Maternal Nutrition

During Pregnancy and Lactation

Health workers often lack adequate information to counsel pregnant and lactating women on how to meet increased nutrient requirements through dietary and behavioral changes and other health practices. They are uncertain how to translate general requirements into individual recommendations. This document attempts to fill this information gap and to help programs develop appropriate protocols and counseling materials on maternal nutrition.

Women's nutrient needs increase during pregnancy and lactation, as shown in tables 1-3 inside this folder. Some of the increased nutrient requirements protect maternal health while others affect birth outcome and infant health. If the requirements are not met, the consequences can be serious for women and their infants.

During pregnancy all women need more food, a varied diet, and micronutrient supplements. When energy and other nutrient intake does not increase, the body's own reserves are used, leaving a pregnant woman weakened. Energy needs increase in the second and particularly the third trimester of pregnancy. Inadequate weight gain during pregnancy often results in low birth weight, which increases an infant's risk of dying. Pregnant women also require more protein, iron, iodine, vitamin A, folate, and other nutrients. Deficiencies of certain nutrients are associated with maternal complications and death, fetal and newborn death, birth defects, and decreased physical and mental potential of the child.

Lactation places high demands on maternal stores of energy, protein, and other nutrients. These stores need to be established, conserved, and replenished. Virtually all mothers, unless extremely malnourished, can produce adequate amounts of breastmilk. The energy, protein, and other nutrients in breastmilk come from a mother's diet or her own body stores. Women who do not get enough energy and nutrients in their diets risk maternal depletion. To prevent this, extra food must be made available to the mother. Breastfeeding also increases the mother's need for water, so it is important that she drink enough to satisfy her thirst.

Maternal deficiencies of some micronutrients can affect the quality of breastmilk. These deficiencies can be avoided if the mother improves her diet before, during, and between cycles of pregnancy and lactation, or takes supplements. For example, studies have shown that appropriate supplementation improves vitamin A levels in the mother, in her breastmilk, and in the infant.

Meeting Nutrient Requirements

Adequate energy intake and a diversified diet that includes fruit, vegetables, and animal products throughout the life cycle help ensure that women enter pregnancy and lactation without deficiencies and obtain adequate nutrients during periods of heightened demand. Some nutrient requirements, particularly iron, folic acid, and vitamin A, are more difficult to achieve than others through food sources. For this reason, supplements with these nutrients are recommended in addition to improved diets. Fortified foods should be promoted through counseling and social marketing in countries where foods fortified with iron, iodine, folic acid, or vitamin A are available and affordable.

Table 1 Weight Gain Recommendations for Pregnancy is based on pre-pregnancy weight. Individual energy requirements vary according to pre-pregnancy height and weight, metabolic rate, and activity level. Energy requirements will increase in special circumstances such as adolescence, multiple pregnancies, and HIV infection. Health workers should assess the nutritional situation of women of reproductive age and tailor antenatal care messages about dietary intake, healthy levels of weight gain during pregnancy, and gradual weight loss during lactation according to pre-pregnancy body mass index (BMI).

Table 2 Micronutrient Supplementation during Pregnancy and Lactation shows the dosage and timing for vitamin A, iron/folate, and iodine supplementation. Appropriate regimens for micronutrient supplementation vary with the prevalence and epidemiology of deficiencies and with existing policies and programs. Health workers should consult local protocols.

Table 3 Summary of Increased Nutritional Needs during Pregnancy and Lactation gives examples of common foods in various parts of the world and lists actions health workers can take to promote improved nutrient intake. The examples show nutrient variations in comparable quantities of food, underlining the necessity of tailoring messages to local foods. For example, because an extra serving of potatoes or tortilla does not provide nearly as many additional calories as a serving of cassava, a generic message to eat an additional serving of the staple food may not be appropriate.

