CHAPTER 5

NUTRITION DURING THE FIRST THOUSAND DAYS OF LIFE

Part I: Pregnancy and Lactation

Lisanne M. du Plessis and Celeste E. Naude

Outline

• Methods for determining the nutritional status of pregnant and lactating women
• Nutritional risks during pregnancy and lactation
• Nutritional needs of pregnant and lactating women
• Nutrition interventions during pregnancy and lactation
• Health care during pregnancy
• Benefits of breast-feeding for maternal health
• Rights of mothers and infants regarding breast-feeding
• The ten steps to successful breast-feeding

Objectives

At the completion of this chapter you should be able to:

• Describe the methods for assessing the nutritional status of pregnant and lactating women
• Discuss nutrition-related health problems of pregnant and lactating women
• Know the nutritional needs of pregnant and lactating women
• Discuss nutritional interventions in pregnancy and lactation that have been proven to be successful
• State the recommendations for health care during pregnancy
• Describe the relationship between breast-feeding and maternal health
• Know the rights of mothers and infants regarding breast-feeding
• Name the ten steps to successful breast-feeding
1. INTRODUCTION

Maternal and child health is a basic, non-negotiable human right. The International Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) of 1989 declares in Article 12(2) that the state should “ensure to women appropriate services in connection with pregnancy, confinement, and the post-natal period, granting free services where necessary, as well as adequate nutrition during pregnancy and lactation” (United Nations, 1979). Numerous treaties, policies, and programmes have been developed over time to address maternal and child health. However, despite commitments throughout the developing world, mothers and children still die at high rates from conditions that could be prevented (Bhutta et al., 2008).

Women between the ages of 15 and 49 represent what is often referred to as the “women of childbearing age” group. Maternal health refers to the period in a woman’s life that involves pregnancy, childbirth, and post-natal care (Shung King et al., 2006). Good nutrition during these first thousand days – that is, from the start of a woman’s pregnancy to her child’s second birthday – is vitally important to the health of both mother and child. As 1000 Days, an organization dedicated to improving nutrition during this critical period, points out, “better nutrition can have a lifelong impact on a child’s future and help break the cycle of poverty” (http://www.thousanddays.org/about).

Pregnancy is one of the most dangerous periods in the life of a woman. Teenage pregnancies are of particular concern since adolescent girls who fall pregnant may not yet have reached their full growth potential (Ronsmans et al., 2008).

Maternal mortality ratio (MMR), expressed as the number of maternal deaths per 100,000 live births per annum, traditionally refers to the rate of deaths in women as a result of childbearing, during the pregnancy, or within 42 days of delivery or termination of pregnancy from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (Ronsmans et al., 2008). MMR is an indicator of socio-economic status and health care in society. The values for MMR cover a wide range in developing countries, varying from 55 (per 100,000 live births) in eastern Asia to 920 in sub-Saharan Africa (Ronsmans et al., 2008). New estimates show that the leading causes of maternal deaths are haemorrhage and hypertension, which together account for more than half of maternal deaths. Indirect causes, which include deaths due to conditions such as malaria, HIV/AIDS, and cardiac diseases, account for about one fifth of maternal deaths (WHO/UNICEF, 2010).

Maternal and child undernutrition remain persistent and destructive conditions in low-income and middle-income countries (Black et al., 2008). Undernutrition affects mortality and ill-health along the entire continuum of care from pre-pregnancy to early childhood (WHO/UNICEF, 2010). When undernourished girls and women have children of their own, the consequences of inadequate nutrient intake are passed on to the following generation (Figure 5.1). It is thus clear that the prevention of maternal and young child undernutrition is a long-term investment that will benefit the current generation as well as their children (Bhutta et al., 2008).

