

California Food Guide

Maternal Nutrition During Lactation

By Paula Benedict Griffin, M.P.H., R.D.



What's New?

Exercise during lactation will not only improve the mother's cardio respiratory fitness but may increase the amount of essential fatty acids in her breast milk.¹

Public Health Implications

Healthy People 2010 Objective 16-19: Increase the proportion of mothers who breastfeed their babies. In the United States, by 2010, 75 percent of mothers will breastfeed their newborns in the early postpartum period, 50 percent will continue to breastfeed through their infants' first six months and 25 percent will breastfeed their babies throughout their first year of life.²

Target and baseline:³

Objective	Increase in Mothers Who Breastfeed	1998 Baseline (unless noted)	2010 Target
<i>Percent of Mothers</i>			
16-19a.	In early postpartum period	64%	75%
16-19b.	At 6 months	29%	50%
16-19c.	At 1 year	16%	25%
16-19d.	Exclusively through 3 months	43% (2002)	60%
16-19e.	Exclusively through 6 months	13% (2002)	25%

In 2004, 83.9 percent of women in California intended to provide “any breastfeeding,” to their newborn infants upon discharge from the hospital, exceeding the Healthy People 2010 target of 75 percent of mothers breastfeeding in the early postpartum period. However, only 40.5 percent intended to exclusively breastfeed, thus, the Healthy People 2010 Objective 16-19 d. target of 60 percent was not met in California (see Figure 1).

Definition

Lactation, the process of milk secretion, is sometimes referred to as the physiological completion of the female reproductive cycle. During pregnancy, hormonal action prepares the female mammary glands to produce milk, which will continue to be produced in the postpartum period in response to the infant suckling at the breast.⁴

Also during pregnancy a woman’s body prepares to breastfeed by storing additional nutrients and energy needed for milk production. Breast milk provides sufficient calories and nutritive factors to allow an infant to double its birth weight by six months of age. Breast milk is a bioactive, complex fluid containing more than 200 recognized substances varying in composition between women, and from the same woman, depending upon her stage of lactation.⁵ Breast milk of women who deliver a premature infant is higher in calories, fats, protein, immune factors, and anti-inflammatory agents compared to full-term breast milk, therefore, adaptive to the additional nutritional needs of the premature infant.

Maternal nutritional requirements during lactation have been studied in women from many cultures, and while much has been learned, some information is conflicting because of differences in sampling techniques and laboratory analysis methods. However, many studies have documented that lactation and infant growth are not compromised when maternal intakes fall below recommended levels for vitamins, minerals, and energy. The nutritional quality of breast milk remains fairly constant, even when the mother’s supply of nutrients is limited on a short-term basis.^{6, 7}

Benefits of Breastfeeding

The American Academy of Pediatrics (AAP) recommends that infants be breastfed without supplemental foods or liquids for their first six months of life, and that breastfeeding should be continued for the first year of life and beyond, as mutually desired by the mother and child.⁸ Additional discussion of the nutritional benefits of breastfeeding for the infant is contained in the Normal Infant Feeding (0-12 months) chapter.

In addition to being the optimal method to nourish an infant, breastfeeding provides many health benefits for the mother. These benefits include more rapid

recovery from childbirth; decreased postpartum bleeding; delayed return to fertility; reduced risk for breast and ovarian cancers; less bladder and other infections; possibly less post-menopausal hip and spinal fractures; and reduced risk for developing type 2 diabetes.^{8, 9, 10, 11} Many lactating women return to their pre-pregnancy weight more quickly than bottle-feeding mothers.¹² Additional health benefits cited by Riordan are lower serum levels of cholesterol and triglycerides in breastfeeding women compared to women who gave their babies manufactured infant milk (formula).¹²

Nearly every woman is physically capable of breastfeeding. According to the CDC, women who are infected with the hepatitis C virus (HCV) can breastfeed, but should temporarily discontinue breastfeeding if the nipples or surrounding areola become cracked and bleeding. The breast milk can be expressed and discarded while the nipples heal.¹³

However, in some cases a woman should not breastfeed because doing so would place the mother or the infant at risk for an adverse health outcome, surpassing the benefits of breastfeeding.⁴ A mother with a new diagnosis of breast cancer or women who are unable to consume less than two alcoholic drinks per day, who currently use street drugs such as heroin or cocaine, and women who have tested positive for the human immunodeficiency virus (HIV) should not breastfeed, and should discuss their infant feeding plans with their health care provider.¹⁴ However, in developing countries, breastfed infants may be better protected from HIV transmission from their mothers compared to infants given manufactured baby formula. One large study found exclusively breastfed infants of HIV-positive mothers had a significantly lower risk of HIV transmission compared to partially-breastfed or formula-fed babies. It was speculated that the exclusively breastfed infant's superior intestinal mucosal barrier prevented HIV transmission.¹² In developing countries, the health risks of not breastfeeding outweigh the possible risk of HIV transmission, due to increased infant mortality from infectious diseases and nutritional deficiencies.¹⁵

Incidence and Prevalence

Breastfeeding rates are lower in the United States compared to other countries. Only 17 percent to 20 percent of infants in the United States are breastfed for 12 months, compared to 79 percent worldwide. Since the 1970s, breastfeeding initiation rates have increased from a low of about 24 percent to a high of 70 percent in 2002.⁹

