Maternal Nutrition: Issues and Interventions

A Computer-based Slide Presentation for Advancing Maternal Nutrition

The LINKAGES Project
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Foreword

In many parts of the world, women do not have equal access to food, health care, and education. Years of such neglect perpetuate the cycle of women's undernutrition from generation to generation. Caught in this cycle, many women are undernourished at birth, stunted during childhood, pregnant during adolescence, and underfed and overworked during pregnancy and lactation.

Undernutrition weakens women's ability to survive childbirth and give birth to healthy children, translating into lost lives of mothers and their infants. It also undermines women's productivity, income generating capacity, and their contribution to their families, communities, and nations. The time has come for women's nutrition to take its rightful place on the development agenda.

Maternal Nutrition: Issues and Interventions has been designed to help nutrition advocates influence the way policy-makers and program planners think about women's nutrition issues and, more important, to engage them in policy dialogue. *Maternal Nutrition: Issues and Interventions* will help nutrition advocates build a case for a life-cycle approach to maternal undernutrition issues. The goal is for policy makers and program planners to realize:

- That the plight of young girls is inseparable from that of their mothers
- That in a woman's life cycle there are some «windows of nutritional vulnerability» (infancy, early childhood, adolescence, prepregnancy, pregnancy, and lactation) that require priority attention
- That there are affordable and cost-effective interventions to break the inter-generational cycle of women's undernutrition.

Maternal Nutrition: Issues and Interventions will provide nutrition advocates with:

- Current information on the extent of maternal undernutrition and its consequences for women and the children they bear
- Internationally agreed upon recommended practices to break the cycle of women's undernutrition and the scientific basis to support such recommendations.
- Lessons learned and better practices on how to integrate/implement priority nutrition interventions to improve women's nutrition.

Maternal Nutrition: Issues and Interventions is a flexible policy communications tool. Its 63 slides (see enclosed diskette for powerpoint slides) and corresponding speaker's notes can and should be organized and presented in the most responsive manner to local policy communication priorities and opportunities.

Other Related Publications by LINKAGES

Breastfeeding and Maternal Nutrition - Frequently Asked Questions. (Available in English, French, and Spanish).

Essential Health Sector Actions to Improve Maternal Nutrition in Africa. The Regional Centre for Quality of Health Care at Makerere University in Uganda and the LINKAGES, MOST, SARA, and SANA Projects. May 2001. (Full document available in English, summary paper available in English and French).

Guidelines for Appropriate Complementary Feeding of Breastfed Children 6–24 Months of Age. Series: Facts for Feeding. (Available in English, French, and Spanish).

Improving Breastfeeding Behaviors: Evidence from Two Decades of Intervention Research. C. Green, The LINKAGES Project. November 1999. (Available in English).

Recommended Feeding and Dietary Practices to Improve Infant and Maternal Nutrition. The LINKAGES Project. February 1999. (Available in English, French, and Spanish).

Recommended Practices to Improve Infant Nutrition during the First Six Months. Series: Facts for Feeding. (Available in English, French, and Spanish).

The Case for Promoting Multiple Vitamin/Mineral Supplements for Women of Reproductive Age in Developing Countries. S. Huffman, J. Baker, J. Shumann, E. Zehner, The LINKAGES Project. November 1998. (Available in English, French, and Spanish).

Maternal Nutrition: Issues and Interventions

Speaker's Notes

Slide 1: Presentation Title

Slide 2: First Part Title. Maternal Nutrition: Issues

Slide 3: Major Issues in Maternal Nutrition

Malnutrition among women manifests itself at the macronutrient and/or the micronutrient level.

- Many women, particularly in developing countries, have inadequate weight and/or height.
- Micronutrient deficiencies such as iron, iodine, vitamin A, and others are highly prevalent among women in many regions of the world.

In this presentation we will see that maternal malnutrition has numerous causes and significant negative functional consequences.

We will see as well that there are feasible and cost-effective interventions to improve the nutritional status of women. These interventions will translate into long lasting benefits for women themselves and the children they bear.

Slide 4: Maternal Malnutrition: A Life-Cycle Issue (one)

Women are vulnerable to malnutrition throughout the life cycle for both biological and social reasons.

Infancy and early childhood (0–24 months). Most young girls living in poor environments are suboptimally breastfed in infancy and early childhood, receive infrequent and poor complementary foods (both in quantity and/or quality), and suffer frequent infections. Such nutritional neglect during the first two years of life has immediate and long-term negative consequences on women's survival, growth, development, and productivity.

Childhood (two to nine years). At two years of age, many of the girls who survive under such nutritional stress are stunted with little chance of recovery. Moreover, in some parts of the world, girls are discriminated against in access to food, health care, and education throughout childhood.

Slide 5: Maternal Malnutrition: A Life-Cycle Issue (two)

Adolescence (10–19 years). During adolescence, girls experience rapid physical growth and sexual maturation which significantly increases their needs for macronutrients and micronutrients (especially iron).

