

Position of the American Dietetic Association: Nutrition and Lifestyle for a Healthy Pregnancy Outcome

ABSTRACT

It is the position of the American Dietetic Association that women of child-bearing ages should maintain good nutritional status through a lifestyle that optimizes maternal health and reduces the risk of birth defects, suboptimal fetal growth and development, and chronic health problems in their children. The key components of a health-promoting lifestyle during pregnancy include appropriate weight gain; appropriate physical activity; consumption of a variety of foods in accordance with the *Dietary Guidelines for Americans 2005*; appropriate and timely vitamin and mineral supplementation; avoidance of alcohol, tobacco, and other harmful substances; and safe food handling. Pregnant women with inappropriate weight gain, hyperemesis, poor dietary patterns, phenylketonuria, certain chronic health problems, or a history of substance abuse should be referred to a registered dietitian for medical nutrition therapy. Prenatal weight gain within the Institute of Medicine recommended ranges has been associated with better pregnancy outcomes. Most pregnant women need 2,200 to 2,900 kcal a day, but prepregnancy body mass index, rate of weight gain, maternal age, and appetite must be considered when tailoring this recommendation to the individual. 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. However, vitamin and mineral supplementation is appro-

priate for some nutrients and situations. This position paper also includes recommendations pertaining to use of alcohol, tobacco, caffeine, and illicit drugs.

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POSITION STATEMENT

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ENVIRONMENT DICTATING A NEED FOR POSITION

Pregnancy is a critical period during which good maternal nutrition is a key factor influencing the health of both mother and child. Risk of complications during pregnancy or delivery is lowest when prenatal weight gain is adequate (1,2). Maternal weight gain during pregnancy influences infant birth weight and health, and outcomes vary depending on the mother's prepregnancy nutritional status (3,4). In long-term follow-up studies of the

Dutch famine in World War II, undernutrition during pregnancy increased chronic disease in the offspring later in life (5). Specific health effects can be traced to the timing of exposure to famine during gestation. Some long-term effects of prenatal nutrition may be modulated by postnatal factors. Low birth weight, followed by rapid postnatal catch-up growth, has been shown to be a risk for metabolic syndrome in adulthood (6).

With more than one third of all women being obese, achieving good pregnancy outcomes can be difficult (7). Obesity is an independent risk factor for neural tube defects, fetal mortality, and preterm delivery. This position paper acknowledges the risks associated with maternal obesity; however, this topic will be covered in another American Dietetic Association position paper on obesity, reproduction, and pregnancy outcomes. The American College of Obstetricians and Gynecologists has also published guidance on obesity issues in pregnant women (8).

Many women of childbearing age in the United States do not maintain good nutritional status before, during, and after pregnancy. Among nonpregnant women of childbearing age (14 to 50 years), dietary intakes of vitamin E, magnesium, potassium, fiber, and calcium are particularly low compared to the appropriate Dietary References Intakes (9) (Table 1). A high prevalence of inadequate intakes of these same nutrients has also been found among pregnant or lactating women (10). Intakes of vitamins A, C, and B-6 and folate are moderately inadequate (30% to 40% of women consuming less than the Estimated Average Requirement). Iron deficiency is relatively common, while sodium and saturated fat intakes may be excessive.

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Table 1. Dietary Reference Intakes for Women^{ab}