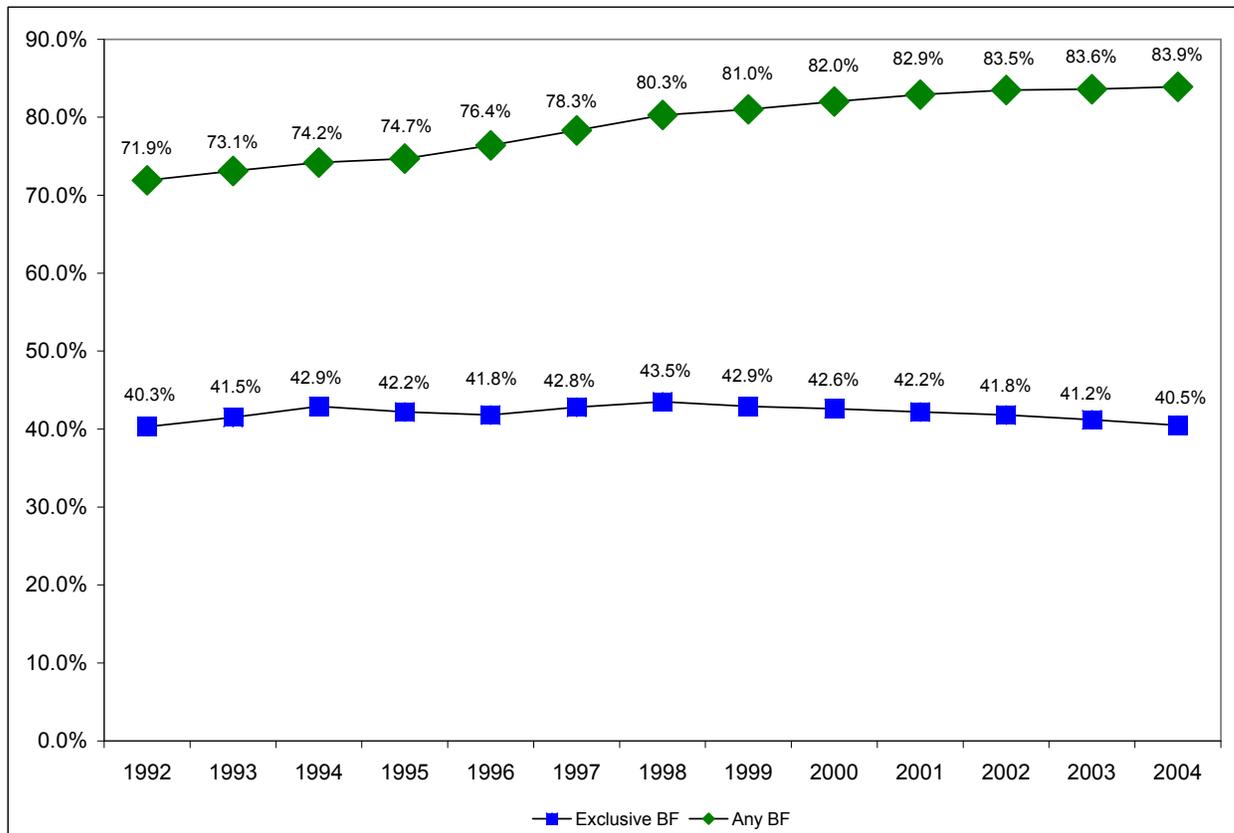
Trends/Nutrient Patterns

As shown in Figure 1, California's rates for "any breastfeeding," a measure of mothers who are "exclusively breastfeeding" and those who give both breast milk and manufactured baby formula to their infants, increased from 71.9 percent to

83.9 percent, between 1992 and 2004, while “exclusive” breastfeeding rates remained relatively stable, with a slight decline since the late 1990s.

Breastfeeding rates differ between ethnic groups, as illustrated in Figure 2. Between 1992 and 2004, Whites, American Indians, and women of “multiple race/other” had higher in-hospital “exclusive breastfeeding” rates, while African-American, Pacific-Islander, and Latina rates were lower. Additional information regarding the incidence and duration of breastfeeding in different ethnic groups in California can be found in the Normal Infant Feeding (0-12 months) and the Health and Dietary Issues Affecting Latinos chapters of this guide.

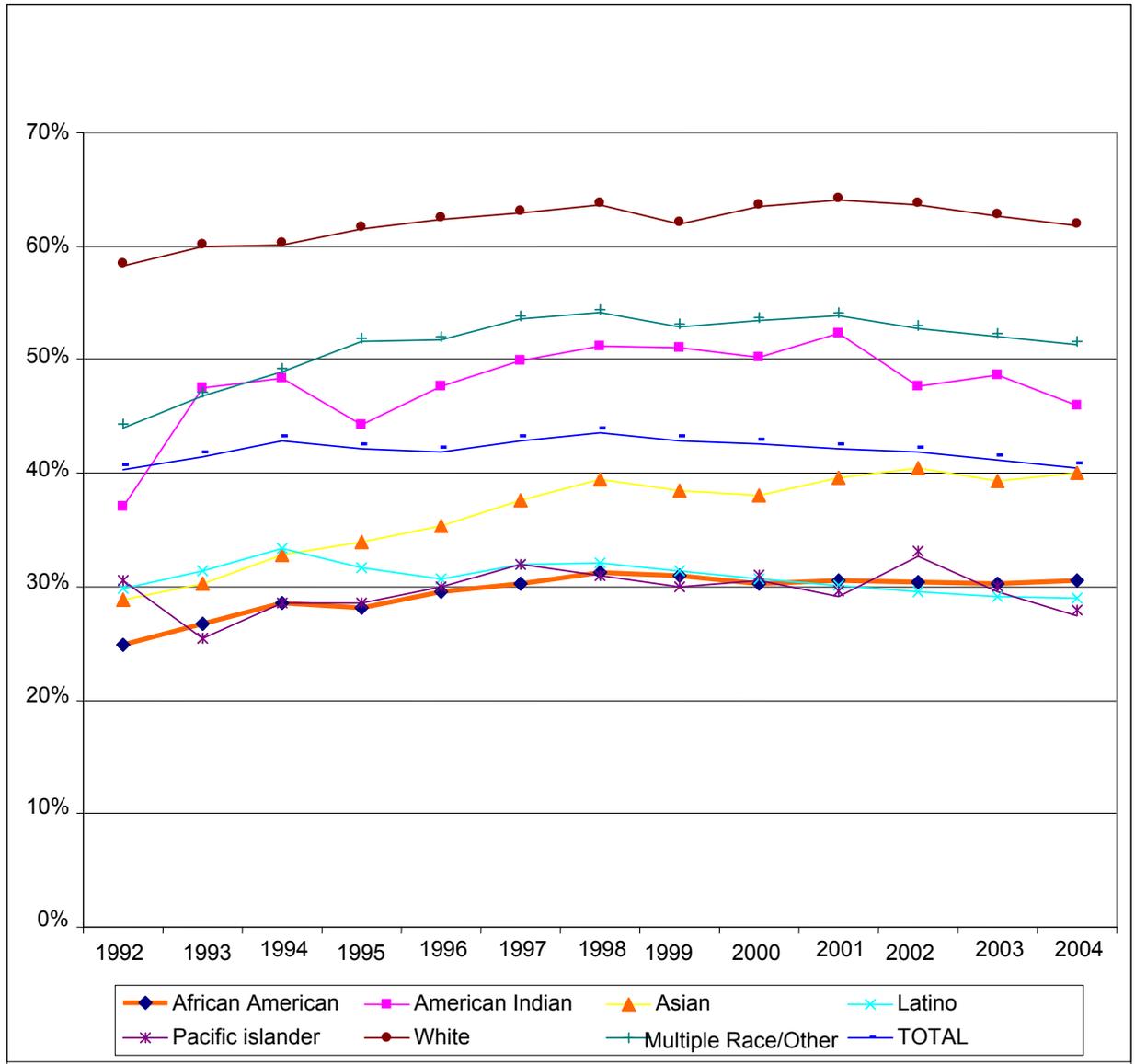
Figure 1: Breastfeeding Rates in California as Reported on the Newborn Screening Test Form (1992-2004)^{16*}



* “Any breastfeeding” includes women exclusively breastfeeding and women who are both breastfeeding and giving manufactured infant formula.