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Table 1. Weight Gain Recommendations for Pregnancy[1]

Pre-pregnancy Weight Category	Recommended Total Gain	
	Kilograms	Pounds
BMI < 19.8	12.5 – 18.0	28 – 40
BMI 19.8 to 26.0	11.5 – 16.0	25 – 35
BMI > 26.0 to 29.0	7.0 – 11.5	15 – 25

1. Institute of Medicine. Nutrition During Pregnancy, 1990.

BMI = body mass index (weight in kg divided by height in meters squared, or kg/m^2)

Consequences of Maternal Malnutrition

Consequences for maternal health

- Increased risk of maternal complications and death
- Increased infection
- Anemia
- Lethargy and weakness, lower productivity

Consequences for fetal and infant health

- Increased risk of fetal, neonatal, and infant death
- Intrauterine growth retardation, low birth weight, prematurity
- Birth defects
- Cretinism
- Brain damage
- Increased risk of infection

Table 2. Micronutrient Supplementation during Pregnancy and Lactation

Supplement	Timing	Dosage
Vitamin A[2,a] *(in vitamin A-deficient populations)*	**During pregnancy:** After the first trimester	10,000 IU daily or a maximum of 25,000 IU weekly
	During lactation (after delivery): As soon as possible, but not later than 8 weeks after delivery	Single dose of 200,000 IU
Iron/Folate[3-4,b]	**Prevention of anemia** Anemia prevalence >40%: 6 months during pregnancy through 3 months postpartum Anemia prevalence ≤40%: 6 months during pregnancy	60 mg iron and 400 µg folic acid daily
	Treatment of anemia Until resolved or a minimum of 3 months, then continue with prevention regimen	120 mg iron and 800 µg folic acid daily
Iodine[5]	Before conception or as early in pregnancy as possible in high risk areas where iodized salt is not available	Single dose of 400–600 mg (2 or 3 capsules)

2. WHO. Safe Vitamin A Dosage during Pregnancy and Lactation, 1998.
3. UNICEF/UNU/WHO. Iron Deficiency Anaemia: Assessment, Prevention, and Control, 2001.
4. Stoltzfus RJ, Dreyfuss ML. Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia, 1998.
5. WHO. Postpartum Care of the Mother and Newborn: A Practical Guide, 1998.

Notes:

[a] Recommendations for vitamin A supplementation are currently under review and may be increased, pending the results of ongoing research. (See: IVACG. The Annecy Accords to Assess and Control Vitamin A Deficiency: Summary of Recommendations and Clarifications, 2002.)

[b] Neural tube defects are caused by folate deficiency during the first few weeks of pregnancy. To prevent these and to ensure that mothers enter pregnancy with sufficient iron stores, women should also take iron/folate supplements routinely if there is a possibility they could become pregnant.

Table 3. Summary of Increased Nutritional Needs[a] during Pregnancy and Lactation[6-7]