Nutrient	Adult woman	Pregnancy	Lactation (0-6 mo)
Energy (kcal)	2,403	2,743 ^c , 2,855 ^d	2,698
Protein (g/kg/d)	0.8	1.1	1.1
Carbohydrate (g/d)	130	175	210
Total fiber (g/d)	25	28	29
Linoleic acid (g/d)	12	13	13
α -Linolenic acid (g/d)	12	13	13
Vitamin A (μ g RAE ^e)	700	770	1,300
Vitamin D (μ g)	5	5	5
Vitamin E (mg α -tocopherol)	15	15	19
Vitamin K (μ g)	90	90	90
Vitamin C (mg)	75	85	120
Thiamin (mg)	1.1	1.4	1.4
Riboflavin (mg)	1.1	1.4	1.6
Vitamin B-6 (mg)	1.3	1.9	2.0
Niacin (mg NE ^f)	14	18	17
Folate (μ g dietary folate equivalents)	400	600	500
Vitamin B-12 (μ g)	2.4	2.6	2.8
Pantothenic acid (mg)	5	6	7
Biotin (μ g)	30	30	35
Choline (mg)	425	450	550
Calcium (mg)	1,000	1,000	1,000
Phosphorus (mg)	700	700	700
Magnesium (mg)	320	350	310
Iron (mg)	8	27	9
Zinc (mg)	8	11	12
Iodine (μ g)	150	220	290
Selenium (μ g)	55	60	70
Fluoride (mg)	3	3	3
Manganese (mg)	1.8	2.0	2.6
Molybdenum (μ g)	45	50	50
Chromium (μ g)	25	30	45
Copper (μ g)	900	1,000	1,300
Sodium (mg)	2,300	2,300	2,300
Potassium (mg)	4,700	4,700	5,100

^aData from reference 22 (Institute of Medicine. *Dietary Reference Intakes: The Essential Guide to Nutrient Requirements* Washington, DC: National Academies Press; 2006).

^bValues are Recommended Dietary Allowances except for energy (Estimated Energy Requirement) and total fiber, linoleic acid, α -linolenic acid, vitamin D, vitamin K, pantothenic acid, biotin, choline, calcium, manganese, chromium, sodium and potassium (Adequate Intakes).

^cSecond trimester for women age 19 to 50 years.

^dThird trimester for women age 19 to 50 years.

^eRAE=retinol activity equivalents.

^fNE=niacin equivalents.

POSITION OBJECTIVES

To optimize the health outcomes of both mother and child, women of childbearing age should begin pregnancy in good nutritional status. Thus, advice needs to reach women before they become pregnant, as well as during prenatal and postpartum care. This position paper has the following objectives:

- to inform health professionals and others who work with women of childbearing age, on the need for a healthful diet and lifestyle;
- to emphasize the key components

of a health-promoting lifestyle during pregnancy: appropriate weight gain and physical activity; consumption of a variety of foods according to the *Dietary Guidelines for Americans 2005* (2005 Dietary Guidelines) (11); appropriate vitamin and mineral supplementation; avoidance of alcohol, tobacco, and other harmful substances; and safe food handling; and

- to provide food and nutrition professionals with clarification on various nutrition issues related to maternal care during pregnancy.

KEY POINTS

A. Optimizing Outcomes through Good Nutrition and Health before Pregnancy

Women need to attain good nutritional status before, during, and after pregnancy to optimize maternal health and reduce the risk of pregnancy complications, birth defects, and chronic disease in their children in later adulthood. Food and nutrition professionals should know recommendations from the 2005 Dietary Guidelines and recommendations from the Centers for Disease Control and Prevention that pertain to opti-

mizing nutrition and health before pregnancy. The 2005 Dietary Guidelines recommend that women of childbearing age consume an adequate amount (400 µg) of synthetic folic acid daily from fortified foods or supplements, in addition to food forms of folate in a varied diet, to reduce risk of birth defects (11). If a woman has iron-deficiency anemia when she becomes pregnant, repleting her iron stores during pregnancy may be difficult. Therefore, women of childbearing age are advised to eat foods high in heme iron, or iron-fortified foods with an enhancer of iron absorption, such as vitamin C-rich foods.

Regular physical activity confers many health benefits, including weight management, increased physical fitness and psychological well-being, and reduced risk of chronic disease. The 2005 Dietary Guidelines recommend accumulating 30 to 90 minutes a day of moderate physical activity, above usual activity, on most days of the week. While at least 30 minutes are recommended to reduce the risk of chronic disease in adulthood, higher levels of physical activity are needed to manage body weight or sustain weight loss.