Adolescent girls' growth spurt occurs before menarche (first menstruation). Adolescent girls continue to grow in height long after menarche. Linear growth, particularly of the long bones, is not complete until the age of 18, and peak bone mass is not achieved until the age of 25.

A malnourished adolescent girl whose menarche has been delayed may achieve full height as late as 23 years and will, therefore, be capable of conceiving before her body size is fully developed. Moreover, the development of the birth canal is slower than that of height and does not reach mature size until about two to three years after the growth in height has ceased.

Pregnancy puts adolescent women at increased risk of malnutrition (diverting nutrients from the mother to the fetus), pregnancy complications, and poor pregnancy outcomes (including death).

Early pregnancy contributes to the cycle of maternal malnutrition in two ways:

- Indirectly, through the premature cessation of the mother's growth.
- Directly, through the increased risk of delivering a low birth weight baby.

Pregnancy and lactation. In most developing countries, women spend a large proportion of their reproductive years pregnant, lactating or pregnant and lactating. McGuire and Popkin (1990) estimate that on average, African and Asian women between the ages of 15 and 45 are pregnant or lactating 30–48 percent of their time. The nutritional demands during pregnancy and lactation are multiple to support fetal growth and breastmilk production. These added nutritional requirements specific to pregnancy and lactation manifest themselves both at the macronutrient and the micronutrient level.

- More calories are needed to achieve adequate pregnancy weight gain and build stores for lactation.
- More iron is needed because of the growth of the fetus and placenta and the expansion of plasma volume. More vitamin A may be needed to ensure adequate vitamin A concentration in breastmilk.
- Closely spaced reproductive cycles, negative energy balance, and micronutrient deficiencies can lead to a condition known as "maternal depletion syndrome". Nutritional stress is greatest when an adolescent woman is pregnant and lactating.

Slide 6: Maternal Malnutrition: a Life-Cycle Issue (three)

Throughout life. Most women living in developing countries experience various biological and social stresses that increase the risk of malnutrition throughout life. These include:

- Food insecurity
- Inadequate diets
- Recurrent infections
- Frequent parasites
- Poor health care
- Heavy work burdens
- Gender inequities

Slide 7: Women Giving Birth before the Age of 18

The percentage of women giving birth before the age of 18 is 18 percent in Asia, 21 percent in Latin America, and 28 percent in Africa (World Fertility Survey, UN, 1986).

Slide 8: Chronic Energy Deficiency in Women 15–49 Years Old

Body Mass Index (BMI) measures weight in relation to height (wt/ht^2) to estimate thinness. In adult women, BMI < 18.5 kg/m^2 is used as an indicator of Chronic Energy Deficiency. The high proportion of women falling below this cut-off value in developing countries shows that women's undernutrition is a staggering problem.

Slide 9: Consequences of Maternal Chronic Energy Deficiency

Women who suffer from chronic energy deficiency:

- Have a higher prevalence of infections because of reduced immunocompetence.
- Are at increased risk of obstructed labor because of disproportion between the size of the baby's head and the space in the birth canal.
- Are at increased risk of mortality. Obstructed labor accounts for eight percent of maternal deaths worldwide (WHO and UNICEF, 1996).
- Are at increased risk of giving birth to low birth weight babies. Low birth weight is a well-known risk factor for neonatal and infant mortality.

Slide 10: Determinants of Intrauterine Growth Retardation

Maternal nutritional factors account for approximately 50 percent of intrauterine growth retardation in developing countries. Most low birth weight in developing countries is due to intrauterine growth retardation.

There is a very strong association between low pre-pregnancy weight and height and intrauterine growth retardation, as shown in a meta-analysis of 25 studies of maternal anthropometry and pregnancy outcome from 20 countries (WHO, 1995).

Low caloric intake is another major risk factor influencing birth weight, the single most important determinant of a child's chances for survival.

Low birth weight, which is primarily the result of maternal malnutrition (either before conception or during pregnancy), is an indirect indicator of women's nutritional status.

Slide 11: The Intergenerational Cycle of Malnutrition

Intergenerational links drive the cycle of malnutrition: small maternal size leads to low birth weight and subsequent growth failure in children, leading to small adult women. This diagram also illustrates the effects of early pregnancy, which causes low birth weight in the current pregnancy and in future pregnancies by inducing the mother's premature cessation of growth.

Slide 12: Iron Deficiency

Iron deficiency occurs when an insufficient amount of iron is absorbed to meet the body's requirements. Iron deficiency is the most common form of malnutrition, affecting as many as 4-5 billion people worldwide. The major clinical manifestation of iron deficiency is anemia or low blood hemoglobin concentration. Iron deficiency and iron deficiency anemia are major public health problems, affecting an estimated 2 billion people - 30% of the world's population - with adverse consequences especially for women of reproductive age and young children. Over 90 percent of affected women and children live in developing countries.

Although anemia rates are often used to assess the severity of iron deficiency in a population, iron deficiency is not the only cause of anemia. Nevertheless, in regions where anemia is highly prevalent, iron deficiency is usually its most common cause. This may result from increased need for iron (e.g., during infancy, adolescence or pregnancy), inadequate iron intake, or chronic blood loss.