**Data Source: Newborn Screening Data Base, Genetic Disease Branch, California Department of Health Services, 1992-2004.

Figure 2: Exclusive Breastfeeding Rates by Ethnicity 1992-2004¹⁶



Data Source: Newborn Screening Data Base, Genetic Disease Branch, California Department of Health Services, 1992-2004.

Dietary Recommendations

Women who are breastfeeding do not need to consume special foods or excessive amounts of fluid to successfully lactate or to increase their milk production.¹² Dietary restrictions are unnecessary, unless certain foods are suspected allergens to the baby. The belief that a woman’s diet must be “perfect” during lactation is not accurate; women with a wide range of dietary habits and customs worldwide are consistently able to nourish their infants to grow and develop properly. Guidance given to lactating women should be carefully weighed in consideration of the misconception that the maternal diet must be perfect in order to produce quality breast milk.¹⁷ Lactating women

should be encouraged to obtain their nutrients through a well-balanced diet, rather than vitamin and mineral supplements,⁵ and consume a variety of foods using MyPyramid¹⁸ as a guide to food choices.

Four overarching themes within the MyPyramid Education Framework provide a basis for dietary guidance for healthy individuals:¹⁸

- (1) Variety—Eat foods from all food groups and subgroups.
- (2) Proportionality—Eat more of some foods (fruits, vegetables, whole grains, fat-free or low-fat milk products), and less of others (foods high in saturated or *trans* fats, added sugars, cholesterol salt, and alcohol).
- (3) Moderation—Choose forms of foods that limit intake of saturated or *trans* fats, added sugars, cholesterol, salt, and alcohol.
- (4) Activity—Be physically active every day.

The 2005 Dietary Guidelines identifies breastfeeding women with different nutritional requirements than other population groups. Key recommendations for lactating women are listed below in Table 1, and a comprehensive list of nutrient recommendations during lactation is included in Appendix 1.

Table 1: Key Recommendations for Breastfeeding Women from the Dietary Guidelines for Americans 2005¹⁹

Weight Reduction	Moderate weight reduction is safe and does not compromise weight gain of the nursing infant.
Physical Activity	Neither acute nor regular exercise adversely affects the mother's ability to successfully breastfeed.
Alcoholic Beverages	Alcoholic beverages should not be consumed by some individuals, including those who cannot restrict their alcohol intake, women of childbearing age who may become pregnant, pregnant and lactating women , children and adolescents, individuals taking medications that can interact with alcohol, and those with specific medical conditions.

The nutritional profile of breast milk stays remarkably uniform over a wide range of dietary intakes. When the maternal diet is limited, levels of protein, carbohydrate, fat, folate, and most minerals are maintained at consistent levels in her breast milk at the expense of nutrient stores.⁵ In women with adequate vitamin and mineral status, fluctuations in micronutrient intakes are not reflected in milk composition.

Nutrient needs during lactation are a function of the woman's nutrient needs and status, and her output of breast milk. Her needs will be greater if she is feeding twins or triplets, and less if she is only partially breastfeeding an infant who is also receiving formula or complementary solid foods.⁵

Daily Food Choices for Lactating Women

The Dietary Guidelines for Americans 2005 (Dietary Guidelines) does not provide detailed recommendations for lactating women; however, MyPyramid for Moms provides guidance for the daily servings of foods and calories based upon information entered at its website:

www.mypyramid.gov/mypyramidmoms/breastfeeding_nutrition_needs.html, including age of the baby, amount of breastmilk and formula being given to the baby, and age and physical activity level of the mother. Table 2, Daily Food Choices for Lactating Women, is an adaptation of recommendations made in the Dietary Guidelines and MyPyramid, and can serve as a guide to meal planning. While this is only a guide and may not be suitable for all breastfeeding women, it can assist women in obtaining their recommended intakes of nutrients from the food groups.

Energy Needs During Lactation

Energy or caloric needs during lactation are based upon the woman's basal metabolic rate, age, activity level, how much breast milk is being produced, and other factors. While calories are needed for milk production, the mother does not need to eat substantially more than she did in her pre-pregnancy state to sustain milk production.¹²

In most cases, a woman who consumes 500 calories (kcal) per day above her pre-pregnancy intake will be able to maintain her body weight during the first six months postpartum and will have sufficient calories for milk production. After six months postpartum, an extra 400 kcals/day is normally sufficient. These recommendations are based on the average energy expenditure of moderately active women, the estimated caloric cost of lactation, and take into account some fat mobilization from maternal stores, equal to approximately 170 kcal/day.^{20, 21, 22} It is recognized that these guidelines allow for wide variance in energy expenditure and represent the upper limit within the recommended range for additional calories, and many women will require fewer calories to avoid weight gain.¹²

A significant maternal energy deficit appears to reduce the quantity, but not the quality of breast milk. Energy intakes less than recommended levels are seen in women attempting to lose weight, those who are inactive or otherwise have low energy needs, or are food insecure.