The Centers for Disease Control and Prevention and its partners have made 10 recommendations for preconception interventions optimize pregnancy outcomes (12). These include: folic acid supplements; management of diabetes; a low phenylalanine diet for women with phenylketonuria; cessation of alcohol, smoking, and substance use; altering dose if taking certain prescription medications (or avoiding pregnancy if taking isotretinoin); vaccination against or treatment for infections; and improving weight status.

B. Weight Gain during Pregnancy

A healthful pregnancy is without physical or psychological pathology in the mother or fetus and results in the delivery of a healthy baby. Maternal weight gain must support the products of conception (fetus, placenta, and amniotic fluid) and maternal accretion of tissues (expansion of blood volume and extracellular fluid, uterine and mammary glands, and maternal fat stores). The target range for weight gain, to optimize maternal and infant outcomes, is that associated with a full-term, healthy baby, weighing 3.1 to 3.6 kg (6.8 to 7.9 lb)

Table 2. 1990 Institute of Medicine guidelines for prenatal weight gain^a

Recommended weight gain	
BMI ^b <19.8	12.5-18 kg (28-40 lb)
BMI 19.8-26	11.5-16 kg (25-35 lb)
BMI >26-29	7-11.5 kg (15-25 lb)
BMI >29	at least 6.0 kg (15 lb)
Twin pregnancies	16-20.5 kg (35-45 lb)
Other	Young adolescents and black women should strive for gains at the upper end of the recommended range. Short women (<157 cm) should aim for gains at the lower end of the range.

^aData from reference 14 (Institute of Medicine. *Nutrition during Pregnancy: Part I Weight Gain and Part II Nutrient Supplements*. Washington, DC: National Academies Press; 1990:10-23).
^bBMI=body mass index; calculated as kg/m².

(13). Recommendations for weight gain during pregnancy should be individualized according to prepregnancy body mass index (calculated as kg/m²) to improve pregnancy outcome, avoid excessive maternal postpartum weight retention, and reduce risk of later chronic disease for the child. The 1990 Institute of Medicine (IOM) recommendations, shown in Table 2, have been the standard for weight gain during pregnancy for more than 25 years (14). Although many studies continue to find that prenatal weight gain within the recommended IOM range is associated with better pregnancy outcomes (1,2,4), others suggest that revisions may be needed. According to IOM recommendations, young mothers and black mothers should strive for weight gains toward the upper end of the recommended ranges. However, a study of birth outcomes among 815 African-American adolescents found the largest reduction in risk of small-for-gestational births occurs when prenatal weight gain increases from below to within the lower half of the IOM range (15). One prospective study reported that children of women whose prenatal weight gains were adequate or excessive according to the 1990 IOM guidelines were more likely to be overweight at 3 years of age, compared to children whose mothers did not gain enough weight (16). Thus, the influence of prenatal weight gain and birth weight on risk of overweight in the offspring needs further consideration, as IOM guidelines are revisited.

To improve outcomes, greater attention to preventing excessive gain is needed (17). In a retrospective study of 20,463 nondiabetic, term sin-

gleton births, 43% of women gained weight above the recommended IOM range, whereas 37% gained with the IOM range and 20% had weight gains below target range. The women with excessive weight gain had a greater risk of adverse infant outcomes, including hypoglycemia, large-for-gestational age, a low Apgar score, seizures, and polycythemia. In a European population, excessive prenatal weight gain has been associated with long-term obesity risk, especially among women who retain more weight at 12 months postpartum (18).

Food and nutrition professionals need to keep in mind that inadequate prenatal weight gain and low birth weight are still concerns, particularly among very young primagravidas. Reducing the risk of low birth weight while avoiding postpartum weight retention is especially problematic in young teenagers, regardless of ethnicity or race. Young adolescent mothers (under 15 years) who deliver infants with normal birth weight appear to do so by lowering their own resting energy needs and ceasing linear growth, in contrast to nonpregnant girls who continue to grow (19). A longitudinal study found that two or more pregnancies during adolescence slowed linear growth and increased body mass index among 464 Brazilian girls (20). Health professionals should focus on delaying pregnancies especially in very young teenagers, helping mothers return to normal weight and good nutritional status after delivery, and preventing subsequent teenage pregnancies.