Other common causes of anemia include parasitic infection and malaria.

Slide 13: Dietary Iron Requirements Throughout the Life Cycle

Iron requirements are highest during infancy, early adolescence, and pregnancy.

- In infancy and early childhood, iron is required for rapid growth.
- In early adolescence, iron requirements are high because of the growth spurt; they are even higher for girls who experience both a growth spurt and the onset of menses at this time.
- In pregnancy, iron requirements are driven by tissue synthesis in the mother, the placenta, and the fetus, and by blood loss at delivery.

Slide 14: Causes of Dietary Iron Deficiency

Dietary iron deficiency is the result of insufficient iron intake to meet requirements.

Dietary iron deficiency may be the consequence of:

- Low dietary iron intake (resulting, for example, from a diet with low iron density), and/or

- Low bioavailability of dietary iron (when dietary iron is not easily absorbed by the body). The causes of low iron bioavailability are:
  - Diet with high content of non-heme iron. Non-heme iron comes from vegetable sources. Its bioavailability is low compared to that of the iron coming from animal products (heme iron) such as red meat.
  - Diet with high content of iron absorption inhibitors. Inhibitors such as tannins, fiber, and calcium decrease the bioavailability of dietary iron. On the other hand, iron absorption enhancers (such as heme iron sources and vitamin C) can increase the bioavailability of non-heme iron.

Slide 15: Parasitic Infection and Anemia

WHO estimates that over one billion women in the developing world are infected with hookworms. Hookworm infection contributes to anemia by causing blood loss in stool. Blood loss increases iron loss. Blood, and the iron in it, are lost in proportion to the number of adult worms in the gut and the duration of infection.

Slide 16: Malaria and Anemia

Malaria causes anemia by destruction of red blood cells.

Malarial infection, particularly that caused by *Plasmodium falciparum*, can lead to very severe anemia.

Anemia resulting from malarial infection can be life-threatening for pregnant women.

Slide 17: Prevalence of Anemia in Women 15–49 Years Old

The cutoff points for anemia used here are those recommended by WHO (110 g/L for pregnant women; 120 g/L for non-pregnant women). The data shown here emphasize the extremely high prevalence of anemia among women of reproductive age in the developing world, particularly among pregnant women.

Slide 18: Anemic Women (15–49 years old) Worldwide

We have seen in the previous slide that South and Southeast Asia have the highest prevalence of anemia among women of reproductive age. Over one fifth of the world's population reside in these regions. These two facts explain why over half of the anemic women in the world reside in South and Southeast Asia.

Slide 19: Severity of Anemia in Pregnant Women

The data presented on the slide show that although the prevalence of anemia in pregnant women (Hb < 110 g/L) is uniformly high in the two populations displayed on the chart—Nepal and China—the prevalence of moderate to severe anemia (Hb < 90 g/L) is more than three times higher in Nepal than in China.

Slide 20: Severity of Anemia in Non-Pregnant Women

Similarly, the prevalence of anemia in non-pregnant women (Hb < 120 g/L) is uniformly high in Zanzibar and Indonesia. Yet, the prevalence of moderate-to-severe anemia (Hb < 90 g/L) is more than four times higher in Zanzibar.

These data suggest that in a given population, it is important to estimate not only the prevalence of anemia among women of reproductive age but its severity as well.

Slide 21: Consequences of Maternal Anemia

Maternal deaths:

- Anemic women are more likely to die from blood loss during delivery. Obstetric hemorrhage is the leading cause of maternal death in developing countries, accounting for approximately 25 percent of all maternal deaths.
- Severe anemia can lead to heart failure or circulatory shock at the time of labor and delivery.
- Anemic women are more susceptible to puerperal infection.

Reduced transfer of iron to fetus:

- Anemic women transfer less iron to their fetuses. These infants are at increased risk of becoming iron-depleted and developing anemia in early infancy.

Low birth weight:

- Anemic women are more likely to deliver low birth weight infants.

Neonatal mortality:

- Low birth weight infants have an increased risk of death during the neonatal period.

Reduced physical capacity:

- Physical work capacity and fitness are reduced in anemic women because iron is needed by the blood to carry oxygen to the brain and muscles and by the muscles for normal functioning.

Impaired cognition:

- Anemic children show lower intellectual scores than non-anemic children.

Slide 22: Severe Anemia and Maternal Mortality (Malaysia)

Anemic women are more likely to die from pregnancy-related causes than non-anemic women. Data collected from over 70,000 pregnant women in Malaysia found that severely anemic pregnant women (pregnancy hemoglobin concentration < 65 g/L) had a risk of death four and a half times greater than women who were not severely anemic during pregnancy (pregnancy hemoglobin concentration ≥ 65 g/L). Even mild or moderate anemia contributes to maternal mortality. Overall, iron deficiency anemia among pregnant women is estimated to cause an estimated 111,000 maternal deaths each year (Stoltzfus et al, 2003.)

