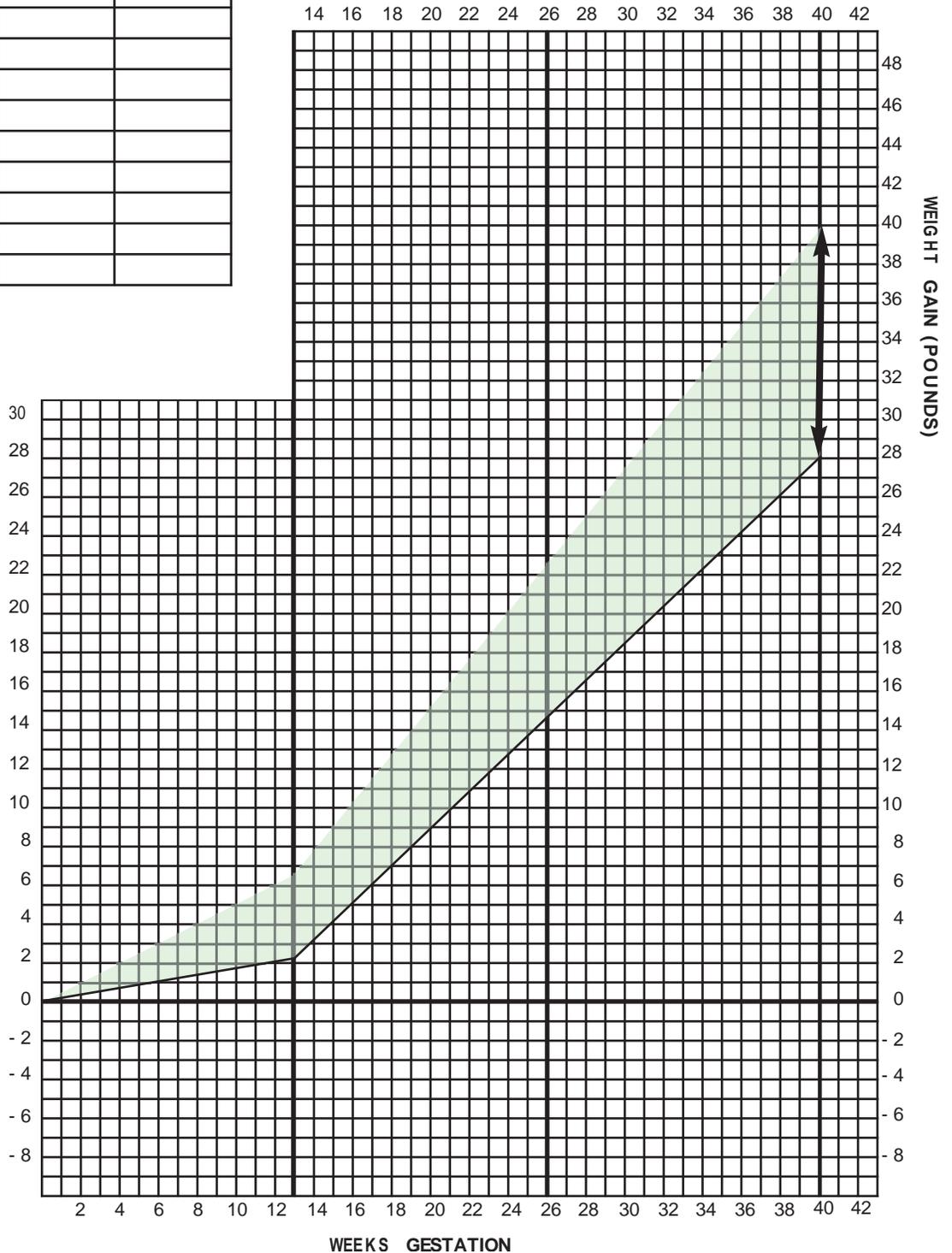
| Height | Under Weight (BMI < 18.5) | Normal Weight (BMI 18.5-24.9) | Over Weight (BMI 25-29.9) | Obese (BMI ≥ 30) |
|--------|---------------------------|-------------------------------|---------------------------|------------------|
| 4'7"   | <80                       | 80-107                        | 108-128                   | >128             |
| 4'8"   | <83                       | 83-111                        | 112-133                   | >133             |
| 4'9"   | <86                       | 86-115                        | 116-138                   | >138             |
| 4'10"  | <89                       | 89-119                        | 120-143                   | >143             |
| 4'11"  | <92                       | 92-123                        | 124-148                   | >148             |
| 5'     | <95                       | 95-127                        | 128-153                   | >153             |
| 5'1"   | <98                       | 98-132                        | 133-158                   | >158             |
| 5'2"   | <101                      | 101-136                       | 137-163                   | >163             |
| 5'3"   | <105                      | 105-140                       | 141-169                   | >169             |
| 5'4"   | <108                      | 108-145                       | 146-174                   | >174             |
| 5'5"   | <111                      | 111-149                       | 150-179                   | >179             |
| 5'6"   | <115                      | 115-154                       | 155-185                   | >185             |
| 5'7"   | <118                      | 118-159                       | 160-191                   | >191             |
| 5'8"   | <122                      | 122-164                       | 165-196                   | >196             |
| 5'9"   | <125                      | 125-168                       | 169-202                   | >202             |
| 5'10"  | <129                      | 129-173                       | 174-208                   | >208             |
| 5'11"  | <133                      | 133-178                       | 179-214                   | >214             |
| 6'     | <137                      | 137-183                       | 184-220                   | >220             |
| 6'1"   | <140                      | 140-189                       | 190-227                   | >227             |
| 6'2"   | <143                      | 143-194                       | 195-233                   | >233             |
| 6'3"   | <148                      | 149-199                       | 200-239                   | >239             |