2. PREGNANCY

2.1 Assessment of Nutritional Status

Nutritional assessment should be incorporated routinely into the medical care of pregnant women. (For general information on assessing nutritional status, see Chapter 22.) The assessment should be comprehensive and should include the so-called “ABCD” approach: Anthropometry, Biochemistry, Clinical signs, and Dietary intake. At the same time, it should be tailored to the setting and available resources. Assessments done early in pregnancy should be used to evaluate the nutritional status of the woman and to predict how well she can cope with the physiological demands of pregnancy. Unfortunately, this is usually neglected despite clear evidence in developing countries that pregnancy and lactation represent a major nutritional drain on the mother (WHO Expert Committee, 1995). Challenges for complete and detailed assessments are late seeking of antenatal care and resource poor environments, including lack of equipment and trained health-care workers.
2.1.1 Anthropometry

**Weight and weight gain.** Body weight measured at various times during pregnancy has been widely used to assess maternal health status. Since body weight changes rapidly during pregnancy, gestational weight adjustments are routinely monitored in prenatal care worldwide. BMI is not an accurate indicator in pregnancy, but a very low pre-pregnancy BMI is a fairly reliable indicator of severe wasting of both fat and lean tissue (WHO Expert Committee, 1995).

Unfortunately, there is no guideline for weight gain for pregnant women from developing countries. In 2009, the Institute of Medicine (IOM, 2009) published new recommendations for total and rate of weight gain during pregnancy by pre-pregnancy BMI. These are based on US data; their application as recommendations for gestational weight gain for developing countries is therefore limited.

**Height.** Measuring a woman’s height provides a proxy indicator of childhood growth and skeletal pelvic structure, and it is a good predictor of the risk of cephalopelvic disproportion and obstructed labour, which is a major cause of death in developing countries. Women of short stature (140 to 150 cm) are also at risk for intrauterine growth restriction (IUGR), low birth weight (LBW), infants who are small for gestation age (SGA), and preterm delivery (WHO Expert Committee, 1995).

**Mid-upper arm circumference.** A woman’s mid-upper arm circumference (MUAC) reflects past and current nutritional status, but is less responsive than weight to short-term changes in health and nutrition conditions. It is relatively stable throughout pregnancy, even when measured relatively late in pregnancy, and it may be more reflective than weight of pre-pregnancy conditions (WHO Expert Committee, 1995). Wasting in pregnant women can be defined as a MUAC <22 cm (Kruger, 2005).

**Skin-fold thickness and calf circumference.** These measures are not considered reliable. Increased skin-fold thickness on the arms, legs, or back may not reflect an increase in total body fat of a pregnant woman. Measurements of the lower body, specifically leg circumferences, may be increased because of normal oedema, particularly during late pregnancy (WHO Expert Committee, 1995).

---

**Figure 5.1:** The malnutrition poverty cycle.

*Source: ACC/SCN, 2000, p. 1.*
**Symphysis fundus height.** Symphysis fundus (SF) height has long been used to measure the size of the pregnant uterus (i.e., interuterine growth rate). A review of studies concluded that SF height is of variable value as a predictor for IUGR (Jacobsen, 1992). However, in late pregnancy it has been used successfully to predict complications of delivery and problems with the newborn (WHO Expert Committee, 1995).

### 2.1.2 Biochemistry

The physiological and metabolic changes of pregnancy cause changes in maternal biochemical and haematological parameters. These indicators should therefore be interpreted with care in pregnancy (Knight et al., 1994).

WHO estimates that more than half of pregnant women in developing countries may be anaemic, defined as haemoglobin below 11 g/dL (WHO, 1992). See also Section 2.2.2.

Proteinuria refers to abnormally high levels of proteins in the urine. During pregnancy, urinary protein excretion in excess of 300 mg in 24 hours (about 1+ on a urine dipstick) is regarded as abnormal. Proteinuria that occurs during the first 20 weeks of gestation (or prior to pregnancy altogether) may signal the presence of underlying kidney disease (Airoldi & Weinstein, 2007).