Slide 23: Pregnancy Hemoglobin and Low Birth Weight

Anemic women are more likely to deliver low birth weight infants. Data collected from over 50,000 pregnancies in Caucasian women show that both low and high hemoglobin concentrations in pregnancy are associated with low birth weight. The risk of low birth weight is 55 percent higher among women whose lowest pregnancy hemoglobin concentration is 80 g/L than among those whose lowest pregnancy hemoglobin concentration is 110 g/L.

Slide 24: Consequences of Anemia on Women's Productivity

Anemic women show symptoms of tiredness and fatigue because their bodies are unable to transport enough oxygen to support activity of long duration. This results in lower productivity. Levin *et al*. (1993) report that workers with iron deficiency anemia are less productive at physical labor than non-anemic workers, producing 1.5 percent less output for every one percent their hemoglobin is below standard. There is growing evidence that iron deficiency can reduce physical capacity for work even without causing anemia.

Slide 25: Consequences of Iron Deficiency Anemia on Children's Education

Studies on the relationship between iron deficiency anemia and cognitive development in preschool and school age children are remarkably consistent in finding that children with iron deficiency anemia have test scores that are significantly lower than those of children with sufficient iron stores.

Slide 26: Causes of Maternal Vitamin A Deficiency

Women of reproductive age, particularly pregnant and lactating women, are at a greater risk of vitamin A deficiency. The three main causes of vitamin A deficiency in women are:

- Inadequate intake. Insufficient dietary intake of vitamin A to meet physiological needs is the major cause of vitamin A deficiency in women.
- Recurrent infections. Infections reduce the efficiency of absorption, conservation, and utilization of vitamin A and can reduce vitamin A intake by depressing appetite.
- Frequent reproductive cycles. As with iron and other micronutrients, vitamin A requirements increase with pregnancy and lactation. In the case of vitamin A, lactation puts greater demands on maternal reserves than pregnancy.

Slide 27: Consequences of Vitamin A Deficiency in Pregnancy (one)

- Increased risk of night blindness. Night blindness is associated with low levels of serum retinol. High rates of night blindness have been reported among pregnant women in most countries where vitamin A deficiency is prevalent.
- Increased risk of maternal mortality, miscarriage, stillbirth, and low birth weight. Available data from vitamin A supplementation studies in Nepal suggest a causal relationship.

Slide 28: Consequences of Vitamin A Deficiency in Pregnancy (two)

Vitamin A is transferred from the mother to the fetus during pregnancy via the placenta. Animal studies suggest that the amount transferred depends on the mother's vitamin A intake.

Slide 29: Consequences of Maternal Vitamin A Deficiency on Lactation

The concentration of vitamin A in breastmilk depends on a woman's vitamin A status and the changing needs of her growing infant. The mature breastmilk of a woman with relatively good health and nutritional status provides her baby with enough vitamin A for at least the first six months of life and possibly the first year. Moreover, when complementary foods are low in fat, the fat in breastmilk may be essential for the utilization of vitamin A. A study in rural West Africa (Prentice and Paul, 1990) reported that breastmilk was the most important source of vitamin A and fat for children over one year of age.

In areas where vitamin A deficiency is endemic, women with low levels of serum retinol have low vitamin A concentration in their breastmilk, increasing their child's risk of becoming clinically deficient during illness. This is particularly true in the case of preterm infants who are at risk of vitamin A deficiency because they have virtually no reserves of retinol in their livers.

Slide 30: Consequences of Vitamin A Deficiency in Childhood

Extrapolations from the best available data suggest that 140 million pre-school aged children suffer from vitamin A deficiency.

Vitamin A deficient children are at an increased risk of:

- Ocular problems. The most obvious health consequences of severe vitamin A deficiency involve the visual system, affecting vision in low light or darkness (night blindness) and disruption in the integrity of the surface of the conjunctiva and cornea (Bitot's spot, corneal clouding, ulceration). Vitamin A deficiency is the most important cause of childhood blindness in developing countries.
- Morbidity and Mortality. Vitamin A deficiency, even at subclinical levels, leads to deterioration in the surface linings of the gastrointestinal, respiratory, and excretory systems. In addition the integrity of the immune system is impaired. Risk for severe disease and death of young children is increased by these hidden changes. Vitamin A deficiency causes an estimated 1.2 to 3 million child deaths every year.
- Anemia. Vitamin A deficiency contributes to inefficient utilization of iron for hemoglobin production.

Slide 31: Iodine Deficiency in Women

Iodine is required for the synthesis of thyroid hormones that in turn are required for the regulation of cell metabolism throughout the life cycle. Up to the 1980s, goiter (i.e. enlargement of the thyroid) was considered the single and almost exclusive consequence of iodine deficiency. Today we know that goiter is only the tip of the iceberg and that the consequences of dietary iodine deficiency during pregnancy are much broader.