BMI = Weight (lbs)/Height (inches)<sup>2</sup> X 703

PREPREGNANCY

WEIGHT: \_\_\_\_\_

HEIGHT: \_\_\_\_\_



1. Per personal communication with the Committee to Reexamine IOM Prepregnancy Weight Guidelines.
2. Institute of Medicine and National Research Council, Rasmussen KM, Yatkina AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press: 2009.

**APPENDIX A3**

**PRE-PREGNANCY OVERWEIGHT RANGE**

Prenatal Weight Gain Grid (1)

Recommended Weight Gain (2): Single 15-25 lbs; Twins 31-50

NAME: \_\_\_\_\_

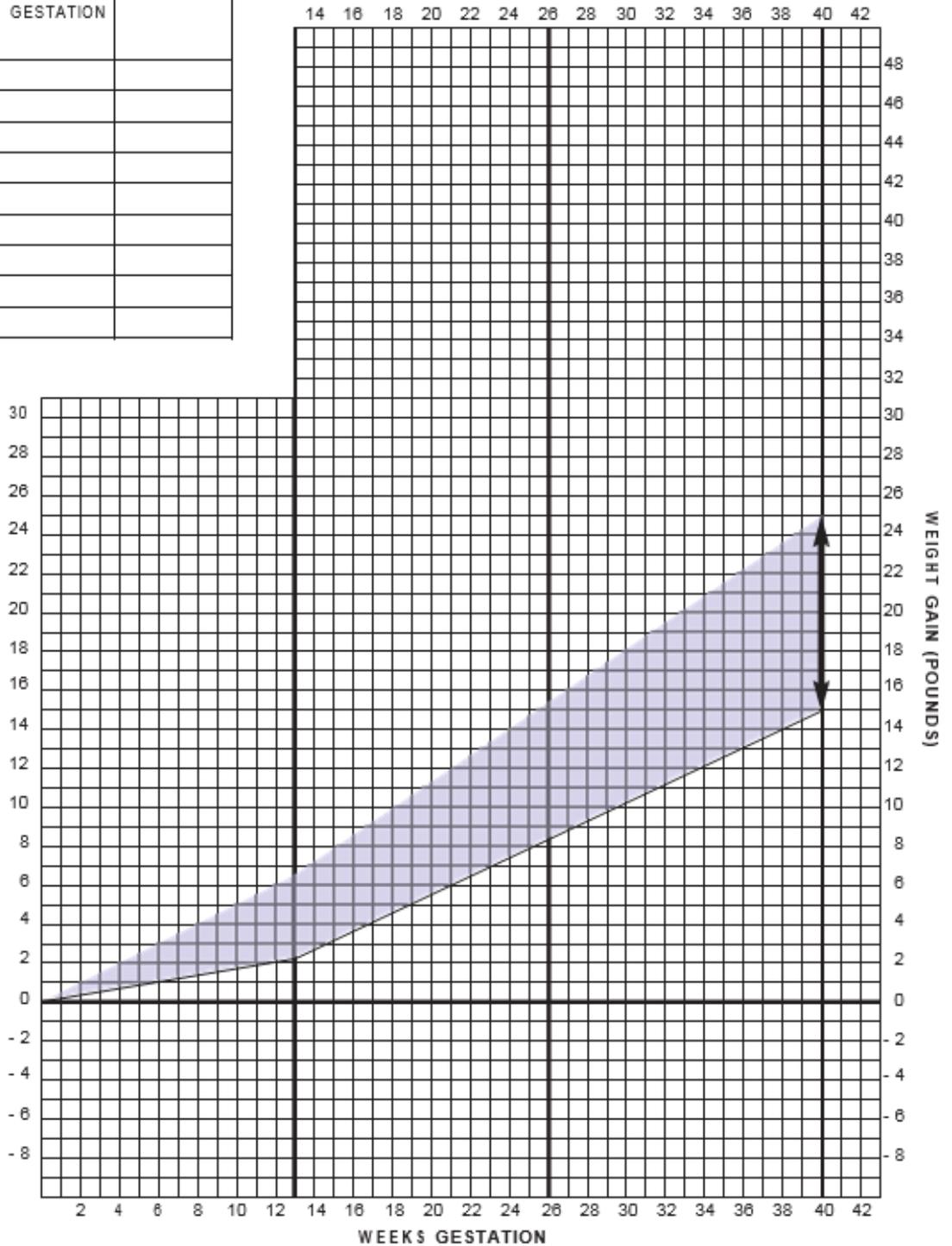
EDC: \_\_\_\_\_ HEIGHT: \_\_\_\_\_

PREPREGNANCY WEIGHT: \_\_\_\_\_

| DATE | WEIGHT | WEEKS GESTATION | INITIALS |
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|      |        |                 |          |

| Height | Under Weight (BMI < 18.5) | Normal Weight (BMI 18.5-24.9) | Over Weight (BMI 25-29.9) | Obese (BMI ≥ 30) |
|--------|---------------------------|-------------------------------|---------------------------|------------------|
| 4'7"   | <80                       | 80-107                        | 108-128                   | >128             |
| 4'8"   | <83                       | 83-111                        | 112-133                   | >133             |
| 4'9"   | <86                       | 86-115                        | 116-138                   | >138             |
| 4'10"  | <89                       | 89-119                        | 120-143                   | >143             |
| 4'11"  | <92                       | 92-123                        | 124-148                   | >148             |
| 5'     | <95                       | 95-127                        | 128-153                   | >153             |
| 5'1"   | <98                       | 98-132                        | 133-158                   | >158             |
| 5'2"   | <101                      | 101-136                       | 137-163                   | >163             |
| 5'3"   | <105                      | 105-140                       | 141-169                   | >169             |
| 5'4"   | <108                      | 108-145                       | 146-174                   | >174             |
| 5'5"   | <111                      | 111-149                       | 150-179                   | >179             |
| 5'6"   | <115                      | 115-154                       | 155-185                   | >185             |
| 5'7"   | <118                      | 118-159                       | 160-191                   | >191             |
| 5'8"   | <122                      | 122-164                       | 165-196                   | >196             |
| 5'9"   | <125                      | 125-168                       | 169-202                   | >202             |
| 5'10"  | <129                      | 129-173                       | 174-208                   | >208             |
| 5'11"  | <133                      | 133-178                       | 179-214                   | >214             |
| 6'     | <137                      | 137-183                       | 184-220                   | >220             |
| 6'1"   | <140                      | 140-189                       | 190-227                   | >227             |
| 6'2"   | <143                      | 143-194                       | 195-233                   | >233             |
| 6'3"   | <148                      | 149-199                       | 200-239                   | >239             |