Calorie intakes of 1,800 per day or above are recommended for lactating women, and should not consistently fall below 1,500 per day during lactation or milk supply could be compromised.^{5, 20} However, due to differences in tissues stores and metabolic and activity needs between women, it is unrealistic to determine a critical energy level necessary for adequate milk production for all women.²²

While the milk supply of well nourished women does not appear to be negatively affected by short-term energy intakes below current recommendations,^{23, 24} undernourished women may benefit from supplemental food. A study of undernourished Guatemalan women supplemented with approximately 280 kcal per day resulted in improved milk production and the duration of exclusive breastfeeding.²⁵

Table 2: Daily Food Choices for Lactating Women^{18, 19} (2200-2800 calories)*

Food Groups	Recommended # of Servings	Serving Sizes and Food Choices
Grains	7-10 choices of these 1 ounce equivalents	A 1 ounce equivalent is: 1 slice whole grain bread 1 cup dry cereal ½ cup cooked cereal, rice, pasta 1 roll, pancake, small tortilla ½ bagel or English muffin 4 crackers
Vegetables	3½ cups	Raw or cooked vegetables such as carrots, broccoli, sweet potatoes, spinach, pumpkin, squash, peppers, tomatoes, greens, cabbage, snow peas, leafy greens, 100% vegetable juice, corn, potatoes, legumes. <i>Aim for these amounts each week:</i> 3 cups dark green veggies, 2½ cups orange veggies, 3½ cups legumes, 7 cups starchy veggies, and 8½ cups of other veggies.
Fruits	2 cups	Choose fresh, frozen, canned fruit or 100% juice. Medium whole fruit= ½ cup ½ cup dried fruit= 1 cup fresh fruit
Milk	3-4* of these choices *4 for teens	1 cup low-fat or fat-free milk or yogurt 1 ½ ounces cheese 2 ounces of low-fat cheese 1 cup pudding or custard made with milk 1 ½ cups frozen yogurt or ice cream 1 cup calcium- fortified, lactose-free milk or soy milk
Meat & Beans	6-7 choices of these 1 ounce equivalents	A 1 ounce equivalent is: 1 ounce of cooked lean meat, poultry, or fish 1 egg ½ cup cottage cheese ¼ cup cooked dry beans, peas, lentils ¼ cup tofu 1 Tablespoon of peanut butter ½ ounce nuts or seeds
Oils	6-8 teaspoons	Vegetable oil, soft margarine, mayonnaise, salad dressing
Discretionary Calories	290-426	Discretionary Calorie Allowance is the remaining amount of calories in a food intake pattern, after accounting for the calories needed for all food groups using forms of foods that are fat-free or low-fat, and with no added sugars.

***Source:** Adapted from the 2005 Dietary Guidelines for Americans and MyPyramid. Based on recommendations that lactating women, in the normal weight range, need an additional 500 calories per day.

Key Nutrients for Women during Lactation

Nutrients are mobilized from maternal stores to produce breast milk, and the lactating woman is vulnerable to depletion of her nutrient stores. She should be encouraged to consume foods high in calcium, vitamins A, B₁ (thiamin), B₂ (riboflavin), vitamin B₆, B₁₂, folate, and iodine to minimize losses and to maintain her health and well-being.^{5, 19}

Calcium

Calcium's role in the body is to assist with blood clotting, muscle contraction, nerve transmission, and the formation of bone and teeth.²⁶ Calcium is mobilized from the bone during lactation and then replenished later. The calcium content of breast milk is maintained at the expense of maternal stores, and does not appear to be affected by the woman's serum calcium levels or dietary intake and supplementation. Women experience temporary acute bone mineral loss during lactation, only to have bone density restored to normal or above baseline after weaning.^{4, 17} During lactation, alterations in metabolism, absorption, and excretion appear to help preserve maternal calcium stores.⁴

The Food and Nutrition Board of the Institute of Medicine recommends that women 19-50 years of age consume 1,000 milligrams (mgs) of calcium per day, and teens aged 14-18 years consume 1,300 mgs.²⁶ Milk and milk products are excellent sources of calcium, and non-dairy sources include calcium-fortified breakfast cereals, juices, and soy milk, calcium-set tofu, Chinese cabbage, kale, broccoli, and canned fish with bones, such as sardines and salmon.

Calcium supplements should be considered for women who do not consume milk or milk products or a regular source of dietary calcium. In the case of lactose intolerance, Lactaid® milk, yogurt, or hard cheeses may be acceptable sources of calcium. Please refer to the Milk and Milk Products chapter of this guide for additional information.

Vitamin A

Vitamin A is required for vision, immune system function, and maintenance of epithelial tissue.²⁶ The vitamin A content of breast milk is influenced to a greater extent by maternal dietary intake than by the woman's vitamin A status.^{4, 17} Infants are born with relatively small amounts of stored Vitamin A in the liver and rely heavily on intake from breast milk or other dietary sources. However, vitamin A deficiency in breastfed infants is quite rare, as breast milk is a good source of the vitamin.¹² Lactating women should consume an extra 600 µg of vitamin A per day, according to the DRIs.²⁶ Fortified milk, liver, and dark green and orange colored fruits and vegetables are good sources of vitamin A or its precursor, beta carotene.

Vitamin B₁ (Thiamin)

Thiamin plays an important role as a coenzyme in the metabolism of carbohydrates and branched-chain amino acids.²⁶ Breastfed infants of women with beriberi, the thiamin deficiency disease, consequently develop infantile beriberi by three to four weeks of age.²⁷ In thiamin-deficient women, supplementation will increase levels in breast milk to a certain limit, while excess is excreted in the urine.⁴

An additional 0.3 mg of thiamin per day is recommended during lactation,²⁶ easily obtained from a slice of enriched bread. Due to the enrichment of grains, thiamin deficiency in the United States has become rare.

Vitamin B₂ (Riboflavin)

Riboflavin also functions as a coenzyme involved in many reactions in the body. As with all the B vitamins, except folate, maternal intake of riboflavin is reflected in breast milk.⁴ Women who are deficient in riboflavin produce breast milk that is low in riboflavin, but is responsive to supplementation.

During lactation, the recommended extra 0.5 mg per day²⁶ can be obtained from a glass of milk and enriched grains. Since grains in the United States have been enriched with riboflavin, deficiencies are rare.

B₆ (Pyridoxine, pyridoxal, and pyridoxamine)

Vitamin B₆ functions as a coenzyme in the metabolism of amino acids and glycogen.²⁶ The B₆ content of breast milk is directly related to maternal intake and has been known to drop to critically low levels in mothers with a long-term history of oral contraceptive use.⁴ However, modern formulations of oral contraception contain lower levels of estrogens than those previously studied, and the effect on B₆ status in breast milk is not clear.⁵

Very high doses of vitamin B₆ have been shown to suppress lactation by reducing prolactin levels, thus lactating women taking supplements should not take more than 25 mg of B₆ per day.²⁸

An extra 0.7 mg of pyridoxine per day is recommended during lactation,²⁶ which can be easily consumed in a bowl of fortified breakfast cereal.

