

Practice Paper of the Academy of Nutrition and Dietetics:

Nutrition and Lifestyle for a Healthy Pregnancy Outcome

July 2014

ABSTRACT

It is the position of the Academy of Nutrition and Dietetics that women of childbearing age should adopt a lifestyle optimizing health and reducing risk of birth defects, suboptimal fetal development, and chronic health problems in both mother and child. Components leading to healthy pregnancy outcome include healthy prepregnancy weight, appropriate weight gain and physical activity during pregnancy, consumption of a wide variety of foods, appropriate vitamin and mineral supplementation, avoidance of alcohol and other harmful substances, and safe food handling. Nutrition assessment needs to encompass changes in anthropometric, biochemical, and clinical indicators throughout pregnancy. Pregnant women should gain weight according to the 2009 Institute of Medicine Guidelines. Energy needs are no higher than the Estimated Energy Requirement for nonpregnant women until the second trimester; thereafter, the extra energy need per day is 340 kcal and 452 kcal in the second and third trimesters, respectively. Using the 2010 Dietary Guidelines for Americans, registered dietitian nutritionists and dietetics technicians, registered can help

pregnant women select a food plan based on age, physical activity, trimester, weight gain, and other considerations. Women are encouraged to participate in at least 150 minutes of moderate-intensity aerobic activity spread throughout the week or 30 minutes of moderately intense exercise on most days of the week. When good food choices are made, food consumption to meet extra energy needs and the increased absorption and efficiency of nutrient utilization that occurs in pregnancy are generally adequate to meet most nutrient needs. However, vitamin and mineral supplementation may be important in vulnerable cases including food insecurity; alcohol, tobacco, or other substance dependency; anemia; strict vegetarian (vegan) diet; or poor eating habits. Multiple strategies are needed to support healthy lifestyles for all women, from preconception through the postpartum period. This practice paper supports the Academy of Nutrition and Dietetics' position paper "Nutrition and Lifestyle for a Healthy Pregnancy Outcome" published in the July 2014 *Journal of the Academy of Nutrition and Dietetics*.

This paper supports the "Position of the Academy of Nutrition and Dietetics: Nutrition and Lifestyle for a Healthy Pregnancy Outcome" published in the July 2014 *Journal of the Academy of Nutrition and Dietetics*.¹ In alignment with the position paper, this practice paper will provide registered dietitian nutritionists (RDNs) and dietetic technicians, registered (DTRs) with an overview of current recommendations related to nutrition and healthy lifestyles during pregnancy and best practices on ways to implement those recommendations. The Academy of Nutrition and Dietetics has several position papers related to pregnancy and the postpartum period that cover specific topics in more detail (www.eatright.org/About/Content.aspx?id=8387).

DEFINITION AND ASSESSMENT OF A HEALTHY PREGNANCY

A healthy pregnancy is without physical or psychological pathology in the mother and results in the delivery of a

healthy baby. The hormonal milieu during pregnancy is important for maintaining the flow of nutrients to the fetus, stimulating uterine growth, promoting mammary development, and relaxing smooth muscle which decreases gut motility.² Absorption of iron and calcium increases during pregnancy. Blood volume expands in the course of a normal, healthy pregnancy, mainly due to a 35%–50% increase in plasma volume. Red cell mass also increases but to a lesser extent (15% to 20%), so that hemoglobin concentration and hematocrit decline until the end of the second trimester. Concentrations of total plasma proteins and many nutrients including vitamins and minerals also decline during pregnancy, but most plasma lipids, including triglycerides, total cholesterol, and high-density lipoprotein cholesterol, increase. Declines in plasma vitamin and mineral concentrations are generally due to normal, physiological changes secondary to the expansion of blood volume and changes in renal function. In early gestation, maternal fat stores increase to meet later energy demands, whereas late

gestation is characterized by decreased insulin sensitivity and increased insulin resistance, both of which allow for greater substrate availability to support fetal growth. During pregnancy, dramatic changes in renal function occur and are associated with marked excretion of glucose, amino acids, and water-soluble vitamins.

Nutritional assessment needs to encompass changes in anthropometric, biochemical, and clinical indicators throughout the course of pregnancy. The Figure shows the recommended weight ranges, by prepregnancy body mass index (BMI) status, to be used in anthropometric assessment. Table 1 shows the normal values and ranges of some biochemical indicators of nutritional status. Serum ferritin may be useful as a screening tool to identify pregnant women who would benefit from additional counseling about iron-rich foods and supplements.³ Vitamin D screening is not routinely recommended but may be considered for pregnant women who are at risk of deficiency (eg, little sun exposure, living at northern latitude, dark-skin, vegan).⁴ The American Diabetes Association recommends that all women, not known to have diabetes, undergo a 75 g, 2-hour Oral Glucose Tolerance Test at 24–28 weeks gestation.⁵ Implementation of new criteria, based on the findings of the Hyperglycemia and Adverse Pregnancy Outcomes study, are expected to diagnose gestational diabetes mellitus (GDM) in about 18% of pregnancies, since thresholds were lowered and only one abnormal value, not two, is sufficient to make the diagnosis.⁶

Oral health should be included in a general clinical assessment. Hormonal changes and immunosuppression during pregnancy can influence the progression of periodontal disease, which is a risk factor for preterm birth, low birth weight, and other adverse pregnancy outcomes.⁷ Screening about dental practices such as brushing and flossing and oral health (tooth loss, inflammation) may signal the need for education about reducing sugary drinks and foods and making referrals to dental care.

RDNs and DTRs should be alert to psychosocial stressors, such as family and household strain, verbal/physical abuse, exposure to discrimination, food insecurity, unemployment, low resources, major/catastrophic life events, and anxiety about the current pregnancy.⁸ Such stressors may indicate need for further screening and referral to a mental health professional for early treatment to prevent adverse pregnancy outcomes. It is also important to screen for a history of eating disorders and explore feelings about weight gain and efforts to control weight, including use of laxatives and vomiting.⁹ In women with a history of or current eating disorders, careful screening for smoking, alcohol use, or self-injurious behaviors is also recommended.