### 2.1.3 Clinical signs

In pregnancy the same clinical evaluation will be done as for any woman, but specific attention should be given to signs of vitamin deficiencies, especially for vitamin A (night blindness), iron (pallor, bleeding gums), and iodine (goitre), which have proven to be problematic in many developing countries. General signs of malnutrition and fluid retention should also be investigated.

### 2.1.4 Dietary intake and physical activity

Women of reproductive age have unique nutrition requirements (FAO, 2001). Energy requirements increase during pregnancy, largely as a result of foetal growth and increased maternal body weight (Brown, 2005). Energy metabolism may be altered in more than one way, and women who seem to enter pregnancy in similar nutritional states have varying responses. Additional energy needs of pregnant women have been found to range from 210 to 570 kcal (882 to 2394 kJ) per day (King, 2000). This additional energy requirement is also dependent on the level of physical activity (Brown, 2005). Women in developing countries often have high levels of physical activity, including physical labour in the fields, fetching fuel, and hauling water, in addition to domestic caring practices. These high levels of physical activity are not offset by increases in energy intake; the resulting imbalance is often reflected in low weight gain and impaired foetal growth (King, 2000). Additionally, energy metabolism and foetal growth is dependant on the pre-pregnancy energy status of the mother and the quality of her living conditions (King et al., 1994). (Appendix III provides the Dietary Reference Intakes [DRIs].)

In pregnancy, attention should be paid and questions should be formulated to ask specifically about nutrition-related health problems and risks, including: heartburn, constipation, nausea, pica (consumption of substances with little or no nutrients), and food safety (ADA, 2003). Relevant nutritional advice and practical guidelines should be formulated to address these issues.

Further investigations and assessments should be performed if gestational diabetes, pregnancy-induced hypertension, and/or HIV are suspected, and management should be tailored accordingly.

The ABCD approach is a useful one, but the environment, availability of population-specific cut-off points, and resources will determine what is feasible to measure. A framework has been proposed that identifies the critical points for action during pregnancy to improve birth outcomes. Women with short stature (<145 cm), low body weight (<45 kg), and/or low MUAC (<22 cm) are considered to be at risk of adverse pregnancy outcomes. Weekly weight gains from the second trimester should range from 0.3 kg for overweight women to 0.5 kg or more for underweight women. Genetic background, age, general health, HIV, educational status, cigarette smoking, past nutritional status, parity, multiple pregnancies, climate, socio-economic conditions, and the availability of health services (Kruger, 2005) should be considered when evaluating the nutritional status of a pregnant woman.

doi:10.15215/aupress/9781927356111.01
2.2 Nutritional Risks During Pregnancy

2.2.1 Undernutrition

Maternal nutritional status at the onset of pregnancy can affect not only the health and development of the foetus but also maternal health (ADA, 2002). Indeed, maternal undernutrition during gestation reduces placental and foetal growth in animals and humans (Guoyao, 2004). A poor nutritional status increases the risk of miscarriage, stillbirth, neonatal malformations, and of infants born with significantly reduced birth weights and lengths. Low pre-pregnancy weight is a predictor of intrauterine growth restriction (IUGR) (Black et al., 2008). Nutritional status prior to conception is therefore as important as during pregnancy (Brown, 2005).

It was previously believed that the needs of the foetus were met at the expense of the mother’s stores and requirements. Emerging evidence suggests that development of the growing baby can be suboptimal if certain nutrients are unavailable during specific responsive periods of development (Zeisel, 2009). Available nutrients are utilized first for maternal needs and physiological changes, next for placental health and development, and lastly for foetal growth and needs. Foetal growth is compromised more than maternal health in periods of inadequate intake (Velzing-Aarts et al., 1999; King, 2003). Thus, an adequate availability of nutrients during gestation is probably the single most important environmental factor influencing pregnancy outcome (King, 2003; Zeisel, 2009).

Improvements in maternal nutrition and health can increase birth weight, survival, and growth of children, and subsequent size and function – including health, productivity, and mental performance – in adult life (Allen & Gillespie, 2001).