Vitamin B₁₂ (Cobalamin)

Vitamin B₁₂ functions as a coenzyme in nucleic acid metabolism. Deficiency of this vitamin has been seen in infants breastfed by mothers who were very strict vegetarians. Maternal supplementation should be considered for women who may have very low B₁₂ stores, such as total vegetarians (vegans) who consume no animal-based foods or beverages, or those with Crohn's Disease, a history of gastrectomy or parasitic or gastrointestinal bacterial infection. Long-term

neurological problems can result from vitamin B₁₂ deficiency during infancy.^{27, 29, 30, 31}

An extra .04 µg of Vitamin B₁₂ is recommended daily during lactation, and is easily obtained from milk, eggs, meat, fish, poultry, or enriched cereals or grains.

Folate (Folic Acid, Folacin)

Folic acid has been recognized for its role in the prevention of neural tube defects. In 1992, the U.S. Public Health Service recommended that all women of childbearing age consume 0.4 mg (400 micrograms) of folic acid daily to prevent two common and serious birth defects, spina bifida, and anencephaly.

While severe maternal folate deficiency can influence the folate content of breast milk, milk production appears to take priority in folate utilization. This was illustrated in a study involving overtly folate deficient women with megaloblastic anemia. The women were supplemented with folate and the researchers observed an increase in the folate content of the women's breast milk, however, no change was seen in their plasma folate levels.^{32, 33}

In 1998, all grain products manufactured in the United States were required to be fortified with folic acid. Orange juice, fortified breakfast cereals, and dark green vegetables are good sources of folic acid.

Iodine

Iodine is a component of the thyroid hormones and is essential to prevent goiter and cretinism.²⁶ Iodine levels in breast milk vary based upon maternal intake and are strongly influenced by maternal intake. Pregnant and lactating women in geographic areas where iodine deficiencies are prevalent should be supplemented with iodine to prevent brain damage and mental retardation in their children.^{32, 34} In the United States, iodized table salt is a good source of this mineral.

Protein

Protein needs are greater for women during lactation compared to non-pregnancy. The Food and Nutrition Board of the Institute of Medicine has set the Recommended Dietary Allowance (RDA) for lactating women of all ages at 71 grams of protein, using 1.1 grams of protein per 1 kilogram reference body weight, with an acceptable range of intake between 10 and 35 percent of total calories.³⁵ Consumption of a variety of six 1- ounce equivalents from the Meat and Beans Group and three servings from the Milk Group helps to meet this need.

The protein content in breast milk appears to be influenced very little by maternal diet and is more affected by the age of the infant.¹⁷ Proteins are synthesized in the breast based on gene expression, which is influenced by changing hormone

levels in the weeks and months after delivery.³⁶ While the protein content of human breast milk is low in comparison to other mammalian species, breast milk proteins provide appropriate amounts of amino acids vital for the proper growth of the infant. Breast milk proteins also provide antiviral, antimicrobial, and anti-inflammatory factors to protect the infant's system.³⁵

Carbohydrate

Carbohydrates provide a readily available source of energy to the body and are present in nearly all foods that have calories, except fats and oils. A woman's RDA for carbohydrates increases to 210 grams during lactation.²² Lactose is the major carbohydrate in breast milk and is second only to water as a major constituent of breast milk. Lactose content in breast milk is similar between women, and does not appear to be affected by maternal diet.⁵

Fat

The total fat content of breast milk remains consistent independently of the mother's diet. However, the types of fatty acids present in breast milk are influenced by maternal diet and energy balance.^{37, 38} A woman with a diet high in monounsaturated fatty acids would have a large amount of this type of fatty acid reflected in her breast milk. This is also true for DHA (docosahexaenoic acid), recognized for its important role in retinal development. When a woman loses weight while lactating, the breast milk contains the types of fatty acids found in her adipose tissue.

The breast milk of women who deliver prematurely is higher in long chain polyunsaturated fatty acids, consistent with the premature infant's greater need for these fatty acids necessary for growth and brain development.³²

Although a mother's dietary fat intake may vary on a daily basis, hormonal changes during lactation allow for the production of breast milk with a fatty acid content appropriate for the baby.³² RDAs for fat intake have not been established, however, an acceptable range for adults is 20-35 percent of total calories, with the recommendation that saturated fat and trans fatty acid consumption be kept as low as possible with a nutritionally adequate diet.²²

Fluid intake

Breast milk production and volume is not affected by short-term increases or decreases in fluid intake. However, excessive fluid intake has been shown to negatively affect milk production in a study by Dusdieker, as cited in Lawrence & Lawrence.⁴ Women can be advised to have a beverage nearby while they are breastfeeding their baby, but only need to drink in response to thirst. Adequate hydration is best indicated by passing urine with a pale yellow color,¹⁷ however, women taking certain medications or multivitamins may find their urine color to be altered and should not depend solely on urine color as a guide to hydration status.

Vitamin and Mineral Supplements

A lactating woman should not routinely depend upon a multivitamin supplement to meet her nutritional needs. However, women with very restricted diets, such as vegans, or who regularly consume less than 1,800 calories per day could benefit from calcium and multivitamin supplements.⁵ A nutritional assessment from a health care provider can reveal if a woman could benefit from a multivitamin supplement.

In 1992, the U.S. Public Health Service recommended that women of childbearing age consume 400 micrograms of folic acid per day to reduce their risk of having a pregnancy affected by a neural tube defect (NTD). Since lactating women are of childbearing age, a daily folic acid supplement or multivitamin with folic acid is advised. Supplementation with folic acid in women before conception and during early pregnancy has been shown to reduce the occurrence of NTDs by at least 50-70 percent.³⁹

Other Vitamins and Minerals during Lactation

Vitamin D

The vitamin D content of breast milk is influenced by maternal vitamin D status, and breast milk does not typically provide enough to meet infant needs. Infants rely on stored vitamin D as well as adequate exposure to sunshine, equivalent to two hours per week while fully clothed. Infants breastfed by mothers who restrict their intake of vitamin D-rich foods, or have severely limited exposure to sunlight can develop rickets due to a vitamin D deficiency.³² See the Normal Infant Feeding (0-12 months) chapter of this guide for additional information.