Thyroid hormones ensure normal growth, especially of the brain, which occurs from fetal life to the end of the third postnatal year. Iodine deficiency during pregnancy, when severe, will impair thyroid function resulting in a lower metabolic rate, growth retardation, brain damage, increased perinatal mortality, and other defects.

Slide 32: Consequences of Iodine Deficiency on Intelligence

Dietary iodine deficiency during pregnancy is known to hinder the development of the fetus and results in the birth of cretins (newborns with extreme forms of brain damage and physical impairment) and infants who show severe forms of mental retardation.

The mental retardation resulting from iodine deficiency during pregnancy is irreversible. Iodine deficiency is the most prevalent cause of preventable mental retardation in the world. Endemic cretinism is prevented by the correction of iodine deficiency, especially in women before and during pregnancy.

Slide 33: Consequences of Iodine Deficiency on Education

Cretinism and severe mental retardation are extreme forms of brain damage resulting from dietary iodine deficiency during pregnancy. Even in areas where there is no evidence of endemic cretinism but a risk of dietary iodine deficiency, there is a downward shift in the frequency distribution of IQ in schoolchildren. Thus, even mild iodine deficiency during pregnancy results in permanent damage to the fetal brain.

Bleichrodt and Born (1993) estimated, based on a larger meta-analysis of 18 different studies, that children in iodine deficient communities suffer on average a 13.5 point reduction in IQ (almost a standard deviation) relative to children in non-deficient communities. The implications for the educability of children, drop-out rates, and the under-utilization of school facilities are obvious. The resulting costs to societies, including delayed socio-economic development, are staggering.

Slide 34: Consequences of Maternal Malnutrition on Productivity

Women's malnutrition has clear consequences on productivity:

- Chronic Energy Deficiency. Stunted children remain stunted for life. A long-term longitudinal study in Guatemala found that children who were stunted at 22 months of age remained stunted into adulthood (Martorell et al., 1994). Haddad and Bouis (1991) in the

Philippines concluded that for every one percent decrease in height, the productivity of agricultural workers decreased by 1.38 percent.

- Iron Deficiency. Women with iron deficiency anemia are less productive at physical labor than non-anemic workers, producing one to two percent less output for every one percent their hemoglobin is below standard (Levin et al., 1993).
- Iodine Deficiency. Cretinism and intellectual impairment caused by iodine deficiency during pregnancy result in permanent reduction in productivity capacity. The average 13.5 IQ point reduction suggests a community-wide impairment in intellectual functioning that must have serious productivity consequences.

Slide 35: Consequences of Maternal Zinc Deficiency

Zinc plays a role in a large number of metabolic synthetic reactions. During periods of rapid growth and higher micronutrient requirements, such as infancy, adolescence, and late pregnancy, girls and women are most susceptible to zinc deficiency.

Prevalence of zinc deficiency is probably similar to that of nutritional iron deficiency because the same dietary pattern induces both. Where diets are plant-based and intakes of animal foods low, the risk of inadequate intakes of both zinc and iron is very high, even when energy and protein intakes meet recommended levels.

A high proportion of pregnant women in developing countries are likely to be at risk of zinc deficiency because of habitually inadequate zinc intakes. Maternal zinc deficiency has negative health consequences for women and their infants. Women with low plasma zinc concentrations have:

- Three to seven times higher risk of premature rupture of membranes.
- Two to nine times higher risk of prolonged second-stage labor.
- Increased risk of preterm delivery and low birth weight. A zinc supplementation trial of pregnant women increased gestation time and reduced preterm delivery by 25–50 percent.
- Increased risk of maternal and infant mortality.

Slide 36: Consequences of Maternal Folic Acid Deficiency

In some developing countries, pregnant and lactating women are at increased risk of folic acid deficiency because their dietary folic acid intake is insufficient to meet their physiological requirements. Women's dietary intakes will be low wherever effective access to folate-rich foods is limited, or where cooking practices lead to high loss. Maternal folic acid deficiency is associated with:

- Maternal anemia. Folic acid deficiency causes megaloblastic anemia because of folic acid's role in DNA synthesis. Folic acid deficiency interferes with DNA synthesis, causing abnormal cell replication.
- Neural tube defects. Low folic acid levels around the time of conception may cause neural tube defects in infants. Folic acid supplementation of women during the peri-conceptional period reduces the incidence of neural tube defects such as anencephaly and spina bifida.
- Low birth-weight. Low folic acid levels are associated with an increased risk of low birth weight.

Slide 37: Consequences of Maternal Vitamin B-6 and B-12 Deficiency

- Vitamin B-6 and vitamin B-12 deficiency increases the risk of maternal anemia.
- Vitamin B-6 is important for the development of the infant's brain. Maternal vitamin B-6 deficiency in lactating women leads to inadequate breastmilk concentrations of vitamin B-6 in breastfed infants which in turn may impair their neurobehavioral development.
- Vitamin B-12 plays a key role in the synthesis of myelin in the nervous system. Maternal vitamin B-12 deficiency can lead to neurological disorders in infants.