2.2.2 Low birth weight, intrauterine growth restriction, and preterm birth

The average duration of gestation is 40 weeks. Before 37 weeks (259 days) the foetus is considered preterm, and after 42 weeks it is considered post-term (Rolfes et al., 1990).

The constituents of low birth weight (LBW) are IUGR and preterm birth (Kramer, 2003). There are two processes that establish birth weight, namely duration of gestation and foetal growth rate. Therefore, being born too early (preterm birth) and being born small for gestational age (SGA) can both result in a LBW (<2500 grams) (Kramer, 2003). Infants with LBW have perinatal mortality rates that are 5 to 30 times greater than those of infants with normal birth weights (Jackson et al., 2003).

Preterm infants are at increased risk of death, short- and long-term pulmonary, ophthalmologic, and neurologic morbidity, and delayed psychomotor development (Kramer, 2003).

IUGR refers to foetal growth that has been constrained; it therefore characterizes a newborn that has growth impairment (ACC/SCN, 2000). This is associated with an elevated risk of sudden infant death syndrome (SIDS), increased perinatal morbidity and mortality, increased mortality and childhood morbidity, as well as a higher tendency towards neurologic impairment and poor cognitive development in childhood. IUGR infants tend to have small but lasting deficits in growth (Gülmezoglu et al., 1997; Kramer, 2003). There is growing evidence that impaired foetal growth is related to an increased risk of chronic disease in adulthood (Guoyao, 2004).

It is estimated that one-third of LBW infants in developed countries are born preterm (<37 weeks gestation). Most LBW infants in developing countries are born term, but have experienced IUGR, which may start early in pregnancy (Ramakrishnan, 2004).

Being born LBW has an intense unfavourable effect on the health and development of the neonate. It is a risk factor for stunting, which starts in the womb and will worsen if the diet and health status is not optimal during post-natal development (Allen & Gillespie, 2001). The causes of preterm birth and IUGR differ. For IUGR the most important factors are low energy intake and resultant low gestational weight gain, low preconception body mass index (BMI <18.5), short stature, maternal infections, abnormal placental blood flow, foetal infections, primiparity, pregnancy-induced hypertension, cigarette smoking, and malaria (for primiparce). Prematurity, regardless of degree, is associated with genetic factors; lower than average maternal age, height, and weight (low preconception BMI); small weight gain in pregnancy; poor prenatal care; lack of social or family support; inadequate spacing of births; multiple births; pregnancy-induced hypertension; placental insufficiency; uterine abnormalities; infections in pregnancy; premature rupture of membranes; history of previous preterm birth; heavy work during pregnancy; and cigarette smoking (Kramer, 2003; Allen & Gillespie, 2001; Illingworth, 1991).
2.2.3 Micronutrient malnutrition

Chronic maternal undernutrition may be associated with deficiencies of micronutrients that influence foetal growth, including folate, iron, zinc, and vitamins A, C, and D (Moore et al., 2004; Rao et al., 2001; Barker, 2001). Micronutrient intake during pregnancy is also associated with various birth outcomes, suggesting that different micronutrients play important roles in improving foetal growth (Rao et al., 2001). For some of these micronutrients, supplementation has been shown to be beneficial, but for others sufficient research is still lacking. Women in low-income countries often have an inadequate intake of various micronutrients because of predominantly cereal-based diets with limited consumption of animal products, fruit, vegetables, and fortified foods (Mahomed & Gülmezoglu, 1997).


Causes of anaemia include nutritional deficiencies (particularly iron, vitamin B12, and folate), genetic factors, and infections. The effects of dietary deficiencies can be exacerbated by factors of poor socio-economic conditions (Mamabolo et al., 2004). Iron-deficiency anaemia is the most widespread nutritional problem among women. Anaemia during pregnancy in developing countries may be only partly due to iron deficiency since malaria, HIV infection, vitamin A deficiency, and intestinal parasites may be equally important causes (Ronsmans et al., 2008).