As more women delay pregnancy until age 35 or older, greater reliance on fertility treatments has increased the incidence of multiple pregnancies (eg,

twins, triplets) more than threefold since 1980 and may present some special concerns (21). Higher weight gains before 20 to 24 weeks may be particularly important in improving birth weight and length of gestation. In a multiple pregnancy, optimal maternal weight gain up to 36 to 38 weeks varies according to pregravid weight status: underweight, 50 to 62 lb; normal weight, 40 to 54 lb; overweight, 38 to 47 lb; and obese, 29 to 38 lb.

C. Food and Physical Activity Guidance during Pregnancy

Energy. Pregnant women should consume a variety of foods according to the 2005 Dietary Guidelines, to meet nutrient needs and gain recommended amounts of weight. According to the Dietary Reference Intakes, energy needs are no higher than the Estimated Energy Requirement for nonpregnant women until the second trimester (22). The extra energy need is 340 kcal in the second and 452 kcal in the third trimester. More research is needed to establishment energy requirements for women who are pregnant with two or more fetuses (21). In the meantime, adequate weight gain should be used as an indicator of sufficient energy intake, with needs potentially ranging from 3,000 kcal in obese women to 4,000 kcal in underweight women carrying more than one fetus.

MyPyramid. Food and nutrition professionals should help pregnant women identify an appropriate food plan, based on age, activity level, trimester of pregnancy, weight gain, and other considerations. Most pregnant women will probably need a total of 2,200 to 2,900 kcal per day. MyPyramid now includes food plans for pregnant women called "MyPyramid for Moms." These plans can be used to identify an appropriate food plan that covers the individual's energy needs before pregnancy plus her additional needs, as recommended by the Dietary Reference Intakes, in the second and third trimesters and to help women make good food choices (23).

For most nutrients, a food plan based on MyPyramid for Moms can meet recommended intakes for pregnant women. However, the need for iron during pregnancy is not likely to be met, even at higher energy levels.

Therefore, an iron supplement should be taken (refer to section on "Iron" below). Special guidance in selecting foods may be needed to ensure that the self-selected diets, based on MyPyramid for Moms, provide enough vitamin E and potassium. The 2005 Dietary Guidelines also include several tables listing food sources of these and other nutrients that may be low in diets of Americans (11).

With the current high rate of obesity, many women may become pregnant while following unbalanced weight-loss diets. Unbalanced diets during pregnancy, particularly with respect to protein and carbohydrate, have been linked to adverse pregnancy outcomes, including low birth weight and other long-term effects on blood pressure, independent of birth weight (24,25). Pregnant women should be encouraged to use their individualized MyPyramid for Moms plan to select a balanced diet. To achieve a balanced diet, some pregnant women, particularly adolescents, may need advice on reducing intakes of sweetened beverages that substitute for milk. Women who avoid dairy products and rely instead on calcium-fortified orange juice or other fortified foods may have lower intakes of vitamin D and magnesium than milk consumers (26). In addition to a balanced diet, pregnant women require 8 to 10 cups of fluids a day for adequate hydration, but some of that need is met through milk, juice, and the water in fruits, vegetables, and other foods. Including plenty of fruit, vegetables, and whole grains in the diet also increases fiber intake and may help alleviate constipation, a common complaint during pregnancy. Women who eliminate certain foods or food groups should be encouraged to see a registered dietitian for dietary evaluation. Food and nutrition professionals need to keep abreast of changes in fortification levels of specific foods and advise women accordingly. They should also be familiar with cultural practices and beliefs that may affect the diet intakes of their clients and adapt the MyPyramid for Moms plan as needed.

Physical Activity. Some evidence suggests that pregnant women who engage in recreational physical activity have a 50% lower risk of gestational diabetes and 40% risk reduction for

preeclampsia (27). Pregnant women should be evaluated for medical or obstetric conditions that might preclude or limit physical activity (11,28). Each sport or activity should be examined for potential risks. Specifically, pregnant women should avoid scuba diving and activities with high risk of falling or abdominal trauma and incorporate 30 minutes or more of moderate physical activity appropriate for pregnancy on most, if not all, days of the week.