Slide 38: Second Part Title. Maternal Nutrition: Interventions

Slide 39: Major Interventions in Maternal Nutrition

There are two types of interventions to improve maternal nutrition:

- Those targeting an improvement in women's weight and/or height
- Those targeting an improvement in women's micronutrient status

Slide 40: Improving Maternal Weight

Increases in weight can be achieved within a woman's reproductive life by:

- Increasing caloric intake and/or by
- Reducing energy expenditure and/or by
- Reducing caloric depletion (delaying the first pregnancy and increasing birth intervals)

Slide 41: Improving Maternal Height

Increases in height cannot be achieved once an adolescent girl reaches her adult height. Improvements in maternal height therefore require a life cycle approach by:

- Increasing birth weight so infant girls are larger from birth, and/or
- Enhancing growth in children less than two years of age to maximize their growth, and/or
- Improving adolescent growth.

Slide 42: Optimal Behaviors to Improve Women's Nutrition

Early Infancy: Exclusive breastfeeding to six months of age.

Breasmilk should be a baby's first taste. Breastfeeding should be initiated within about one hour of birth to stimulate breastmilk production, provide the infant with the antibodies present in colostrum (baby's first immunization), minimize maternal postpartum hemorrhage, and foster mother-child bonding.

Breastmilk covers completely the infant's nutritional and fluid needs for about the first six months of life. Infants should not receive any prelacteal feed such as water, other liquids, or ritual foods to maintain good hydration, not even in hot and dry climates.

Offering water and foods to infants before six months is both unnecessary and dangerous because it reduces breastmilk intake, interferes with the absorption of breasmilk nutrients, and introduces pathogens and contaminants that put the baby at a greater risk of illness and death. Studies show that exclusively breastfed infants are at a much lower risk of infection from diarrhea and acute respiratory infections than infants who receive other foods or fluids.

Moreover, exclusive breastfeeding contributes to a delay in the return of fertility.

Slide 43: Optimal Behaviors to Improve Women's Nutrition

Late Infancy and Childhood: Appropriate complementary feeding from about six months.

By about six months of age, breastmilk alone cannot meet most babies' energy, protein, and micronutrient requirements. Complementary foods need to be introduced at this time. Guidelines on the best combinations of foods and feeding practices should be based on local research. General principles are:

As the child gets older, gradually increase the consistency, energy density, and variety of the food using a combination of age-appropriate meals and snacks adapted to the child's requirements and abilities.

Feed fruits and vegetables daily, especially those rich in vitamin A and other vitamins. Feed meat, poultry, fish, or other animal products as often as possible (even small quantities). Use micronutrient-enriched foods (especially those with iodine, iron, and/or vitamin A) when available and economically accessible.

When animal products, fortified foods, and/or vitamin A-rich foods are not available, give vitamin-mineral supplements containing appropriate levels of micronutrients to children to prevent micronutrient deficiencies. This is particularly important in the case of vitamin A deficiency. Eight large-scale vitamin A supplementation trials have been conducted among preschool-age children in developing countries to assess the impact of vitamin A supplementation on child mortality. Seven of the eight studies demonstrated a reduction in mortality. A meta-analysis of these studies has estimated an average 23 percent reduction in child mortality from vitamin A supplementation.

Practice active feeding (positive reinforcement, persistence, and supervised feeding), good hygiene, and proper food handling to optimize a child's food intake.

During and after illness practice frequent and active feeding. Patiently encourage the sick child to eat favorite foods and, after illness, give food more often than usual and encourage the child to eat more at each sitting.

Slide 44: Optimal Behaviors to Improve Women's Nutrition

Late Infancy and Childhood: Continue frequent on-demand breastfeeding to 24 months of age and beyond.

Although adequate complementary foods need to be introduced at six months, breastmilk remains a very important source of energy, protein, and micronutrients. Infants should continue to breastfeed frequently (on-demand), including night feeding.

Breastmilk is high in fat and vitamin A compared with most complementary foods in developing countries. The fat in breastmilk is an important source of energy and essential for the absorption of the vitamin A present in complementary foods. In a study in rural West Africa, breastmilk was the most important source of vitamin A and fat for children over one year of age (Prentice and Paul, 1990).

Breasmilk provides high-quality protein. This is particularly important where the levels of high-quality protein in complementary foods are low. Studies in Bangladesh reported that breastmilk contributed nearly half of the protein intake (Brown et al., 1982).

Breastfeeding continues to reduce the risk of infection, especially diarrheal diseases.

During and after illness, breastfeeding is extremely important. Mothers should be advised to breastfeed their young children more often. Children often continue breastfeeding even when they are anorexic or refuse other foods.

Breastfeeding helps reduce fertility. In regions where modern contraceptive use is limited, women who breastfeed their infants at frequent intervals over prolonged periods of time have lower fertility than women who do not breastfeed or who breastfeed infrequently or for shorter periods of time.

Slide 45: Optimal Behaviors to Improve Women's Nutrition

During pregnancy: Increase food intake, take iron/folic acid tablets daily, and reduce workload.