BMI = Weight (lbs) / Height (Inches)<sup>2</sup> X 703



1. Per personal communication with the Committee to Reexamine IOM Prenatal Weight Guidelines.
2. Institute of Medicine and National Research Council, Rasmussen KM, Yaktin AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press: 2009.

Appendix A4

**PRE-PREGNANCY OBESE WEIGHT RANGE**  
 Prenatal Weight Gain Grid (1)  
 Recommended Weight Gain (2): Single 11-20 lbs; Twins 25-42

NAME: \_\_\_\_\_

EDC: \_\_\_\_\_

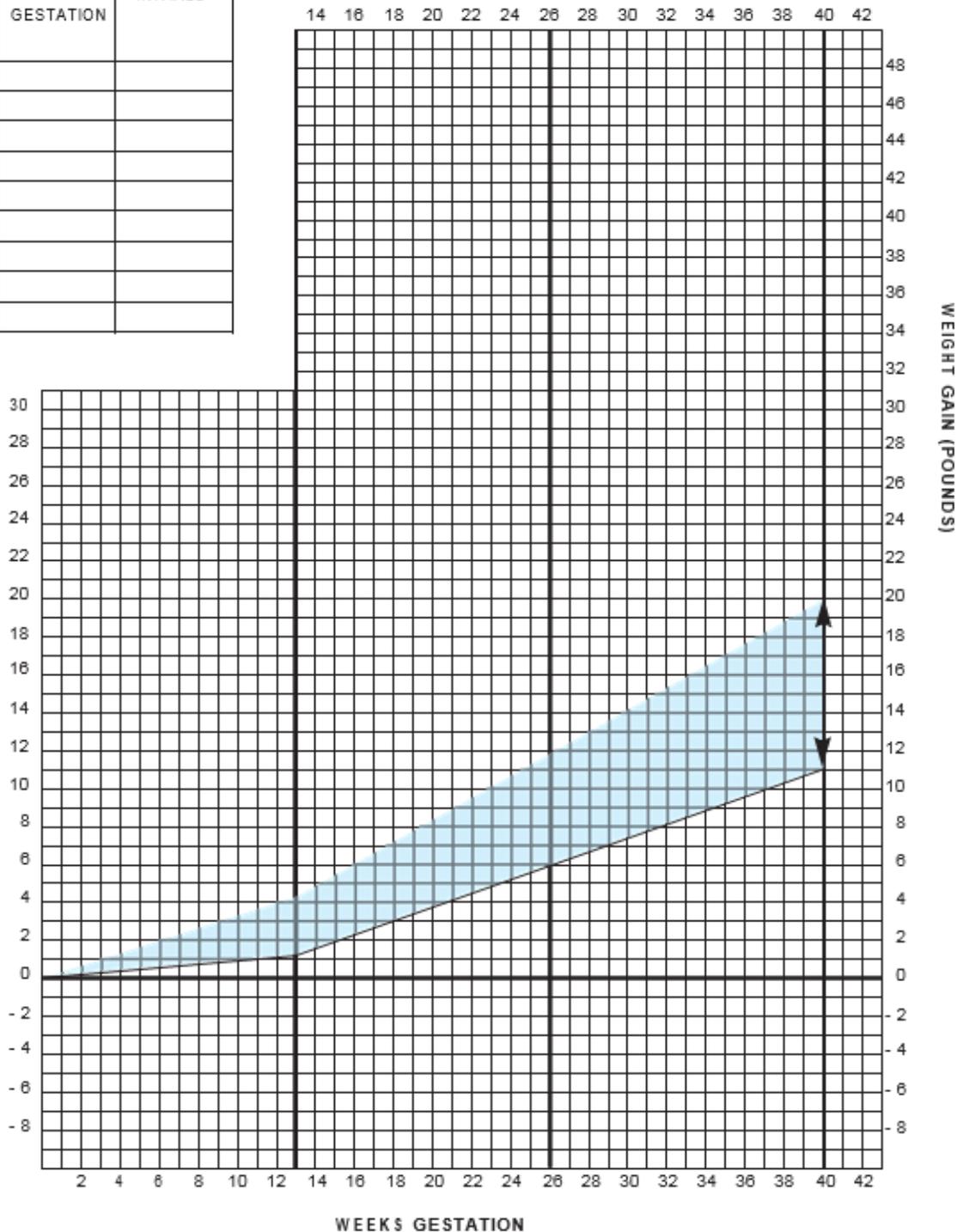
HEIGHT: \_\_\_\_\_

PREPREGNANCY WEIGHT: \_\_\_\_\_

| DATE | WEIGHT | WEEKS GESTATION | INITIALS |
|------|--------|-----------------|----------|
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|      |        |                 |          |

| Height | Under Weight (BMI < 18.5) | Normal Weight (BMI 18.5-24.9) | Over Weight (BMI 25-29.9) | Obese (BMI ≥ 30) |
|--------|---------------------------|-------------------------------|---------------------------|------------------|
| 4'7"   | <80                       | 80-107                        | 108-128                   | >128             |
| 4'8"   | <83                       | 83-111                        | 112-133                   | >133             |
| 4'9"   | <86                       | 86-115                        | 116-138                   | >138             |
| 4'10"  | <89                       | 89-119                        | 120-143                   | >143             |
| 4'11"  | <92                       | 92-123                        | 124-148                   | >148             |
| 5'     | <95                       | 95-127                        | 128-153                   | >153             |
| 5'1"   | <98                       | 98-132                        | 133-158                   | >158             |
| 5'2"   | <101                      | 101-136                       | 137-163                   | >163             |