D. Appropriate and Timely Vitamin and Mineral Supplementation

Folic Acid. Pregnant women should consume 600 μg synthetic folic acid daily from fortified foods or supplements in addition to food forms of folate in a varied diet (11). This can reduce risk of neural tube defects if taken prior to conception through the sixth week of pregnancy, and possibly reduces other birth defects if taken later in pregnancy. After mandatory fortification of wheat flour with folic acid in the United States, serum and red blood cell levels of folate increased in women of childbearing age (29). However, from 2000 to 2004, serum and red blood cell folate levels declined by 16% and 8%, respectively. The reasons for this decline are not known, but the popularity of low-carbohydrate diets might have lowered intake of fortified foods. Folate levels have declined for non-Hispanic white, Mexican-American, and non-Hispanic black women, but remain the lowest in the latter. The proportion of women who report taking folic acid supplements was 33% in 2005 and has changed only slightly from 1995 to 2005 (30). Messages about the importance of folic acid should target women who are nonwhite, Hispanic, low-income, young, and/or who have less than a high school education.

Iron. Iron deficiency anemia affects about 30% of low-income pregnant women. The problem continues postpartum especially for those who are iron deficient at delivery. About 30% of poor women have iron deficiency at 6 months and 20% at 12 months postpartum compared to about 8% for women above the poverty level (31). Maternal iron deficiency anemia increases risk of low birth weight and possibly preterm delivery and perinatal mortality, and may impair maternal-infant interac-

tion (32). In a randomized trial, maternal iron supplementation increased birth weight by over 200 g and reduced low birth weight and preterm low birth weight (33). Supplementation with 27 mg iron daily during pregnancy is recommended. Anemic women may need 60 mg daily until the anemia is resolved.

Calcium and Vitamin D. Vitamin D is obtained either from the diet (notably from fortified milk) or through the effect of sunlight on skin. During winter over most of the United States, especially at more northern latitudes, and in persons with heavily pigmented skin, vitamin D status is poor. In pregnancy this leads to low serum calcium in the infant and adversely affects neonatal bone metabolism in more severe cases. Supplementation of pregnant women with amounts greater than the Recommended Dietary Allowance of 200 IU daily does not appear to provide additional benefit (34).

Indications for Other Supplements. Multivitamin and mineral supplements are recommended for women with iron deficiency anemia or poor-quality diets and for those who consume no or small amounts of animal source foods. For vegans and even some lacto-ovo vegetarians, supplemental vitamin B-12 is particularly important during both pregnancy and lactation to transfer enough to the fetus and infant to avoid developmental delays. Women carrying two or more fetuses, and those who smoke or abuse alcohol or drugs, should also take a multivitamin and mineral supplement (21).

Multivitamin supplements may also be beneficial in pregnant women who are infected with human immunodeficiency virus, especially where access to antiretroviral treatment is limited. In human immunodeficiency virus-infected pregnant women in Tanzania, a supplement containing B-vitamin complex, vitamin E, and vitamin C slowed progression of the disease, reduced some of the complications of human immunodeficiency virus, and reduced incidence of low birth weight compared to iron plus folic acid alone (35,36).

E. Guidance on Other Substances

Alcohol. Alcohol should not be consumed by pregnant women or those who may become pregnant (11).

Drinking during pregnancy is associated with major neurological and developmental birth defects (37). Even moderate drinking during pregnancy may have behavioral or developmental consequences. The risks associated with prenatal alcohol use are greater in older mothers and in binge drinkers (38). In 2005-2006, about 11.8% of pregnant women aged 15 to 44 years reported current use of alcohol, with 2.9% being binge drinkers. Binge drinking occurs in 23.6% of women aged 18 to 25 years (39) and increases risk of unplanned sexual activity, abandonment of safe sexual practices, and unwanted pregnancies.