Iron

In contrast to pregnancy, the recommended intake for iron during lactation is not increased, and is actually lower than that of a non-pregnant female. The RDA for iron during lactation is nine grams for women 19-30 years of age, versus 18 grams for the non-pregnant female and 27 grams for pregnant women of the same age. These recommendations for intake are based on menstruation resuming at six months postpartum and iron losses in breast milk and normal metabolic processes, but does not take into account the high prevalence of iron-deficiency anemia in women of childbearing age and the need to recover iron stores after pregnancy.²³

The iron content of breast milk does not appear to be related to maternal dietary intake. Iron supplements taken by the mother will not increase iron levels in breast milk, even if the mother is anemic. In women, iron-deficiency anemia has been associated with postpartum depression.⁴⁰

Barriers to Implementations/Myths

Postpartum Weight Loss

Although the caloric cost of breastfeeding has been estimated at 670 calories per day, and the hormonal environment favors the mobilization of fat stores, most lactating women lose weight at a relatively slow rate during the first six months postpartum, ~0.8 kg/mo in affluent populations and ~0.1 kg/mo in disadvantaged populations. Differences in mean weight changes are likely due to differences in gestational weight gains, cultural practices, physical activity level, and seasonal food availability.⁴¹

Weight loss in the first six months postpartum is normally 0.5-1.0 kg (~1-2 pounds) per month; however, not all lactating women lose weight. Overweight women can lose up to 2.0 kg (~4.5 pounds) per month without adverse effects on milk production.⁵

Intentional weight loss should not be attempted until two months postpartum, and then at a rate of no more than 2 kg (~4.5 pounds) per month, consuming a diet of at least 1,800 calories per day.⁵ This loss should be managed with a combination of changes in food intake and increased physical activity.

For women motivated to lose weight at a somewhat increased rate, a modest reduction in caloric intake does not appear to influence breast milk composition or volume.²⁰ A study involving well-nourished women, found that milk production was not compromised during a ten week weight loss program that included a 23 percent reduction in energy intake and resulted in a weekly weight loss of one pound.⁴²

A recent study with overweight lactating women who decreased their energy intake by 500 calories per day, primarily by restricting chips, soft drinks, and other fats and sweets, had nutrient intakes comparable to a group of overweight lactating women who did not restrict their intake. However, the restricted group consumed one less serving of milk and had lower vitamin D and calcium intakes than the control group. Both groups had low intakes of vitamin C and E.⁴³

Colic and Maternal Diet

It is commonly believed that eating certain foods, such as onions, garlic, and broccoli can cause a colicky baby. However, few studies have shown any association between these foods and infant distress. Women should presume that all foods will be tolerated well by the infant and only eliminate specific foods after they have been demonstrated as problematic for the baby. If a mother is concerned that her infant is reacting to her diet, she should keep a record of the food she eats and information about her baby's response, including symptoms and/or behaviors and discuss any concerns with her health care provider.^{4, 17}

Maternal Intake of Food Allergens

Breastfeeding offers protection from both respiratory and food allergies throughout childhood and adolescence. However, if a breastfed baby shows allergic symptoms, the mother should consider avoiding the major food allergens—wheat, peanuts, soybeans, tree nuts, eggs, cow’s milk—for ten to 14 days. If the infant shows a reduction in symptoms, the foods can be reintroduced one at a time to help identify the cause. The most common food allergen for infants is cow milk’s protein, which can be ingested from whole milk, manufactured baby formula, or passed through the breast milk from the mother.¹²

Vegetarianism and Lactation

Vegetarian mothers should be encouraged to breastfeed as they produce breast milk with a similar composition to that of non-vegetarian women. However, vegetarian diets must include regular sources of vitamin B₁₂, calcium, and vitamin D. Vitamin B₁₂ is found naturally in foods of animal origin, and sometimes added as a supplement to plant-based food products. Vegetarians who do not use milk and milk products need good alternate sources of calcium, protein, and vitamins B₂, B₁₂, and D.¹⁹

Docosahexaenoic acid (DHA) is an essential fatty acid that plays a role in infant brain and eye development. Vegans and other vegetarians who do not do regularly eat eggs should be encouraged to include sources of linolenic acid, a DHA precursor. DHA has been measured in breast milk of vegetarian women at lower levels than in non-vegetarians. These women should also be encouraged to limit their intake of foods containing linoleic acid, such as corn, safflower and sunflower oil, and limit foods with hydrogenated fats, such as stick margarine, as they hinder the conversion of linolenic acid to DHA.⁴⁴

Additional information about vegetarianism can be found in the *Vegetarian Diets* chapter in this guide.

Physical Activity and Lactation

Milk production appears to be protected when lactating women participate in exercise and increase their energy expenditure. Several factors may be involved including an increase in energy intake and an increase in prolactin levels. Several studies suggest that lactating women will increase energy intake to compensate for any increase in energy expenditure due to a physical activity program, with no apparent effect on milk production or infant growth.^{45, 46} Additionally, in response to aerobic activity, there is an increase in fatty acid mobilization to meet the needs of milk production.³²

Caffeine and Lactation

Caffeine is a stimulant found in many foods, beverages, and over-the-counter medications. Products such as energy beverages, weight loss aids, and herbal supplements may also contain caffeine. Caffeine concentration peaks in breast milk one to two hours after consumption. While adults can metabolize a large

amount of caffeine within five hours, this process can take nearly 20 times longer in a newborn. Irritability and sleeplessness in the breastfed infant after maternal caffeine consumption has been described.²⁸

Chronic coffee drinking may also reduce the amount of iron in breast milk. Chronic and persistent ingestion of caffeine during lactation should be avoided, especially during the first few months of the infant's life; however, occasional use of caffeine is not contraindicated during lactation.^{28, 47} If a baby appears to be responding to the caffeine in the mother's diet, all caffeine-containing products should be avoided for two to three weeks.⁴⁸

Alcohol and Lactation

Although wine and beer have been recommended to improve lactation, this has proven untrue. Studies suggest that alcohol can impair milk ejection and cause a reduction in milk volume.⁴⁹

Peak breast milk levels are seen 30-60 minutes after alcohol consumption and at 60-90 minutes when accompanied by food. As alcohol is metabolized by the woman's liver, her plasma and milk levels decline. Clearing the equivalent of one serving of beer or wine from a 120-pound woman's body has been estimated to take two to three hours.^{4, 50}