Nutrient	Non-pregnant, non-lactating woman	Increase in pregnancy: 1st trimester	Increase in pregnancy: 2nd trimester	Increase in pregnancy: 3rd trimester	Increase in lactation: 0-6 months	Increase in lactation: 7-12 months	Food sources (with nutrient value of cooked portions)[c]	Health actions
Energy	2200 kcal	+0 kcal	+240 kcal	+452 kcal	+500[b] kcal	+400 kcal	All oily, starchy, and protein foods contribute significant calories 1 cup rice =267 kcal 1 corn tortilla =66 kcal 1 cup cassava =204 kcal 1 white bun (bread) (35g) =90 kcal 1 cup potatoes =135 kcal 1 Tbsp oil or fat =90 kcal	Advise families that pregnant women need extra food each day (one or more servings of the staple food) and that lactating women need an extra meal. Counsel families that reducing the woman's workload and ensuring opportunity for rest will help her conserve energy. Monitor weight gain during pregnancy.
Protein	46 grams			+25 grams			Animal source foods, fish, pulses/legumes 70 g chicken, stewed =19 g 1 egg (raw or cooked) =6 g 1 cup cow's milk =9.6 g 1 cup dried beans, peas, lentils =16-18 g 100 g tempeh or tofu =18 g	Promote favorable intra-family food distribution by educating men and older women. Improve food and economic security and, in rural areas, promote small livestock production. Counsel pregnant women and their families on the need for protein and identify local foods rich in protein.
Vitamin A	700 RAE[d]		+70 RAE		+600 RAE		Liver, eggs, dark orange and yellow fruits and vegetables, dark green vegetables, red palm oil, fortified oils or other fortified products 1 chicken liver (20g) =983 RAE 1 whole egg =229 RAE 1 whole carrot =1010 RAE 1 cup cooked greens =150 RAE 1 cup cooked pumpkin =1325 RAE 1 medium mango =321 RAE	Promote increased consumption and production of fresh or dried fruits and vegetables. Initiate or strengthen systems for prenatal and postpartum supplementation.
Iron	18 mg		+9 mg		+0 mg		Animal source foods such as red meats, red organ meats, poultry, fish; fortified foods; beans and some green leafy vegetables 3.5 oz/100g red meat =2.5 mg 3.5 oz/100g liver =4.3 mg 1 cup black beans =3.6 mg* 1 cup lentils =6.6 mg* 1 cup spinach =2.7 mg* *(when eaten with foods high in vitamin C)	Promote supplements during pregnancy and consumption of iron-fortified foods where available. Counsel on coping with side effects of supplements. Promote consumption of iron-rich foods and foods that enhance absorption (meat, fish, poultry, and vitamin C-rich foods).[e] Suggest alternatives to tea or coffee with meals. Prevent and treat malaria in endemic areas per WHO protocols for pregnant women. Implement deworming programs.

Folate	400 µg	+200 µg		+100 µg	Dark green leafy vegetables, legumes, nuts, liver 3.5 oz/100g liver =217 µg 1/2 cup peanuts =106 µg	Counsel women to increase consumption of folate-rich foods. Provide supplements (combination of iron-folic acid), particularly during first weeks of pregnancy.
Iodine	150 µg	+70 µg		+140 µg	Sea food, iodized salt 3.5 oz/100g marine fish or shellfish =80 µg	Promote consumption of iodized salt. Where iodine deficiency is endemic and iodized salt is not available, supplementation may be needed.
Calcium	1000 mg		+0 mg		Milk and milk products, whole fish (including bones), dark green leafy vegetables, legumes 1 cup whole milk or yoghurt =306 mg 1 cup dark leafy green vegetables =150-300 mg 1 cup white beans or chickpeas =95 mg	Promote consumption of calcium-rich foods throughout the life cycle.
Zinc	8 mg	+3 mg		+4 mg	Organ meats, red meat, poultry, whole fish 3.5 oz/100g liver, kidney =4.2-6.1mg 3.5 oz/100g beef, pork =2.9-4.7 mg 3.5oz/100g seafood (fish, etc) =0.5-5.2 mg	Promote small livestock production and aquaculture for targeted feeding of children and pregnant and lactating women. Promote germination and fermentation to reduce phytate in cereal-based diets.

6-7. Food and Nutrition Board, Institute of Medicine. Dietary Reference Intakes, forthcoming and 2002.

Notes:

a "Needs" are the estimated average requirement for energy and the recommended dietary allowances for all other nutrients.

b Caloric requirements during lactation assumes that the mother has no energy stores to contribute, so all the energy in breastmilk is derived from the mother's diet.

c All examples are for cooked foods unless otherwise stated. Protein, iron, iodine, and energy are unaffected by cooking, but significant folate is lost. Iodine decreases with storage and high humidity. Vitamin A (beta-carotene) is lost with high heat and with chopping leafy vegetables.

d RAE = retinol activity equivalent, equal to the activity of 1µg of retinol (This is different from the older "retinol equivalent" which used different conversion factors for provitamin A carotenoids in foods.)