BEST PRACTICES FOR NUTRITION CARE DURING PREGNANCY

Weight Gain within 2009 Institute of Medicine (IOM) Recommendations

RDNs and DTRs should encourage pregnant women to gain weight according to the 2009 IOM guidelines, providing individualized targets according to a woman's prepregnancy BMI status.¹⁰ An important implication of the 2009 guidelines is that more women are likely to be classified as having excessive weight gain, compared to the 1990 guidelines.^{11,12} For example, in a study of 11,688 women in Massachusetts, 17.1% of the women, classified as "appropriate weight gainers" by 1990 IOM guidelines, were classified as "over-gainers" by the 2009 guidelines.¹¹ Having their weight status defined by adult BMI cut-points, more adolescents will be classified as having "normal" pre-pregnant BMI, compared to overweight status and thus, their target range for weight gain will be higher using the 2009 guidelines, compared to the 1990 guidelines.¹² Substantial changes will be needed in health provider practices to help women gain weight within the 2009 target ranges.

Under the 1990 IOM guidelines, a few studies documented success in slowing down prenatal weight gain, but achieving significant improvement in adherence to IOM guidelines has been more difficult. Recent studies, using the 2009 IOM prenatal guidelines, have found that supervised physical activity and an individualized diet plan can reduce excessive prenatal weight gain¹³ and result in greater adherence to the IOM guidelines.¹⁴ Across several studies, best practices that lead to greater success in achieving recommended prenatal weight gains include:

- early and frequent motivational counseling about recommended weight gain and diet;¹⁵
- personalized dietary advice, provided face-to-face by a dietitian, beginning early in pregnancy;^{14,16}
- supervised group and/or home exercise programs;^{13,14} and
- showing women how their weight gain compares to their target IOM range.¹⁷

Energy Intake and Physical Activity to Sustain Normal Fetal Growth

Singleton pregnancy. Pregnant women need to consume a variety of foods according to the 2010 Dietary Guidelines for Americans (DGA)¹⁸ to meet energy and nutrient requirements and gain recommended amounts of weight. According to the Dietary Reference Intakes (DRIs), energy needs are no higher than the Estimated Energy Requirement for nonpregnant women until the second trimester.¹⁹ The extra energy need per day is 340 kcal and 452 kcal in the second and third trimesters, respectively. A useful

<p>Weight Gain by Prepregnancy Body Mass Index</p> <table border="1"> <thead> <tr> <th></th> <th>Total Weight Gain (lb)²</th> <th>2nd & 3rd Trimester Rate of gain (lb)/wk</th> </tr> <tr> <th></th> <th>Range</th> <th>Mean (range)</th> </tr> </thead> <tbody> <tr> <td>Underweight (<18.5):</td> <td>28–40</td> <td>1 (1–1.3)</td> </tr> <tr> <td>Normal weight (18.5–24.9):</td> <td>25–35^a</td> <td>1 (0.8–1)</td> </tr> <tr> <td>Overweight (>25.0–29.9):</td> <td>15–25^b</td> <td>0.6 (0.5–0.7)</td> </tr> <tr> <td>Obese (≥30.0):</td> <td>11–20^c</td> <td>0.5 (0.4–0.6)</td> </tr> </tbody> </table>			Total Weight Gain (lb) ²	2nd & 3rd Trimester Rate of gain (lb)/wk		Range	Mean (range)	Underweight (<18.5):	28–40	1 (1–1.3)	Normal weight (18.5–24.9):	25–35 ^a	1 (0.8–1)	Overweight (>25.0–29.9):	15–25 ^b	0.6 (0.5–0.7)	Obese (≥30.0):	11–20 ^c	0.5 (0.4–0.6)	<p>Source: Institute of Medicine (IOM)⁹</p>
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<p>Estimated Energy Requirement (EER) for Pregnancy</p> <p>EER_{pg} = EER pre-pg + additional energy expended during pg + energy deposition where: First trimester = EER pre-pg + 0 Second trimester = EER pre-pg + 340 Third trimester = EER pre-pg + 452</p> <p>For 19 and older: EER pre-pg = 354-(6.91 X age [y]) + PA X [(9.36 X weight [kg] + 726 X height [m])] where PA is the physical activity coefficient: PA= 1.0 for sedentary (Physical Activity Level, PAL ≥ 1.0 < 1.4) PA= 1.12 for low active (PAL ≥ 1.4 < 1.6) PA= 1.27 for active (PAL ≥ 1.6 < 1.9) PA= 1.45 for very active (PAL ≥ 1.9 < 2.5)</p>		<p>Source: IOM¹⁸; To calculate the EER for overweight and obese women and for younger women (14–18 yr), consult the IOM source</p>																		
<p>Physical Activity</p> <p>Engage in 30 minutes of moderate exercise on most days of the week or at least 150 minutes of moderate physical activity per week. Unless contraindications are present, previously inactive and active women should be encouraged to be physically active throughout their pregnancy.</p>		<p>Source: United States Dept of Health & Human Services²¹; American Congress of Obstetrics and Gynecology²²</p>																		
<p>Nutrient Supplements</p> <p>400 mcg per day of synthetic folic acid from fortified foods (cereals and other grains), supplements or both, in addition to consuming folate from foods in a varied diet</p> <p>30 mg/day iron, starting early in pregnancy</p>		<p>Source: IOM¹⁸; Dietary Guidelines for Americans 2010¹⁷; Center for Disease Control and Prevention 1998³⁹</p>																		
<p>Figure. Summary of nutritional recommendations for healthy pregnancy outcomes. ^aFor twins, 37–54 lb. ^bFor twins, 31–50 lb. ^cFor twins, 25–42 lb.</p>																				

website to calculate pre-pregnancy BMI, Estimated Energy Requirement, and the recommended nutrient intakes is the Interactive DRI for Healthcare Professionals (www.fnict.usda.gov/fnic/interactiveDRI).²⁰

Multiple pregnancy. For women with a BMI of 18.5–24.9 carrying more than one fetus, an estimated 40–45 kcal per kg prepregnancy weight per day has been recommended, with the caveat that adequate weight gain should be used as an indicator of sufficient energy intake.²¹ For underweight women, the estimate is 42–50 kcal per kg prepregnancy weight per day, whereas for overweight women, 30–35 kcal per kg prepregnancy weight per day has been suggested. The DRIs state that beginning in the second trimester sufficient energy and an additional 50 g protein per day, above the nonpregnant DRI for protein, is prudent for multiple pregnancies.¹⁹ To ensure that protein intake is adequate

for women carrying multiple fetuses, macronutrient composition (% kcal) may be optimal at 20% protein, 40% fat, and 40% carbohydrate sources with an emphasis on high-fiber foods.²¹

Physical activity. Unless the health care provider identifies a medical reason that precludes physical activity, pregnant women can be encouraged to participate in at least 150 minutes of moderate-intensity aerobic activity per week, ideally spread throughout the week²² or 30 minutes of moderately intense exercise on most days of the week.^{23,24} For women beginning physical activity during pregnancy, they can gradually increase amounts of moderate-intensity activity over time. Women who regularly engage in vigorous-intensity activity, high amounts of activity, or strength training do not necessarily need to reduce activity, provided they discuss with their health care provider any adjustments advisable during pregnancy.