Studies show that maternal ingestion of alcohol changes the odor of the breast milk and can reduce the volume consumed by the infant by as much as 20 percent. Even short-term exposure to small amounts of alcohol in breast milk has been shown to result in a decrease in the total sleep time for the infant.⁵⁰

Smoking, Nicotine, and Lactation

Maternal smoking is associated with reduced milk volume, impaired milk ejection reflex, and early weaning. However, breastfed infants of mothers who smoke receive better protection than bottle-fed babies with less acute respiratory illness⁸ and risk for Sudden Infant Death Syndrome (SIDS). Women who are unable to quit should be advised to not smoke while nursing or in the presence of the infant.^{4, 51, 52, 53}

Studies have shown that using a 14-mg or seven-mg nicotine patch offers a sustained and lower nicotine level than smoking and appears to not affect the milk intake of the breastfed infant. However, nicotine gum may cause significant peaks in plasma nicotine levels and it is recommended that mothers wait two to three hours after using the gum product to breastfeed.²⁸

Herbal Products, Over the Counter Medications, and Prescription Drugs during Lactation

Several herbal preparations are marketed with the promise to either increase or decrease milk supply. However, some herbal supplements are incompatible with successful lactation while others can be dangerous to the woman's health. Since

herbal preparations and dietary supplements are not regulated as medications, their active ingredients, safety, efficacy, potency, and purity are unknown.^{54, 55}

Fenugreek is an herbal substance with a widespread reputation as a galactagogue, a substance which increases milk production; yet its efficacy is not supported by scientific evidence. While this product has limited toxicity when consumed in moderation, a few cases of adverse side effects have been reported.²⁸

Most non-prescription, over-the-counter medications pose little or no risk of harm to a breastfed infant. However, aspirin, implicated in Reye's syndrome, and pseudoephedrine, which can dramatically reduce milk production, should be avoided during lactation, and better alternatives such as ibuprofen and acetaminophen could be used under the guidance of a health care provider.²⁸ The recommendation to reduce or discontinue breastfeeding due to maternal medication should only be made when no alternative drug can be given and the risk to the baby significantly outweighs the benefits of breastfeeding.¹⁷ Breastfeeding women should discuss their use of herbal products or medication with their health care provider in order to select the best option during lactation.¹⁴

Illicit Drugs and Lactation

Most drugs pass to some extent into breast milk. The active ingredient in marijuana, delta-9-tetrahydrocannabinol (THC), concentrates in breast milk prior to entering the infant's circulatory system and can result in impaired infant motor development at twelve months of age.⁵⁶ Other drugs of abuse, such as heroin, cocaine, the hallucinogens, and methamphetamines pass into breast milk and can have detrimental effects on the infant.¹²

Women who are currently using illegal, recreational drugs should be advised of the effect of these substances on their infants, and that their infants will be drug-screen positive for as long as a few weeks after ingestion. The lactating woman who is unable to remain drug-free should discuss her infant feeding plans with her health care provider, and should probably be advised to bottle-feed.¹²

Opportunities for Improvement

- (1) Assure lactating women are assessed for nutritional adequacy and the use of tobacco, alcohol, drugs, herbal products, and over-the-counter medications, and have access to appropriate counseling and referral sources.
- (2) Support measures to provide pre-conception nutrition and healthy lifestyle education and counseling, including the importance of a daily 400 mcg. folic acid supplement, and appropriate child spacing to allow recovery of maternal nutritional status.

- (3) Support an environment where lactating women can comfortably breastfeed their babies, without fear of ridicule or unwarranted reprisal.
- (4) Support communities that provide reduced exposure to tobacco, alcohol, and drugs to all women of childbearing age.

This chapter was reviewed by Suzanne Haydu, MPH, RD, Janet Hill, MS, RD, IBCLC, of the California Department of Health Services (CDHS), Maternal, Child, and Adolescent Health and Office of Family Planning Branch, Jeanette Panchula, RN, IBCLC, of CDHS and Solano County Health and Human Services, and Lindsay Bowersox, RD, IBCLC, Dietitian and Lactation Consultant, Community Medical Centers WIC Program and UC Davis, MS Graduate Program.

Significant contributions to this chapter were made by original author Timaree Hagenburger, MPH, RD. Additional contributions to this chapter were made by Natalie Melcher, B.A. and Jacqueline Kampp, PHN, MS, RN.

Appendix 1: Nutrient Recommendations for Lactating Women (19, 22, 26)				
Nutrient	Dietary Reference Intake (DRI) for non-pregnant, non-lactating women (per day) 19-50 yrs	Additional amount above DRI recommended for Lactating Women (per day) 19-50 yrs	Tolerable Upper Intake Level (UL) (per day)	Food Sources
Protein	50 g	+15 g (0-6 mo postpartum) +12 g (6-12 mo postpartum)	Not determined	Meat, fish, poultry, dry beans, eggs, tofu, cheese, nuts, seeds
Carbohydrates-- total digestible	130 g	+80 g	Not determined	Grains, pasta, starchy vegetables, fruit and fruit juices
Total Fiber	25 g	+4 g	Not determined. Excessive intake can cause gastrointestinal distress and is usually self-limiting.	Whole grains, vegetables, whole fruit, dry beans, nuts
Total Fat	Not determined	Not determined	No defined excessive intake level for potential adverse effects	Whole milk, meats, vegetable oils, butter
Linoleic acid (n-6 polyunsaturated fatty acids)	12 g	+1 g	No defined excessive intake level for potential adverse effects	Nuts, seeds, vegetable oils
Linolenic (n-3 polyunsaturated fatty acids)	1.1 g	+2 g	No defined excessive intake level for potential adverse effects	Vegetable oils, flax seed, fatty fish, fish oils, eggs
Fat-Soluble Vitamins				
Vitamin A	700 µg	+600 µg	3,000 µg	Liver, fish, dairy products, darkly-colored fruits and leafy vegetables
Vitamin D	5 µg	-----	50 µg	Fortified dairy products
Vitamin E	15 mg	+ 4mg	1000 mg	Nuts, vegetable oils
Vitamin K	90 µg	----	Not determined	Leafy green vegetables, Brussels sprouts, broccoli, vegetable oils.
Water-Soluble Vitamins				
Vitamin B ₁ (Thiamin)	1.1 mg	+0.3 mg	Not determined	Enriched, fortified, or whole-grain products
Vitamin B ₂ (Riboflavin)	1.1 mg	+0.5 mg	Not determined	Organ meats, milk, bread products and fortified cereals
Vitamin B ₃ (Niacin)	14 mg	+3 mg	35 mg	Meat, fish, poultry,