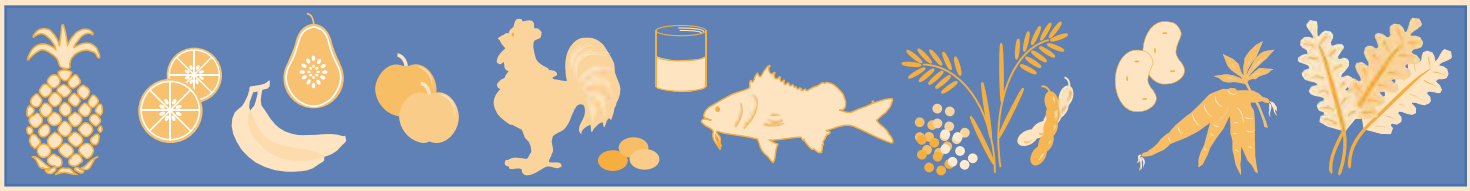
e Iron from animal sources is more readily absorbed and utilized than iron from plant sources. Animal foods also enhance the absorption of iron from other sources.

Improving Nutrition throughout the Life Cycle

Pregnancy and lactation are times of heightened nutritional vulnerability. However, the threat of malnutrition begins in the womb and continues throughout the life cycle. A mother who was malnourished as a fetus, young child, or adolescent is more likely to enter pregnancy stunted and malnourished. Her compromised nutritional status affects the health and nutrition of her own children.

Growth faltering earlier in life leaves women permanently at risk of obstetric complications and delivering low birth weight babies. Deficiencies of some micronutrients, such as folic acid and iodine, affect the fetus shortly after conception. By the time the pregnancy is detected, permanent damage is done. For these reasons, maternal malnutrition cannot be addressed during pregnancy alone. The periods before and between pregnancies provide an opportunity for women of reproductive age to prepare for pregnancy by consuming an adequate balanced diet, including supplements and fortified foods where available, and by achieving a desirable weight.

Overweight and obesity at all ages, even in poor communities, present a difficult challenge for maternal and child health programs. Underweight and overweight often occur in the same communities and even the same households. Maternal overweight and obesity increase the risk of perinatal mortality, premature delivery, major birth defects, and maternal obstetric complications, including hypertension and gestational diabetes. Maternal and child health programs should alert women at all stages of the life cycle to the need to adjust diet and physical activity levels to achieve and maintain a desirable weight for their own health as well as for better birth outcomes.



Supporting Interventions

The following interventions can improve maternal nutrition and complement food-based approaches and micronutrient supplementation:

Reduction of malaria infection in pregnant women in endemic areas. Malaria causes anemia in several ways, primarily by destroying red blood cells and suppressing production of new red blood cells. Over the past decade, new approaches to controlling malaria in pregnancy that emerged in Africa proved highly effective. These approaches include insecticide-treated materials (ITMs) and intermittent preventive treatment after the first trimester (i.e., after quickening), a strategy that is gaining recognition as more effective than prophylaxis. Pregnant women in malaria endemic areas should be given intermittent preventive treatment according to national protocols and protected from further infection by using bednets and other ITMs.

Reduction of hookworm infection in pregnant women in endemic areas. Hookworm is an important cause of anemia in many situations. In areas where hookworm is considered a public health problem, WHO recommends deworming pregnant women after the first trimester (i.e., after quickening). Wearing footwear and carefully disposing of feces can prevent hookworm infection.

Birth spacing of three years or longer. Adequate spacing between pregnancies gives a woman's body time to recover and replenish nutrients. Pregnant and lactating women and their partners can be counseled on child spacing.

Decreased work load or rest during pregnancy. Minimizing heavy work and reducing work hours enable energy-deficient women to conserve energy needed for pregnancy and lactation.