Indicator	Cut-off Values	Comments	Source
Hemoglobin (Hgb) mg/dL			Walsh et al ²
1st Trimester	11.0	Due to expansion of plasma volume, Hgb and Hct are lower in the second trimester. Hgb > 13.0–13.5 mg/dL in mid-pregnancy indicate poor plasma expansion and increased risk of restricted fetal growth and pre-eclampsia	
2nd Trimester	10.5		
3rd Trimester	11.0		
Hematocrit (Hct) %			
1st Trimester	33.0		
2nd Trimester	32.0		
3rd Trimester	33.0		
Serum ferritin µg/L	12 (absent iron stores) 20 (low iron stores)	Very low serum ferritin (and low Hgb) indicate iron deficiency anemia	
Serum 25-hydroxyvitamin D	20 ng/L	Vitamin D screening may be considered for women at risk of deficiency. Optimal levels in pregnancy have not yet been determined but may be higher than 32 ng/L	American College of Obstetrics and Gynecology ³
Plasma glucose values	Abnormal values are: Fasting: ≥ 92 mg/dl (5.1 mmol/l) 1 hr: ≥ 180 mg/dl (10.0 mmol/l) 2 hr: ≥ 153 mg/dl (8.5 mmol/l)	Based on 75 g-Oral Glucose Tolerance Test (OGTT) for screening all women without diabetes at 24–28 weeks; diagnosis of gestational diabetes mellitus based on one abnormal value	American Diabetes Association ⁴

Table 1. Biochemical indicators of nutritional status during pregnancy.

Engaging in physical activity during pregnancy supports cardiorespiratory fitness and does not increase the risk of early pregnancy loss, low-birth weight or preterm delivery.²² Participating in resistance training has also been shown to be a safe mode of activity for pregnant women. A variety of activities and sports appears to be safe (eg, walking, swimming, riding a stationary bicycle); however, activities with a high-risk of falling or those with risk of abdominal trauma including contact or collision sports (eg, horseback riding, downhill skiing, soccer, and basketball) should be avoided. Contraindications to engaging in physical activity during pregnancy include hypertension, premature rupture of the membranes, intrauterine growth retardation, preterm labor, incompetent cervix/cervical cerclage, or persistent bleeding in the second or third trimester.

Foods and Fluids for a Balanced Healthy Diet

Daily Food Plan for Moms. RDNs and DTRs should help pregnant women select an appropriate food plan, based on age, activity level, trimester of pregnancy, weight gain, and other considerations. Most pregnant women (except those who are overweight or obese) will need food plans that provide between 2,200 to 2,900 kcal per day. The Daily Food Plan for Moms (DFPM) is available on an interactive website (www.choosemyplate.gov/supertracker-tools/daily-food-plans/moms.html) and can be used as a starting point to help women make good food choices and plan a balanced diet.²⁵ MyPlate (www.choosemyplate.gov) can be used in conjunction with the DFPM to convey appropriate portion sizes to follow the food plan. A sample DFPM menu for a pregnant woman (25 years; second trimester; prepregnancy

weight=125 lb; height=64 inches; low activity) is shown in Table 2.

The US Department of Agriculture (USDA) Food Patterns, which form the basis for the DFPM, have nutrient profiles that meet 100% of Recommended Daily Allowance (RDA) or Adequate Intake (AI) for most nutrients during pregnancy.²⁶ Even though they are based on nutrient-dense food choices, the USDA Food Patterns provide less than the nutrient goals for iron, vitamin D, vitamin E, and choline at all calorie levels.²⁷ At calorie levels less than 2,600 and 2,800, the USDA Food Patterns may not meet nutrient goals for magnesium and potassium, respectively. RDNs and DTRs can help by educating pregnant women about food/beverage choices that are good sources of these nutrients (for example, see potassium list in Appendix 12 of 2010 DGA).¹⁸ If women make typical rather than nutrient-dense food choices, their dietary intakes may be 15%–30% above target calorie levels and fail to meet moderation goals for saturated fat and sodium.²⁸

Vegetarian food patterns. USDA Food Patterns for lacto-ovo vegetarians and vegans were included in Appendices 8 and 9 of the 2010 DGA.¹⁸ Similar to the base USDA Food Patterns, the vegetarian patterns meet most nutrient goals except for iron, vitamin D, vitamin E, and choline.^{26,29} Due to the inclusion of fortified-soy beverages and other fortified products such as ready-to-eat cereals in the Vegan Food Pattern, the needs for calcium and B-12 can be met. If no eggs are consumed, other nutrients of potential concern are the n-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (see further discussion in n-3 fatty acids section). Protein, zinc, and selenium are lower in the vegetarian patterns than in the base USDA Food Patterns, though all are adequate at calorie intakes at or above 2,000 kcal per day. According to the Academy Evidence Analysis Library (EAL), limited evidence (Grade III*) suggests that carbohydrate intakes are higher and protein intakes are lower among pregnant vegetarians, compared to pregnant omnivores, though no studies reported protein deficiency.³⁰ RDNs and DTRs need to stay up-to-date on the nutrient content of new vegan food products that may be fortified, so that appropriate advice on supplements can be provided.