Pregnant women need to increase food intake to support fetal growth and future lactation. Weight gain during pregnancy depends on pre-pregnancy weight, body size, and activity level, among others. The average woman gains about ten kilograms during pregnancy. Yet, in many developing countries women gain barely half this amount as a consequence of poor diets and heavy workloads.

For women who enter pregnancy with good nutritional status, the additional food intake required is about 350 kcal/day after the first trimester. For women who enter pregnancy underweight, more calories are needed to achieve adequate weight gain. The beneficial effect of food supplementation on maternal nutritional status and infant birth weight is greatest when food supplementation targets undernourished women, particularly at times of the year when food is scarce and/or workload is high

Pregnant women should take iron/folic acid tablets daily. Iron requirements increase significantly during the last two trimesters of pregnancy because of the growth of the fetus and placenta and the expansion of the mother's blood volume. Pregnant women should take a daily supplement of iron and folic acid (60 mg of iron and 400 ug folic acid) during the last two trimesters of pregnancy. In regions where the prevalence of anemia in pregnant women is higher than 40 percent, supplementation should also continue for three months after delivery.

If supplementation starts late in pregnancy there are two options:

- Make sure the pregnant woman receives daily supplements containing 120 mg of iron until the end of pregnancy.
- Make sure the pregnant woman receives daily supplements containing 60 mg of iron until the end of pregnancy and that she continues receiving those same supplements for six months after delivery.

Folic acid is included in the supplement because it helps to prevent anemia and reduces the risk of obstetric complications and neural tube defects.

Pregnant women should reduce workload during pregnancy to decrease energy expenditure and optimize energy balance.

Slide 46: Optimal Behaviors to Improve Women's Nutrition

During lactation: Increase food intake, take a high dose vitamin A capsule at delivery, and reduce workload.

In developing countries, breastfeeding mothers should be advised to consume 20-25% more food than before pregnancy every day (about 500 kcal) to meet their energy requirements during lactation.

The energy and protein content of breastmilk are barely affected by the nutritional status of the breastfeeding mother. Only under famine conditions are the energy and protein content of breastmilk significantly affected. Malnourished mothers can therefore breastfeed successfully. Yet, it is important that they increase their food intake so that their own nutritional status and health are not compromised to nourish their infants.

Maternal micronutrient deficiencies may result in lower levels of these nutrients in breastmilk. Vitamin A is a good example of this. Women living in areas where vitamin A deficiency is prevalent should receive a high dose vitamin A capsule (200,000 IU) as soon after delivery as possible (not later than eight weeks postpartum) to build stores, improve breastmilk vitamin A content, and reduce maternal morbidity.

Lactating mothers should reduce workload to decrease energy expenditure and optimize energy balance.

Slide 47: Vitamin A Postpartum Supplementation (Indonesia)

In communities where vitamin A deficiency is common, WHO currently recommends postpartum supplementation with a single megadose of vitamin A (200,000 IU) as soon as possible after delivery. This improves maternal vitamin A status, increases breastmilk vitamin A concentration, and contributes to improved vitamin A status of the breastfed infant. The international Vitamin A Consultative Group has recently proposed a regimen of 2 doses of 200,000 IU each, spaced at least 2 days apart. WHO may adopt this proposal, pending the results of ongoing research.

Because of risk to an unborn fetus, it is recommended that vitamin A not be given to a lactating mother who may already be pregnant (i.e. after eight weeks following delivery). Distribution channels for maternal vitamin A supplementation can be traditional birth attendants, community health workers, community-based distribution agents, and/or community pharmacies.

Slide 48: Optimal Behaviors to Improve Women's Nutrition

Delay first pregnancy and increase birth intervals. When pregnancies start early in life and/or are separated by short intervals, women are at greater risk of nutrient depletion. A short inter-birth interval provides less time for recovery from pregnancy and lactation and leads to an increased number of pregnancies.

Delaying the first pregnancy until after adolescence (when growth has ceased), increasing birth intervals, and allowing at least six months between the cessation of lactation and the next pregnancy helps replace and build up fat and micronutrient stores, improving women's immediate nutritional and health status and having a positive impact on pregnancy outcomes (birth weight, maternal survival, and infant morbidity/mortality).

Slide 49: Optimal Behaviors to Improve Women's Nutrition

At all times: Increase food intake if underweight, diversify the diet, use iodized salt, and take micronutrient supplements if needed.

Women of reproductive age, if underweight, should increase food intake to protect their own health and establish reserves for pregnancy and lactation. Women who enter pregnancy underweight and continue to engage in heavy physical labor may not be able to gain the weight necessary to ensure adequate fetal growth and favorable birth outcomes. Increased energy intake by underweight women between reproductive cycles can improve birth weight and maternal health.

Micronutrient deficiencies contribute to women's undernutrition. In order to improve quality and micronutrient intake, women of reproductive age should diversify their diets by increasing their daily consumption of fruits and vegetables, consuming animal products when feasible, and using fortified foods such as vitamin A-fortified sugar, iron-fortified flour, other micronutrient-enriched staples when available, and iodized salt.