Health workers should mobilize support for maternal nutrition at all levels through the following actions:

- Initiate or strengthen health service systems for timely provision of micronutrient supplements, deworming, and malaria treatment.
- Involve community leaders and other influential people in discussing increased nutritional demands during pregnancy and lactation and the need for more rest and a decreased workload.
- Disseminate messages to women and their families through varied channels and contact points.
- Counsel not only women, but also their husbands and elders.
- Promote dietary diversification, coupled with food production or income-generation activities, to make more diverse foods available at the family level. Promote fortified foods where available and affordable.
- Negotiate with women and their families to take small steps to improve maternal diet and to increase opportunities for resting.

References

1. Institute of Medicine (IOM). Nutrition During Pregnancy: Report of the Committee on Nutritional Status During Pregnancy and Lactation. Washington: National Academy Press, 1990.

2. WHO. Safe Vitamin A Dosage during Pregnancy and Lactation. WHO/NUT/98.4. Geneva: World Health Organization, 1998.

3. UNICEF/UNU/WHO. Iron Deficiency Anaemia: Assessment, Prevention, and Control. WHO/NHD/01.3. Geneva: World Health Organization, 2001.

4. Stoltzfus RJ, Dreyfuss ML. Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia, Washington, DC: The International Nutritional Anemia Consultative Group, 1998.

5. WHO. Postpartum Care of the Mother and Newborn: A Practical Guide. WHO/RHT/MSM.98.3 Geneva: World Health Organization, 1998.

6. Food and Nutrition Board, Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients). Washington: National Academies Press, pre-publication date 2002, final version forthcoming.

7. Food and Nutrition Board, Institute of Medicine. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington: National Academies Press, 2002.

Maternal Nutrition Resources

Food composition tables available in many countries can help field workers identify good, local sources of nutrient-rich foods. The Food and Agriculture Organization's website (www.fao.org/infoods) lists countries or regions with food composition tables. The nutrient content of specific quantities of most foods can be calculated using the nutrient database on the United States Department of Agriculture website (www.nal.usda.gov/fnic/foodcomp). Additional resources on maternal nutrition are available from the LINKAGES Project and members of the CORE Group.

LINKAGES Publications

Frequently Asked Questions on Breastfeeding and Maternal Nutrition. Updated 2004.

Essential Health Sector Actions to Improve Maternal Nutrition in Africa. 2001.

Maternal Nutrition: Issues and Interventions. (computer based slide presentation) Updated 2004.

Recommended Feeding and Dietary Practices to Improve Infant and Maternal Nutrition. 1999.

The Case for Promoting Multiple Vitamin/Mineral Supplements for Women of Reproductive Age in Developing Countries. 1998.

Using the Essential Nutrition Actions to Improve the Nutrition of Women and Children: A Four-Day Training Course for Program Managers and Pre-service Instructors. 2004.

CORE Members' Publications

CARE. Promoting Quality Maternal and Newborn Care: A Reference Guide for Program Managers. 1998.

CARE. The Healthy Newborn: A Reference Manual for Program Managers. 2002.

Freedom from Hunger. Women's Health: Healthy Women, Healthy Families. (10 learning sessions for group-based education programs) 2003.

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Maternal Nutrition During Pregnancy and Lactation is a joint publication of **LINKAGES: Breastfeeding, LAM, Related Complementary Feeding, and Maternal Nutrition Program** and the **Child Survival Collaborations and Resources (CORE) Nutrition Working Group**. The CORE Group is a membership association of more than 35 U.S. nongovernmental organizations working together to promote and improve primary health care programs for women and children and the communities in which they live. Support for LINKAGES was provided to the Academy for Educational Development (AED) by the Bureau for Global Health of the United States Agency for International Development (USAID), under the terms of Cooperative Agreement No. HRN-A-00-97-00007-00. The opinions expressed herein are those of the authors and do not necessarily reflect the views of USAID or AED.

August 2004