Individualized advice. For several reasons, RDNs need to work with pregnant women to tailor dietary advice, using the website like the DFPM as a starting point for a balanced diet plan.³¹ First, the DFPM is geared towards the needs of women with uncomplicated pregnancies. For example,

women with GDM will need modified food plans. Second, the calorie levels that provide the basis for the DFPM may differ from the woman's actual energy needs based on her prenatal weight gain.¹⁹ Third, some women may need additional help to learn how their cultural food choices can be part of a healthy, balanced diet.

RDNs should fully explore with pregnant women any cultural food practices and preparation methods, as well as attitudes, beliefs, health literacy, and economic constraints, that may affect dietary intakes, physical activity, and/or prenatal weight gain. Understanding the context for cultural attitudes and beliefs is important to increase the effectiveness of dietary advice.

Gluten-free diet. According to the EAL, pregnant women with undiagnosed or untreated celiac disease are at increased risk of spontaneous abortion, miscarriage, low-birth weight, small-for-gestational age, stillbirth, and pregnancy-related complications, while compliance with a gluten-free diet results in outcomes similar to healthy controls (Grade II=Fair).³² Careful planning is essential because a gluten-free diet may be low in carbohydrates, iron, folic acid, niacin, calcium, phosphorus, zinc, and fiber. RDNs may recommend whole or enriched gluten-free grains and products, such as brown rice, wild rice, buckwheat, quinoa, amaranth, millet, or sorghum. Women who are newly diagnosed or unaccustomed to high-fiber diets should introduce these foods gradually to their diets. If the usual dietary intake is nutritionally inadequate and cannot be improved through eating habits, then a daily gluten-free, prenatal multivitamin and mineral supplement should be recommended.

Fluids. Pregnant women need three liters of water (AI) a day for adequate hydration, but some of that requirement is met through milk, juice, and high moisture foods such as fruits, vegetables, meats, and other foods.¹⁹ Moisture in food accounts for about 19%–25% of total water intake; for pregnant women, about 10 cups a day in total beverage intake is needed.

Nonnutritive sweeteners. According to the EAL, very limited evidence (Grade IV=Expert Opinion) is available to support the use of nonnutritive sweeteners for GDM.³³ The Food and Drug Administration (FDA) has approved aspartame, acesulfame potassium, sucralose, saccharin, and neotame for general use, while whole leaf or crude extracts of stevia have not been approved.³⁴ The use of FDA-approved nonnutritive sweeteners during pregnancy is acceptable with the exception of aspartame for pregnant women with phenylketonuria.

* The EAL assigns a grade to indicate the overall strength or weakness of the supporting evidence. The Academy uses Grades I, II, III, IV, and V for Good, Fair, Limited, Expert Opinion Only, and Not Assignable, respectively. See Grade Definitions and Chart at http://andevidencelibrary.com/content.cfm?content_id=11.

Case Study: 25 year old woman, second trimester; pre-pregnancy weight=125 lb and height = 64 in ; low active (30-60 min moderate activity per day)

Dietary Reference Intakes (DRIs)^a (Amounts per day)	DFPM (2,400 kcal) (Food groups per day)	Sample Menu	Energy/ Nutrients Report from DFPM (Estimated amounts from sample menu)
<p>Estimated Energy Requirement (EER) (2nd trimester)= 2,099+340= 2,439 kcal</p> <p>Macronutrients Carbohydrate: 175 g 45%–65% Protein: 71 g^b 10%–35% Total Fat: 20%–35% Saturated Fat: less than 10% Fiber 28 g</p> <p>Vitamins^a Vitamin A: 770 mcg Vitamin C: 85 mg Vitamin D: 15 mcg Vitamin E: 15 mg Thiamin: 1.4 mg Riboflavin: 1.4 mg Niacin: 18 mg Vitamin B-6: 1.9 mg Vitamin B-12: 2.6 mcg Folate: 600 mcg^c Choline: 450 mg</p> <p>Minerals^a Calcium: 1,000 mg Copper: 1,000 mcg Iron: 27 mg Magnesium: 350 mg Potassium: 4,700 g Selenium: 60 mcg Sodium: 1.5 g (Less than 2300) Zinc: 11 mg</p>	<p>Grains: 8 oz (4or more whole grain)</p> <p>What counts as 1 oz: 1 slice of bread ½ c cooked rice 1 tortilla (6 in dm) 1 oz ready-to eat cereal (about 1 cup cereal flakes)</p> <p>Vegetables: 3 c Dark green 2 c/wk Red and orange 6 c/wk Beans & peas 2 c/wk Starchy 6 c/wk Other 5 c/wk</p> <p>What counts as 1 c: 1 c cooked or raw 2 c leafy salad green</p> <p>Fruits: 2 c What counts as 1 c: 1 c cooked or raw 1 c 100% fruit juice ½ c dried fruit</p> <p>Dairy: 3 c What counts as 1 c: 1 c milk or fortified soy milk/ beverage 1 c yogurt 1.5 oz natural cheddar cheese</p> <p>Protein: 6.5 oz Seafood 10 oz/wk What counts as 1 oz: 1oz lean meat, poultry, or fish 1 egg 1 Tbsp peanut butter ¼ c cooked beans or peas ½ oz nuts or seeds</p> <p>Oils: 7 tsp What counts as 1 tsp: 1 tsp canola, olive, or other vegetable oil 2 tsp tub margarine 2 tsp French dressing</p>	<p>Breakfast: 1 c oatmeal 8 oz low fat milk ½ c strawberries</p> <p>Morning snack: Trail mix (½ c almonds, ¼ c mixed dried fruit)</p> <p>Lunch: Turkey sandwich (2 slices whole wheat bread; 3 slices turkey, ½ Tbsp light mayonnaise) Salad (1 c lettuce, , 1 med tomato, ½ c kidney bean salad w/ French dressing) 1 med banana 8 oz low-fat milk</p> <p>Afternoon snack: ½ c carrot slices 4 whole wheat crackers</p> <p>Dinner: ½ cup cole slaw (cabbage, pineapple, light mayonnaise) 4.5 oz grilled salmon (with oil) 1 c broccoli stalks, steamed 1 c white rice 8 oz low-fat milk</p> <p>Evening snack: 1 med scoop frozen vanilla yogurt, low fat 3 c air-popped popcorn</p>	<p>Total kcal: 2,408</p> <p>Macronutrients^a Carbohydrate: 306 g 51% Protein: 139 g 23% Total Fat: 29% Saturated Fat: 5% Fiber: 45 g</p> <p>Vitamins^a Vitamin A: 1,314 mcg Vitamin C: 200 mg Vitamin D: 22 mcg Vitamin E: 27 mg Thiamin: 1.7 mg Riboflavin: 3.2 mg Niacin: 32 mg Vitamin B-6: 2.7 mg Vitamin B-12: 8.0 mcg Folate b: 696 mcg Choline: 583 mg/day</p> <p>Minerals^a Calcium: 1,608 mg Copper: 2,265 mcg Iron: 17 mg/day (under) Magnesium: 681 mg Potassium: 5,342 g Selenium: 184 mcg Sodium: 1,897 mg Zinc: 16 mg</p>

Table 2. A sample Daily Food Plan for Moms (DFPM).