Appendix 1: Nutrient Recommendations for Lactating Women (19, 22, 26)				
Nutrient	Dietary Reference Intake (DRI) for non-pregnant, non-lactating women (per day) 19-50 yrs	Additional amount above DRI recommended for Lactating Women (per day) 19-50 yrs	Tolerable Upper Intake Level (UL) (per day)	Food Sources
				whole grain breads and bread products, fortified cereals
Vitamin B ₆ (Pyridoxine, Pyridoxal, and Pyridoxamine)	1.3 mg	+0.7 mg	25 mg	Fortified cereals, organ meats, fortified soy-based meat substitutes
Vitamin B ₁₂ (Cobalamin)	2.4 µg	+0.04 µg	Not determined	Meat, fish, poultry, fortified cereals
Folate	400 µg	+100 µg	800 µg	Enriched cereal grains, fortified ready-to-eat cereals, dark green leafy vegetables
Vitamin C	75 mg	+45 mg	2,000 mg	Citrus fruit, strawberries, bell pepper, broccoli, cabbage, spinach, tomatoes
Pantothenic Acid	5 mg	+2 mg	Not determined	Whole grains, poultry, yeast, potatoes, broccoli
Biotin	30 µg	+5 µg	Not determined	Liver, some meats and fruit
Choline	425 mg	+ 125 mg	3,500 mg	Eggs, liver, milk, peanuts
Minerals				
Calcium	1,000 mg 1,300 mg (14-18 yrs)	---	2,500 mg	Milk and milk products, Chinese cabbage, kale, broccoli, calcium-set tofu
Potassium	4.7 g	+0.4 g	Not determined	Fruits, vegetables. dried peas, dairy products, meats, nuts
Phosphorus	700 mg	---	4000 mg	Milk and milk products, eggs, peas, meat
Magnesium	310 mg (19-30 yrs) 320 mg (31-50 yrs)	---	350 mg <i>only when consumed in supplemental form. No UL established for Mg</i>	Green leafy vegetables, unpolished grains, nuts, meat, milk

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			<i>consumed from foods.</i>	
Manganese	1.8 mg	+0.8 g	11 g	Nuts, legumes, tea, whole grains
Chloride	2.3 g	---	3.6 g	Processed foods with added sodium chloride, salted meats, nuts, cold cuts
Chromium	25 µg	+ 20 µg	Not determined	Some cereals, meats, poultry, fish, beer
Copper	900 µg	+400 µg	10,000 µg	Organ meats, seafood, nuts, seeds, whole grains
Fluoride	3 mg	----	10 mg	Fluoridated water, teas, marine fish
Iodine	150 µg	+140 µg	1,100 µg	Iodized salt, foods of marine origin
Iron	18 mg	less 9 mg	45 mg	Meat, poultry, for- tified breads and grains, dry beans
Selenium	55 µg;	+15 µg	400 µg	Organ meats, seafood, plants (depending upon soil selenium content)
Sodium	1.5 g	--	2.3 g	Processed foods with added sodium chloride, salted meats, nuts, cold cuts
Zinc	11 mg	+2 mg (≤ 18 yrs) +1 mg (19-30 yrs) +1 mg (31-50 yrs)	34 mg (≤ 18 yrs) 40 mg (19-30 yrs) 40 mg (31-50 yrs)	Fortified cereals, red meat

Sources: See reference citations listed above in the table title.

Resources/Web Sites

The Academy of Breastfeeding Medicine (ABM)

<http://www.bfmed.org/index.asp>

The American Academy of Pediatrics

141 Northwest Point Blvd., Elk Grove Village, IL, 60007

1-847- 434-4000

<http://www.aap.org/>

Breastfeeding Policy

<http://www.aap.org/policy/re9729.html>

Breastfeeding Promotion in Pediatric Office Practices Program

1-847-228-5005, extension 4779

<http://www.aap.org/breastfeeding/new%20resources.cfm#AAP>

Baby-Friendly USA Hospital Initiative

1-508- 888-8092

<http://www.babyfriendlyusa.org>

Best Start Social Marketing

Web site: www.beststartinc.org/trainings.asp

Breastfeeding Online (Jack Newman, M.D.)

<http://www.breastfeedingonline.com/newman.shtml>

The Breastfeeding Task Force of Greater Los Angeles

<http://www.BreastfeedLA.org>

California Department of Public Health

Maternal Child and Adolescent Health Branch

1615 Capitol Avenue

Sacramento, California 95899-7420

1-866-241-0395

<http://www.cdph.ca.gov/programs/MCAH/Pages/default.aspx>

California Department of Public Health

WIC Supplemental Nutrition Branch

3901 Lennane Drive

Sacramento, California 95834

1-800-852-5770

<http://www.wicworks.ca.gov>

UC Davis Human Lactation Center
Department of Nutrition
University of California
One Shields Avenue
Davis, California 95616
Phone: (530) 754-5364
<http://lactation.ucdavis.edu>

Human Milk Banking Association of North America
1500 Sunday Drive, Suite 102, Raleigh, NC 27607
1-919-787-5181
<http://www.hmbana.org>

International Lactation Consultants Association
ILCA · 1500 Sunday Drive · Suite 102 · Raleigh, NC 27607
1-919-861-5577
<http://www.ilca.org>

Lactation Education Resources
3621 Lido Place
Fairfax, VA 22031
1-703-691-2069
<http://www.LERon-line.com>

La Leche League International
1400 N. Meacham Rd., Schaumburg, IL 60173-4808
1- 847-519-7730
TTY: 1-847-592-7570
<http://www.lalecheleague.org>

MyPyramid for Pregnancy and Breastfeeding
<http://www.mypyramid.gov/mypyramidmoms/index.html>

Wellstart International
P.O. Box 80877
San Diego, CA 92138-0877
Phone: 619-295-5192
<http://www.wellstart.org>

World Alliance for Breastfeeding Action (WABA)
P.O. Box 1200, 10850 Penang, Malaysia
<http://www.waba.org.my/>

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