Caffeine. Based on the Continuing Survey of Food Intakes by Individuals in 1994-96 and 1998, the average caffeine intake among pregnant women was 125 mg per day, with about 48% from coffee beverages, 23% from teas, 26% from carbonated beverages, and 3% from sweets, grains, and flavored dairy products (40). High caffeine intake is associated with delayed conception, spontaneous miscarriage, and low birth weight, but not with birth defects (41). The current position of the American Dietetic Association is that pregnant women should avoid caffeine intakes above 300 mg/day. A randomized controlled trial found no additional benefit for low-birth-weight prevention or longer gestation of lowering caffeine intakes from a mean of 317 to 117 mg/day, except in the subset of women who smoked (42). Mean caffeine content of selected brewed coffees is 188 mg per 16 oz (range: 143 to 259 mg) (43) but can vary in the same outlet from 259 to 564 mg per 16 oz. While most carbonated sodas contain between 18 and 48 mg of caffeine per 12 oz can, the caffeine content of energy drinks is generally higher (33 to 75 mg per 8.4 oz) (44).

Smoking. In 2005-2006, 16.5% of pregnant women reported smoking in the past month, compared to 29.5% of nonpregnant women (39). Carbon monoxide and nicotine from smoking increase fetal carboxyhemoglobin and reduce placental blood flow, both of which limit oxygen supplied to the fetus. Cigarette smoking during pregnancy is associated with greater risk of spontaneous abortion, placenta previa, placental abruption, ectopic pregnancy, preterm birth, fetal growth re-

tardation, and sudden infant death syndrome (37). Smoking during or after pregnancy is also associated with slightly poorer academic achievement in the offspring (38). A population-based study of 26,000 pregnancies in Finland found that smoking cessation in early pregnancy reduces the risk of delivering a small-for-gestational age infant but not preterm birth or perinatal mortality (45). Advice and support related to smoking cessation should target women before conception.

Illicit Drugs. Marijuana, cocaine, and other illicit drugs should be avoided during pregnancy. Substance abuse during pregnancy increases the risk of low birth weight, small head circumference, prematurity, and other developmental problems (46). Marijuana is the most commonly used substance. Long-term follow-up studies of children exposed prenatally to marijuana have found more depressive symptoms and poor attention skills (38). However, isolating the effects of specific substances is often difficult because women who use illicit drugs may use multiple drugs, smoke, and drink alcoholic or caffeinated beverages, live in poverty, have poor nutrition, be exposed to sexually transmitted diseases, and have inadequate access to prenatal care. In 2005-2006, 4% of pregnant women reported use of any illicit drugs in the past month, compared to 10% of nonpregnant women (39).

Herbal/Botanical/Alternative Remedies. Many pregnant women who would not consider taking over-the-counter medications view herbal and botanical products as a safe and natural alternative. However, very few randomized, clinical trials have examined the safety and efficacy of alternative therapies during pregnancy. Pregnant women should be advised to consider herbal treatments as suspect until their safety during pregnancy can be ascertained. Consumer information related to botanical use can be located on the MyPyramid for Moms Web site (23). Health professionals should ask about any herbal products, botanicals, or other supplements that their pregnant clients may be taking and evaluate any potential risks.

Sweeteners and Other Ingredients. Use of sweeteners and other ingredients

that are classified as Generally Recognized as Safe are acceptable in moderation during pregnancy. Risk assessment considers any potential toxicity during pregnancy. Consumption of acesulfame potassium, aspartame, saccharin, sucralose, and neotame within acceptable daily intakes is considered safe during pregnancy (47).

F. Specific Health Conditions

Diabetes. Major congenital malformations may occur in infants born to mothers with uncontrolled diabetes in the first few weeks of pregnancy (48). Women who have diabetes should be educated about the risks and use contraception until they have attained good metabolic control (ie, hemoglobin A1c levels that are normal or as close to normal as possible [$<1\%$ above the upper limits of normal]). All women with diabetes who are planning a pregnancy should be evaluated and, as appropriate, treated for conditions related to diabetes, such as retinopathy, nephropathy, and others. Good preconception care reduces the risk of birth defects related to diabetes.