^aBold type=Recommended Daily Allowance (RDA) and Roman type=Adequate Intakes (AI) for pregnant females, ages 19–30 years¹⁸

^bAn additional 25 g/day of protein (above nonpregnant levels) is recommended for all pregnant women, starting in the second trimester. 50 g/day is considered prudent for women with twins.¹⁸

^cAs dietary folate equivalents (DFE). 1 DFE=1 mcg food folate or 0.6 mcg folic acid from a supplement or fortified food consumed with food or 0.5 mcg folic acid as a supplement on an empty stomach. It is assumed that women will continue to consume 400 mcg of folic acid (as a supplement or from fortified foods) in addition to the amounts of this vitamin from other foods.

Recommendations also include avoiding saccharin during pregnancy due to possible slow fetal clearance.³³

Common Complaints during Pregnancy

Nausea and vomiting. Management of nausea with or without vomiting, which occurs in 75% of pregnancies, depends on the severity of the symptoms.³⁵ Milder cases are often managed by consuming small meals frequently, avoiding offensive odors and spicy or greasy foods, drinking enough fluids, and getting fresh air. However, a Cochrane review of 27 studies covering treatment for pregnancy-related nausea and vomiting (excluding hyperemesis) found no studies in the literature evaluating the effectiveness of many of the dietary and lifestyle modifications commonly recommended.³⁶ There is limited evidence that B-6 supplements (30–100 mg per day) and ginger products provide relief without adverse side effects. Studies of acupuncture found no significant benefit to women with nausea and vomiting in early pregnancy. About 0.3%–3% of pregnant women experience hyperemesis gravidarum, characterized by persistent vomiting, weight loss >5%, electrolyte imbalances (hypokalemia), and dehydration (high urine specific gravity).^{35,36} Women with hyperemesis gravidarum are usually given intravenous hydration with multivitamins (including thiamin), treated with antiemetic medications, and monitored for electrolytes and urinary ketones; hospitalization may be required.

Acid reflux. About 17%–45% of pregnant women experience acid reflux.³⁷ Randomized controlled trials have found that calcium-based antacids pose low risk of adverse effects and can provide effective, rapid, relief of symptoms. One or more of the following are commonly recommended to relieve acid reflux in pregnancy:

- 1) avoid lying down for three hours after eating;
- 2) sleep with the head slightly elevated to avoid acid reflux;
- 3) consume small, frequent meals; and
- 4) avoid reflux-inducing foods such as greasy and spicy foods, tomatoes, highly acidic citrus products, carbonated drinks, and beverages containing caffeine.

However, no clinical studies have been conducted to evaluate the effectiveness of these remedies for acid reflux during pregnancy.

Constipation. Defined as infrequent or hard, dry stools, constipation occurs among 11%–38%, either as a side effect of high doses of supplemental iron or as part of the normal digestive changes associated with pregnancy.³⁷ Very limited evidence exists to support the effectiveness of interventions to manage constipation during pregnancy, although the need for referral to a gastroenterologist for this condition is rare. As a first measure, increasing fluid

intake should be recommended since this approach can be inexpensive, is readily available, and helps meet the DRI for water. Pregnant women with low fiber intakes may be advised to increase high-fiber foods, such as 100% bran cereals and legumes in their diet (see Appendix 13, 2010 DGA¹⁸), and if possible, get regular physical activity. Fiber and fluids may also be recommended to prevent hemorrhoids during pregnancy, although the effectiveness of this approach remains to be determined.

Pica and cravings. Food cravings and aversions are very common during pregnancy worldwide.³⁸ In the United States, the most commonly craved items are chocolate, citrus fruits, pickles, chips, and ice cream. The most common aversions are to coffee, tea, fried or fatty foods, highly spiced foods, meat, and eggs. There is little evidence to conclude that cravings and aversions have a significant impact on dietary intake, at least in most developed countries. Pica generally refers to the compulsive intake of non-food substances over a sustained period of time. Geophagia specifically refers to compulsive eating of clay or dirt. Other substances that may be consumed include ice or freezer frost (pagophagia), laundry starch, soap, ashes, chalk, paint, or burnt matches. However, abnormal craving for and intake of some food items, such as cornstarch or baking soda, are also considered examples of pica. In counseling pregnant women, health professionals should be alert to abnormal cravings and intakes of non-food and food items, and screen for nutritional deficiencies, as well as potential exposure to toxic substances.

Toxins and Food Safety Issues

Methyl mercury. While the 2010 DGA recommend that pregnant women consume 8 to 12 oz of seafood per week to meet their need for n-3 fatty acids, a caution is included about the types of fish.¹⁸ Due to their methyl mercury content, pregnant women should limit white (albacore) tuna to 6 oz per week and avoid the following four types of fish: tilefish, shark, swordfish, and king mackerel. Pregnant women should also check local advisories to verify the safety of fish caught in their region (<http://fishadvisoryonline.epa.gov/General.aspx>) and refer to the FDA website for consumer brochures related to fish consumption during pregnancy (www.fda.gov/Food/ResourcesForYou/Consumers/ucm110591.htm).