| 5'3"   | <105                      | 105-140                       | 141-169                   | >169             |
| 5'4"   | <108                      | 108-145                       | 146-174                   | >174             |
| 5'5"   | <111                      | 111-149                       | 150-179                   | >179             |
| 5'6"   | <115                      | 115-154                       | 155-185                   | >185             |
| 5'7"   | <118                      | 118-159                       | 160-191                   | >191             |
| 5'8"   | <122                      | 122-164                       | 165-196                   | >196             |
| 5'9"   | <125                      | 125-168                       | 169-202                   | >202             |
| 5'10"  | <129                      | 129-173                       | 174-208                   | >208             |
| 5'11"  | <133                      | 133-178                       | 179-214                   | >214             |
| 6'     | <137                      | 137-183                       | 184-220                   | >220             |
| 6'1"   | <140                      | 140-189                       | 190-227                   | >227             |
| 6'2"   | <143                      | 143-194                       | 195-233                   | >233             |
| 6'3"   | <148                      | 149-199                       | 200-239                   | >239             |

BMI = Weight (lbs)/Height (Inches)<sup>2</sup> X 703



1. Per personal communication with the Committee to Reexamine IOM Prenatal Weight Guidelines.
2. Institute of Medicine and National Research Council, Rasmussen KM, Yatkina AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press: 2009.

**For more information:**

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