Risk of diabetes should be assessed in all women without pre-existing diabetes at the first prenatal visit. Pregnant women are considered to be at high risk if they have any of the following: obesity, personal history of gestational diabetes mellitus (GDM) or delivery of a previous large-for-gestation-age infant, glycosuria, polycystic ovary syndrome, or a strong family history of diabetes. Pregnant women at high risk of GDM should undergo glucose testing as soon as possible. High-risk women not found to have diabetes at the initial screening and average-risk women should be tested between 24 and 28 weeks of gestation. Further guidelines on diabetes screening can be found elsewhere (48).

Medical nutrition therapy (MNT) is recommended for pregnant women with diabetes (49). Generally, MNT involves a carbohydrate-controlled meal plan that provides enough energy for appropriate weight gain while maintaining target blood glucose goals and avoiding ketosis. The amount and distribution of carbohydrate allowed should be based on clinical measures, such as blood glucose

levels, weight gain, and ketones. However, at least 175 g carbohydrate daily is needed. Less carbohydrate at breakfast and more at other meals may be most effective in achieving glucose control. Insulin (human) with daily self monitoring of blood glucose is the therapy of choice if MNT fails to control glucose levels. More research is needed to establish safety of oral agents. Women without medical/obstetric complications should be encouraged to exercise.

For obese women with GDM, caloric restriction of 30% may improve glycemic control without increasing ketonuria. Nevertheless, concerns about the effects on fetal development appear to be shifting the focus from energy to carbohydrate restriction. Additional evidence related to the management of GDM in obese women will be discussed in an American Dietetic Association position paper on obesity, reproduction, and pregnancy outcomes.

Hypertensive Disease. Hypertensive disease occurs in 12% to 22% during pregnancy in the United States (50). Gestational hypertension is defined as elevated blood pressure (systolic ≥ 140 mm Hg or diastolic ≥ 90 mm Hg) with onset after 20 weeks gestation. About 25% of women with gestational hypertension will develop preeclampsia which is characterized by proteinuria (0.3 g protein in a 24-hour urine sample). Eclampsia is defined as grand mal seizures occurring in women with preeclampsia. Important risk factors for preeclampsia include: primiparity, multiple pregnancy, older maternal age (≥ 35 years), African-American race, maternal obesity, history of preeclampsia, and chronic hypertension. Monitoring and treatment of hypertensive disease are very important to reduce infant and maternal morbidity and mortality. Long-term risk of cardiovascular disease is increased in women who develop preeclampsia, especially where fetal growth retardation and preterm delivery occur (51).

Preeclampsia seems to develop in two stages, with the first being abnormal implantation that reduces placental function, and the second involving maternal response to substances produced by the poorly functioning placenta. Particularly in that second stage, oxidative stress and nu-

tritional factors may be involved (52). After adjusting for energy, high intakes of fat, particularly polyunsaturated fat, are associated with indicators of oxidative damage which, in turn, predict the risk of preeclampsia. Better antioxidant status in the blood significantly reduces risk. The role of calcium has been controversial, but a review concluded that high amounts of calcium supplements, particularly in high-risk women with low calcium intakes, appears to reduce risk of preeclampsia (53). Not enough evidence exists to conclude that vitamin E supplements are helpful (54).

Although several observational studies report benefits of fish and other sources of n-3 fatty acids, there is not enough evidence to support the routine use of marine oil or other prostaglandin precursor supplements during pregnancy for reducing risk of preeclampsia, preterm birth, low birth weight, or small-for-gestational age (55). Marine oils are a rich source of n-3 long-chain polyunsaturated fatty acids, including eicosapentaenoic and docosahexaenoic acids. As precursors to prostaglandins, these fatty acids have hypotensive effects and, thus, are thought to play a protective role in women at risk of preeclampsia and/or premature labor. Further large, randomized trials are needed to determine whether there are long-term benefits or potential risks from routine prenatal supplementation with marine oils and other sources of n-3-fatty acids.