Since pregnant women and their unborn children are more susceptible than the general population to foodborne illness, special caution is recommended in handling and/or preparing food.¹⁸ Pregnant women should only eat seafood, meat, poultry, or eggs that have been cooked to recommended safe minimum internal temperatures. Special

precautions also include avoiding unpasteurized (raw) juice or milk or foods made from unpasteurized milk, like some soft cheeses (eg, Feta, *queso blanco*, *queso fresco*, Brie, Camembert cheeses, blue-veined cheeses, and Panela). Women are advised to reheat deli and luncheon meats and hot dogs to steaming hot to kill *Listeria*, the bacteria that causes listeriosis, and not to eat raw sprouts, which also can carry harmful bacteria. For more detailed information on the principles of safe food handling and useful websites, refer to Appendix 3 in the DGA.¹⁸

Micronutrient Needs and When to Recommend Supplements

The consumption of more food to meet energy needs and the increased absorption and efficiency of nutrient utilization that occurs in pregnancy are generally adequate to meet the needs for most nutrients when good food choices are made (see Table 2). However, vitamin and mineral supplementation may be important in vulnerable cases, including food insecurity; alcohol, tobacco, or other substance dependency; anemia; strict vegetarian (vegan) diet; or poor eating habits.³⁹ In general, pregnant women should seek medical consultation before taking a supplement that exceeds the Tolerable Upper Limits (UL) for a particular vitamin or mineral.

Iron. The RDA for iron during pregnancy is 27 mg per day and the UL is 45 mg per day.¹⁹ Pregnant women should be encouraged to consume iron-rich foods such as lean red meat, fish, poultry, dried fruits, and iron-fortified cereals. Meat and ascorbic acid-rich fruits enhance the absorption of non-heme iron (eg, from plants and iron-fortified foods). Foods that inhibit iron absorption, such as whole-grain cereals, unleavened whole-grain breads, legumes, tea, and coffee, should be consumed separately from iron-fortified foods and iron supplements. Calcium supplements may also inhibit iron absorption. As shown in Table 2, even a nutrient-dense diet planned according to the DFPM is likely to fall short in iron. Currently, a low-dose iron supplement (30 mg per day) is recommended for pregnant women, starting early in pregnancy.⁴⁰ A Cochrane review of 49 studies concluded that daily or intermittent (1–2 times per week) iron supplementation schemes are similarly effective in reducing maternal anemia or iron deficiency.⁴¹ However, risk of hemoconcentration (Hgb > 13.5 mg/dL) in the second or third trimester is higher with daily compared to intermittent iron supplements, especially at doses >60 mg per day.

Folate. The RDA for folate during pregnancy is 600 mcg per day of dietary folate equivalents.¹⁹ The major natural sources of dietary folate are legumes, green leafy vegetables, liver, citrus fruits and juices, and whole wheat bread. Compared to naturally occurring folate in foods, the synthetic form

of the vitamin (folic acid), contained in fortified foods and supplements, is almost twice as well absorbed, so that 1 mcg from these sources is equivalent to 1.7 mcg dietary folate equivalents. To prevent neural tube defects, women of childbearing years and pregnant women should consume 400 mcg per day of folic acid from fortified foods (cereals and other grains), supplements or both, *in addition to* consuming folate from foods in a varied diet beginning at least 1 month before conception.^{18,19}

Zinc. The RDA for zinc during pregnancy is 12 mg per day for ages 14–18 yr and 11 mg per day for ages 19–50 yr; the ULs are 34 and 40 mg per day, respectively.¹⁹ Food sources of zinc include meat, some shellfish, fortified cereals, legumes, and whole grains. However, bioavailability can be low in vegetarian diets due to the presence of phytate, fiber, and/or calcium that may inhibit zinc absorption. High intakes of supplemental iron may also inhibit zinc absorption when both are taken without food. Zinc supplementation may be prudent in any of the following conditions: 1) gastrointestinal disorders that affect absorption; 2) high intakes of supplemental iron; or 3) cereal and plant-based diets that are high in phytates.⁴²

Vitamin B-12. The RDA for B-12 during pregnancy is 2.6 mcg per day, and no UL has been set.¹⁹ Naturally found in animal products, vitamin B-12 is particularly high in shellfish, organ meats such as liver, some game meats (venison), and fish such as herring, trout, and sardines. In the United States, primary sources of vitamin B-12 are mixed dishes containing meat, fish or poultry; milk beverages; and ready-to-eat fortified cereals. Pregnant women who consume little or no animal products need guidance on choosing a reliable source of vitamin B-12 such as a fortified cereal or supplement.

Calcium. The RDA for calcium during pregnancy is 1,300 mg per day for ages 14–18 yrs and 1,000 mg per day for ages 19–50 yrs.⁴³ The ULs are 3,000 mg per day and 2,500 mg per day, respectively. Milk, cheese, yogurt, and foods containing milk products (eg, pizza, lasagna, dairy desserts) provide about 72% of the calcium in US diets. Increasingly, other foods and beverages, such as orange juice and ready-to-cereals, have been fortified with calcium. Antacids may also contain calcium carbonate and need to be counted towards total calcium intake. For women with lactose intolerance, dairy products with less lactose, such as cheese, yogurt, or milk with added lactase enzyme, can be substituted for regular milk. For pregnant women who do not consume milk products (eg, due to milk allergy or other reason) or calcium-fortified foods or beverages, such as those containing soy or nut milks, a calcium and vitamin D supplement may be needed.

Vitamin D. The RDA for vitamin D during pregnancy is 600 IU per day and the UL is 4000 IU per day.⁴³ Synthesized in the skin through exposure to ultraviolet B rays in sunlight, vitamin D is also found in the flesh of fatty fish, fish oils, fortified cow's and plant milk products, ready-to-eat fortified cereals, and eggs of hens fed vitamin D. According to the American Congress of Obstetricians and Gynecologists (ACOG), supplements of 1,000 to 2,000 IU per day are probably safe for pregnant women who are deficient in vitamin D.⁴ Pregnant women at increased risk of vitamin D deficiency include those with little exposure to sunlight, vegan diets, and darker skin.

n-3 fatty acids. The major n-3 long chain polyunsaturated fatty acids that may be of concern during pregnancy are DHA and EPA. These n-3 fatty acids can be synthesized in the body from α -linolenic acid (AI during pregnancy is 1.4 g per day) but the conversion is less than 10%.^{19,44} Some experts have recommended that at least 200 mg per day of DHA be consumed during pregnancy.⁴⁵ Seafood (eg, salmon, trout, sardines) is a good source of n-3 fatty acids; see Appendix 11 of the 2010 DGA for a list of EPA, DHA, and mercury content of common seafood choices.¹⁸ While vegetarians and people who do not consume fish or DHA-enriched eggs should be encouraged to consume flaxseed, walnuts, canola oil, and products fortified with n-3 fatty acids (eg, soy milk and breakfast bars), an algae-based DHA supplement may also be recommended due to low bioconversion of α -linolenic acid from plant sources to DHA.⁴⁴