When micronutrient requirements cannot be met through available food sources (fortified or not), women of reproductive age need to take micronutrient supplements containing iron, folic acid, vitamin A, zinc, and other micronutrients to build stores and improve their nutritional status. Deficiencies of some micronutrients (such as folic acid and iodine) cause congenital defects very early in pregnancy so fetal development depends on adequate nutrition before the pregnancy is detected. Addressing multiple deficiencies prior to pregnancy and lactation would improve women's current health, establish reserves for pregnancy and lactation, and protect fetal and infant health.

Slide 50: Improving Women's Micronutrient Status

Four complementary interventions are then possible to improve women's micronutrient status:

- Dietary modification
- Parasite control
- Fortification
- Supplementation

Slide 51: Dietary Modification to Improve Women's Micronutrient Status

Dietary modification aims to improve women's food consumption habits and increase:

- Micronutrient intake and/or
- Bioavailability of micronutrient intake

Slide 52: Parasite Control to Improve Women's Micronutrient Status

Reduction of parasite transmission is an important component of anemia control in women of reproductive age in regions where hookworms are endemic. Two complementary interventions are needed:

- Improve hygiene-related behavior
- Increase access to effective antihelmintics

Slide 53: Food Fortification to Improve Women's Micronutrient Status

Food fortification is the addition of nutrients to a common food to improve its nutritional quality. It can be a medium-term strategy to improve women's micronutrient intake without the need to change food habits. Food fortification requires:

- Appropriate nutrient fortificant and
- Appropriate food vehicle (widely consumed and centrally processed)

Slide 54: Examples of Micronutrient Food Fortification

- Vitamin A in sugar
- Iron in wheat flour
- Iodized salt
- Multiple micronutrient fortification:
    - Iron and iodine in salt
    - Iron and B vitamins in wheat flour

Slide 55: Supplementation to Improve Women's Micronutrient Status

Micronutrient supplementation program options:

- Preventive or therapeutic
- Daily or periodic
- Targeted to specific groups (pregnant women)
- Mass distribution

Slide 56: Iron+Folate Supplementation for Women of Reproductive Age

Where prevalence of anemia is greater than 40 %, periodic iron and folic acid supplementation (60mg of iron and 400µg folic acid for 3 months) should be considered for: prepubertal and adolescent girls and for all women of childbearing age. Distribution channels include schools, factories, community pharmacies, community based distribution agents, and community health workers.

Slide 57: Iron+Folic acid Supplementation During Pregnancy

During pregnancy, iron and folic acid supplements should be given daily, starting as early as possible but preferably by the fourth month of pregnancy and continuing for six months. Pregnant women should take a daily supplement of iron + folic acid (60 mg of iron and 400 ug folic acid) for six months of pregnancy. In regions where the prevalence of anemia in pregnant women is higher than 40 percent, supplementation should continue for three months after delivery. When supplementation starts late in pregnancy there are two options:

- Make sure that the woman receives daily supplements containing 120 mg of until the end of pregnancy.
- Make sure the woman receives daily supplements containing 60 mg of iron until the end of pregnancy and that she continues taking those same supplements for six months after delivery.

Monthly packets of supplements can be distributed to women. Distribution channels include antenatal care services, community pharmacies, and community health workers.

Slide 58: Multiple Micronutrient Supplementation

Multiple micronutrient supplementation programs may target pregnant women or all women of reproductive age within a population. In either case, the supplement should include iron + folic acid and other standard vitamins and minerals.

Addition of other micronutrients to standard iron + folic acid supplements increases production cost (production cost is low if compared to the cost of producing each supplement individually). Delivery cost remains stable, and the benefits to women's health could be very high.

Slide 59: Elements of a Successful Supplementation Program

The success of a supplementation program relies on four key components:

- Supplement supply
- Delivery system
- Women's demand and compliance
- Monitoring and evaluation

Slide 60: Supplement Supply

Key elements of the supplement supply strategy:

- Data-based ordering
- Organized and timely procurement process
- Timely distribution to delivery points: factories, community pharmacies, community-based distribution agents, community health workers, antenatal care services.

Slide 61: Supplement Delivery System

The supplement delivery system should be accessible to the target population. Geographical accessibility, though, is not enough. The delivery system staff should be:

- Motivated
- Approachable
- Supportive and
- Adequately trained

Slide 62: Women's Demand/Compliance

To increase women's demand and compliance, the supplement delivery system should:

- Develop and implement a communications component to educate the community and promote micronutrient supplementation by:
  - Increasing community awareness about the extent of micronutrient deficiencies among women, their consequences, and the benefits of micronutrient supplementation for women.
  - Providing adequate information to women on side effects and how to minimize them.
- Provide good quality supplements.

Slide 63: Monitoring and Evaluation

Monitor at all levels:

- Supply system
- Supplementation coverage
- Women's compliance
- Communications component

Evaluate impact on prevalence