G. Avoidance of Foodborne Illness during Pregnancy

Pregnant women and their fetuses are at higher risk of developing foodborne illness. Experts consider *Listeria monocytogenes*, *Salmonella* species, and *Toxoplasma gondii* to be of particular concern (56). Food and nutrition professionals should be aware of pathogens found in foods not commonly considered to be high risk and work with retail establishments to reduce incidence of foodborne illness in pregnant women. Pregnant women should pay particular attention to the following specific 2005 Dietary Guidelines for pregnancy, as well as other guidance relating to fish and shellfish consumption (11,57):

- Avoid soft cheeses not made with pasteurized milk, cold smoked fish, and cold deli salads.
- Eat only deli meats, luncheon meats, bologna, and frankfurters that have reheated to steaming hot.
- Do not eat or drink raw (unpasteurized) milk or milk products, raw or partially cooked eggs (or foods containing raw eggs), raw or undercooked meat and poultry, unpasteurized juice, raw sprouts, and raw or undercooked fish or shellfish.
- Do not clean cat litter boxes or wear plastic gloves when cleaning litter boxes.
- Do not handle pets when preparing foods and keep them out of food preparation areas.
- Do not eat shark, swordfish, king mackerel, or tilefish. Twelve ounces or less per week of fish and shellfish lower in mercury, such as shrimp, canned light tuna, salmon, pollock, and catfish is safe; limit albacore (“white”) tuna to 6 oz or less per week since this type of tuna contains more mercury than canned light tuna.
- Check local advisories about the safety of fish in local lakes, rivers, and coastal areas. If no advice is available, up to 6 oz a week of fish from local waters and no other fish during that week is considered safe.

H. Encouragement to Breastfeed

Food and nutrition professionals should educate pregnant women about the benefits of breastfeeding and provide practical information on getting started (58). They should also use several strategies, recommended elsewhere by the American Dietetic Association, to promote and support breastfeeding.

I. Nutrition Advice to Postpartum Women

In addition to encouraging breastfeeding, food and nutrition professionals should provide advice to the postpartum woman to replenish nutritional stores, return to a healthful weight, prevent problems in subsequent pregnancies, and reduce risk of chronic diseases later in life. 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 as recommended by MyPyramid. Although symptoms of GDM 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 follow-up glucose screening and intensive counseling on diabetes prevention. The American Diabetes Association recommends blood glucose screening at 6 weeks postpartum for women with GDM and annual testing of any women with impaired fasting glucose or impaired glucose tolerance (59).

J. Referrals to Professional and Community Services

Referrals should be made to registered dietitians and community-based programs. Women with poor weight gain, hyperemesis, poor dietary patterns (eg, avoidance of certain food groups), phenylketonuria, health problems (eg, diabetes, hypertension, other chronic disease), or a history of substance abuse should be referred to a registered dietitian for MNT. Poverty-related factors, including food insecurity, other stressors, and neighborhood characteristics, pose substantial barriers to achieving recommended food intakes and may result in poor pregnancy outcomes (60). Food security of pregnant women can be improved through participation in the federal Special Supplemental Nutrition Program for Women, Infants, and Children. Low-income pregnant women may also benefit from other food assistance or nutrition education programs, including the Food Stamp Program; the Food Stamp Nutrition Education Program; the Expanded Food and Nutrition Education Program; and the National School Lunch and Breakfast Programs. Other appropriate community services may include the Commodity Supplemental Food Program, family service centers, teen pregnancy programs, and minority youth programs.

K. Roles and Responsibilities of Food and Nutrition Professionals

Food and nutrition professionals should coordinate their efforts with schools, health providers, and other

agencies to educate adolescents and women of child-bearing age about the need for good nutritional status before, during, and after conception. Pregnancy provides a window of opportunity to encourage women to make behavior changes that improve immediate outcomes and reduce the risk of future chronic disease in both the mother and her child.

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