Choline. While an RDA has not yet been set for choline, the AI for pregnancy is estimated to be 450 mg per day, with a UL of 3 g per day for ages 14–18 yrs and 3.5 g for ages 19–50 yrs.¹⁹ Many pregnant or lactating women in the United States may not be consuming adequate amounts of choline.⁴⁶ Multivitamin and mineral supplements for pregnant women typically do not contain choline; as mentioned previously, the DFPM may fall short in choline for some women. Therefore, pregnant women should be advised to include good sources of choline in their diets. A few examples of the choline content include: egg, one large (145 mg); salmon, 3 oz (100 mg); kidney or navy beans, 1 cup (60 mg); and low-fat milk, 1 cup (45 mg). Additional food sources and a recent review of choline's role in nutrition and health can be found elsewhere.⁴⁶

Other Supplements and Substances

Herbal and botanical. Very few randomized, clinical trials have examined the safety and efficacy of complementary and alternative therapies during pregnancy.⁴⁷ RDNs need to approach the topic of herbal and botanical supplements in a non-judgmental way to encourage pregnant women to

discuss openly the products they are consuming. They also need to remind pregnant women that the safety of many herbal and botanical products during pregnancy has not been determined. To keep abreast of alerts about adverse reactions related to herbal and botanical supplements, RDNs should consult the FDA website (www.fda.gov/Food/DietarySupplements/default.htm) and other useful websites referenced in the position paper on nutrient supplements.³⁹

Caffeine. According to the ACOG, consumption <200 mg of caffeine a day does not appear to contribute to increased risk of miscarriage or preterm birth.⁴⁸ Recent trends in the beverage market can make it difficult for health professionals to guide pregnant women on moderating caffeine intake without knowing specific brands or sources. For example, an analysis of 20 commercial espresso beverages found that the caffeine content varied six-fold (51–322 mg per serving), depending mainly on the amount of beans but also the type and roasting procedures.⁴⁹ The market for energy drinks has grown exponentially during the past decade, making available to the public a wide range of products that range in caffeine content from 80 mg per 8.3 oz to 505 mg per 24 oz.⁵⁰ Decaffeinated beverages are often viable options for pregnant women. In addition to the above citations, some websites compile manufacturer data, as well as journal references to provide information on caffeine content in beverages (www.energyfiend.com/the-caffeine-database).

Tobacco, Alcohol, Marijuana, and Other Substances

A role of the RDN is to assess behaviors related to tobacco, alcohol, marijuana, and other substances and to make appropriate referrals to health providers. According to the Tobacco Use Supplement in the Current Population Survey of 2010–11, 14.2% of US women (18 yrs and older) smoked cigarettes but the prevalence varies regionally with the highest estimates in the Midwest.⁵¹ Availability of new flavors and forms of delivery for tobacco makes it necessary for health providers to be aware of and screen carefully for use of all tobacco products. Safety during pregnancy has not been determined for some products, such as electronic cigarettes that deliver vaporized nicotine (http://en.wikipedia.org/wiki/Electronic_cigarette). The ACOG has described a five “A’s” intervention process (Ask, Advise, Assess, Assist, and Arrange) that health providers can use to assess, motivate, and counsel women appropriately about tobacco cessation.⁵⁷

The 2010 DGA recommend that pregnant women, and those who could become pregnant, do not consume alcohol.¹⁸ Based on the Behavioral Risk Factor Surveillance System data from 2006–2010, the highest estimates of alcohol use during pregnancy are among those who were ages 35–44 y (14.3%), white (8.3%), college graduates (10%), and employed (9.6%).⁵² Given that some pregnant

women do not follow the advice and others may consume alcohol, unaware that they are pregnant, it is important that health providers counsel women in a non-judgmental way to prevent unintended consequences, such as excessive fear that may deter women from revealing their drinking patterns and seeking prenatal care and/or treatment services. It is also important health providers ask about and counsel appropriately about marijuana, cocaine, and street drugs, as well as prescription and over-the-counter medications, to avoid during pregnancy.

HEALTH CONDITIONS DURING PREGNANCY

Gestational Diabetes Mellitus

The EAL presents a summary and analysis of studies related to the prevention and management of GDM.²⁴ Maternal obesity, excessive weight gain, and high intake of saturated fat are factors in the pre-pregnancy interval that have been associated with the development of glucose abnormalities during pregnancy (Grade III=Limited). Pregnant women with impaired glucose tolerance have metabolic similarities to women with gestational diabetes and are at increased risk of delivering large-for-gestational age infants (Grade I=Good). For women with GDM, improved outcomes are observed with dietary intake limiting carbohydrates to 45% of energy but further research is needed regarding goals for protein, fat, and fiber (Grade II=Fair). Further research is also needed to determine energy requirements in women with GDM (Grade II=Fair). For women without contraindications, moderate physical activity for a minimum of 30 minutes, three times a week, may help improve glycemic control during pregnancy (Grade II=Fair). When glycemic control has not been achieved or fetal growth is excessive, pharmacological therapy, in conjunction with medical nutrition therapy (MNT), is recommended (Grade I=Good). Insulin analogs (lispro or aspart) are safe and effective during pregnancy. For less severe cases, glyburide can be effective. Blood glucose monitoring improves glycemic control in GDM (Grade II=Fair). When implemented early (within 1 week of diagnosis) with a minimum of three visits, MNT is associated with better outcomes, including decreased hospital admissions, insulin use, and complications and increased likelihood of normal fetal and placental growth (Grade I=Good).