Iron supplementation of around 60 mg elemental iron daily in pregnancy improves maternal iron status during pregnancy and immediately after delivery in both industrialized and developing countries (Ronsmans et al., 2008).

Folate. Poor folate intake during pregnancy is associated with anaemia and reduced foetal growth (Shabert, 2004). Inadequate availability of folate between 21 and 37 days after conception can interrupt normal cell differentiation and cause neural tube defects, such as spina bifida (Eskes, 1998).

Iodine. Iodine deficiency in early pregnancy can lead to hypothyroidism in the offspring, a widespread problem in parts of the developing world (Cao et al., 1994). The incidence of infant hypothyroidism has been found to decrease by more than 70% when at-risk women in developing countries are given iodine supplements before or in the first half of pregnancy. This intervention also leads to improved psychomotor development of the infants and a reduced frequency of infant deaths (Mahomed & Gülmezoglu, 1997). The vital importance of adequate iodine is covered again in Chapter 9.

Vitamin A. Vitamin A deficiency causes night blindness in pregnant women and may increase the risk of maternal mortality. Four pathways have been suggested by which supplementation with vitamin A (or its precursors) may improve the maternal health status during pregnancy, namely (1) vitamin A may enhance maternal immunity and thereby decrease the risk of bacterial and viral infections during pregnancy, (2) it may improve the mother’s haematological status, (3) it may enhance the implantation and development of the placenta, and (4) vitamin A deficiency has been associated with pregnancy-induced hypertension. The most convincing potential mechanism of action of vitamin A and its precursors is through the first two of these pathways (Ronsmans et al., 2008).

Vitamin A deficiency can affect iron metabolism and thereby contribute to low haemoglobin. This may occur when deficiencies of both nutrients coexist and particularly in environments that favour frequent infections. Maximum haemoglobin response occurs when iron and vitamin A deficiencies are corrected together (Ronsmans et al., 2008).

The Cochrane Review of vitamin A supplementation during pregnancy concluded that, despite positive findings from two developing countries, further trials are needed to provide evidence of a beneficial effect on maternal mortality and morbidity and to clarify the mechanism behind any such effect (Kennedy et al., 2000).

High-dose vitamin A is contra-indicated in pregnancy because of its teratogenic effect. Supplementation during the post-partum period (6 to 8 weeks) increases vitamin A in breast milk and improves maternal immunity (Rice, 2007). Vitamin A nutrition is discussed again in Chapter 9.

Calcium. Reviews of calcium supplementation trials during pregnancy provide strong support for this intervention as a means of preventing pregnancy-induced hypertension and pre-eclampsia in communities with low calcium intake. Supplementation with one to two grams of calcium daily is associated with a 42% reduction in risk of hypertension, with or without proteinuria, and a 65% reduction in risk of pre-eclampsia (Ronsmans et al., 2008).
**Vitamin D.** There is a disturbingly high prevalence of hypovitaminosis D amongst pregnant women in many populations around the world; this is an area of growing concern. Inadequate vitamin D status during gestation may have adverse effects on maternal pregnancy as well as foetal and post-natal growth and development. Therefore, an increasing number of experts are advocating that recommended vitamin D intakes in pregnancy should be revised. The optimal circulating 25(OH)D concentration throughout pregnancy is still debated, but it is evident that prior levels used to establish intake recommendations were too conservative. In light of existing evidence, public health intervention to reduce the prevalence of hypovitaminosis D in pregnant women worldwide is urgently needed (Dror & Allen, 2010). The topic of vitamin D is revisited in Chapter 13.

### 2.2.4 Multiple pregnancies
A woman who is pregnant with more than one foetus poses considerable risks for both the mother and the foetuses, with the risk increasing as the number of foetuses increases (Brown & Carlson, 2000). Adequate prenatal nutrition improves the chance that the infants will achieve a higher birth weight when born closer to term (Klein, 2005).