Hypertensive Disorders of Pregnancy

Pre-eclampsia, characterized by a diastolic blood pressure ≥ 90 mm Hg or systolic blood pressure ≥ 140 mm Hg and proteinuria with onset after 20 weeks, can result in preterm delivery, intrauterine growth restriction, and maternal morbidity and mortality.⁵³ A Cochrane review of 13 good quality, randomized controlled trials concluded that calcium supplements (at least 1,000 mg/day) reduce blood pressure

and risk of pre-eclampsia but had no significant effect on reducing maternal and infant morbidity and mortality.⁵⁴ Calcium supplementation may only be beneficial in high-risk women and where calcium intakes are very low. While observational studies have found an association between low blood levels of DHA in women who experience pre-eclampsia, randomized controlled trials involving n-3 fatty acid supplements have not demonstrated significant effects in reducing risk of pre-eclampsia, even among high-risk women (eg, maternal obesity, diabetes, hypertension).^{2, 55} A meta-analysis of 15 randomized controlled trials concluded that perinatal outcomes, related to pre-eclampsia, are not improved by vitamin C or E supplements either.⁵⁶

NUTRITION CARE: FROM PRECONCEPTION TO POSTPARTUM

Preconception and Interconception

Some key indicators to monitor in women of childbearing age include use of folic acid supplements and as a measure of access to care, cervical cancer screening.⁵⁷ Another factor to consider is that, even among women planning to become pregnant, relatively few implement nutrition and lifestyle changes in the preconception period.^{58,59} Based on a large prospective study in the United Kingdom, less than 3% of women are estimated to be compliant with folic acid recommendations during the preconception period. In addition, no changes were observed in smoking, fruit/vegetable intakes, or physical activity behaviors.⁵⁹ Women may reduce caffeine intake prior to pregnancy but not alcohol or cigarette use, demonstrating a need for preconception guidance related to a wide range of nutrition and lifestyle behaviors.⁵⁸

Breastfeeding

Although the decision to breastfeed may be made before pregnancy, education provided during pregnancy can improve breastfeeding outcomes (see the Academy's position on breastfeeding for specific guidance).⁶⁰ Educational programs should focus on practical advice about breastfeeding and address the participants' specific concerns and questions. A family-centered approach may help identify and prevent problems that may lead to early weaning. Exclusive breastfeeding is recommended for the first 6 months of life, with continued breastfeeding until at least 12 months of age as complementary foods are gradually introduced.

Postpartum

In addition to encouraging breastfeeding, RDNs and DTRs should provide advice to the postpartum woman to replenish nutritional stores, prevent problems in subsequent

pregnancies, and reduce risk of chronic diseases later in life. Key indicators of the quality of care include scheduling of a health checkup within 21–56 days postpartum and screening for depressive symptoms. Postpartum women can be encouraged to maintain certain lifestyle changes adopted during their pregnancies, such as smoking cessation and increased consumption of whole grains, fruits, and vegetables. Adequate folic acid intake may reduce risk of coronary heart disease in the mother, as well as prevent birth defects in a subsequent pregnancy.¹⁸ Postpartum women should be encouraged to return to or improve their pre-pregnant weight.¹⁰ Although symptoms disappear after delivery, women who have had GDM, especially those who continue to have impaired glucose tolerance in the postpartum period, are at high risk of developing type 2 diabetes later in life and should be targeted for intensive counseling on risk reduction. Good evidence (Grade I=Good) supports weight loss in these women as a strategy to prevent recurring GDM or type 2 diabetes.²⁴

Psychosocial Issues

Women with a past or current eating disorder may find the loss of control over their bodies during pregnancy to be terrifying.⁹ For these women, evaluation of prenatal weight gain can be stressful; maintaining privacy in taking measurements (preferably performed by the same person) may help. While purging may decrease, bingeing can be more common during pregnancy. Meal planning to include some protein, complex carbohydrates, and fat at each meal or snack may help prevent overeating or bingeing. Women who have abused laxatives may have decreased intestinal motility, which is compounded by the physiologic changes during pregnancy. At the postpartum visit, health providers need to continue screening for eating disorders as many women experience a relapse during this period.

Food insecurity is prevalent in the United States and is correlated with poor diet quality and physical/mental health.⁶¹ RDNs and DTRs can refer to the Academy position paper on how to screen for food insecurity and provide appropriate nutrition care and referrals to federal and non-federal nutrition assistance programs.

ROLE OF THE RDN AND DTR

Regardless of the client's socioeconomic status, RDNs and DTRs need to implement multiple strategies to provide nutrition and lifestyle advice to all women, from preconception through the postpartum period. Pregnant women with inappropriate weight gain either limited or in excess, multiple gestation, hyperemesis gravidarum, poor dietary patterns, gestational diabetes, other nutrition-related chronic health problems or a history of eating disorders or substance abuse should be referred to an RDN for MNT.

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Authors: Lucia L. Kaiser, PhD, RD, University of California, Davis; Christina G. Campbell, PhD, RD, Iowa State University, Ames, IA (Lead Author).

Reviewers: Jeanne Blankenship, MS, RD (Academy Policy Initiatives & Advocacy, Washington, DC); Quality Management Committee (Melissa N. Church, MS, RD, LD, Chickasaw Nutrition–Get Fresh! Program, Oklahoma City, OK); Sharon Denny, MS, RD (Academy Knowledge Center, Chicago, IL); Public Health dietetics practice group (DPG) (Kathryn Hillstrom, EdD, RD, CDE, California State University, Los Angeles, CA); Vegetarian Nutrition DPG (Reed Mangels, PhD, RD, LDN, FADA, University of Massachusetts, Amherst); Kathleen Pellechia, RD (US Department of Agriculture, WIC Works Resource System, Beltsville, MD); Julie A. Reeder, PhD, MPH, CHES (State of Oregon WIC Program, Portland, OR); Tamara Schryver, PhD, MS, RD (TJS, Communications LLC, Minneapolis, MN); Alison Steiber, PhD, RD (Academy Research & Strategic Business Development, Chicago, IL); Women's Health DPG (Laurie Tansman, MS, RD, CDN, Mount Sinai Medical Center, New York, NY).

Academy Positions Committee Workgroup: Cathy L. Fagen, MA, RD (chair) (Long Beach Memorial Medical Center, Long Beach, CA); Ainsley M. Malone, MS, RD, CNSC, LD (Mount Carmel West Hospital, Columbus, OH); Jamie Stang, PhD, MPH, RD, LN (content advisor) (University of Minnesota, Minneapolis, MN).

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