### 2.2.5 Closely spaced pregnancies
Women who have short interpregnancy intervals (<18 months) may not have sufficient time to replace nutrients used during the previous pregnancy and are at risk of having an inadequate supply of nutrients to meet the needs of the subsequent pregnancy, especially in poor communities. Women with closely spaced pregnancies are at increased risk for delivering preterm, LBW, or SGA infants (King, 2003).

### 2.2.6 Overnutrition
Overnutrition is a growing health problem globally. Obesity often coexists with undernutrition in developing countries and is a complex condition, with serious social and psychological dimensions, affecting virtually all ages and socio-economic groups (WHO, 2013).

The reproductive risks of overnutrition or obesity include infertility or difficulty with conception, gestational diabetes, hypertension (pregnancy-induced), premature birth, and increased rates of caesarean section, as well as a birth weight of greater than 4000 grams (Shabert, 2004).

Early identification by means of nutritional screening, dietary treatment, and monitoring of obese pregnant women as part of standard prenatal care may affect outcomes for the mother and infant.

### 2.2.7 Alcohol
Alcohol should be avoided during pregnancy since it can lead to foetal alcohol syndrome (FAS), which is the most common preventable cause of mental retardation in the world. Other symptoms can include growth retardation, abnormal facial features, and an increased frequency of major birth defects. Children born with FAS never recover. A milder form of FAS is known as foetal alcohol effects (FAE). Children with FAE may be short or have only minor facial abnormalities, or develop learning disabilities, behavioural problems, or motor impairments.

FAS-affected children are frequently born to mothers who abused alcohol while they were unaware that they were pregnant. The type of alcoholic beverage is not important; the quantity of alcohol is the critical factor.

Alcohol use during pregnancy is a complex problem that is inseparable from other factors such as a woman’s mental health, her socio-economic status, power relations between her and her partner, and the attitudes of her family and community towards drinking. It is now generally accepted that any woman who is or may become pregnant should abstain from alcohol consumption (Carlo, 2007).

### 2.2.8 Other harmful substances
Food-borne illness during pregnancy can have severe consequences, including spontaneous abortion and
stillbirth and it may also cause blindness, mental retardation, and seizures. Raised progesterone levels during pregnancy decrease a pregnant woman’s ability to resist infectious disease, thus making her more susceptible to food-borne illness (ADA, 2003). To prevent food-borne infection, pregnant women should avoid raw fish and shellfish, unpasteurized cheese, raw or undercooked meat, unpasteurized milk (Brown, 2005), and unwashed surfaces of fruit and vegetables (Soto, 2002).

Other harmful substances to be avoided during pregnancy include contaminants in food, cigarette smoking, and heavy metals such as mercury, lead, and cadmium (Shabert, 2004). The use of all other pharmacological agents, drugs, herbal and natural remedies, and over-the-counter medications should be discussed with a doctor or pharmacist before use, because these may be harmful to the foetus.

3. NUTRITION AND HEALTH CARE FOR PREGNANT WOMEN

3.1 Nutrition Interventions for Pregnant Women

The period from the start of pregnancy up to the age of 24 months, the so-called “first 1000 days of life,” presents a critical window of opportunity for nutrition interventions. Bhutta et al. (2008) reviewed interventions that affect maternal and child undernutrition and nutrition-related outcomes. Table 5.1 summarizes the evidence for the effectiveness of these interventions.

Table 5.1: Interventions that affect maternal and child undernutrition

<table>
<thead>
<tr>
<th>Sufficient evidence for implementation in all 36 countries</th>
<th>Evidence for implementation in specific, situational contexts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal and birth outcomes</td>
<td></td>
</tr>
<tr>
<td>- Iron folate supplementation</td>
<td>- Maternal supplements of balanced energy and protein</td>
</tr>
<tr>
<td>- Maternal supplements of multiple micronutrients</td>
<td>- Maternal iodine supplements</td>
</tr>
<tr>
<td>- Maternal iodine through iodisation of salt</td>
<td>- Maternal deworming in pregnancy</td>
</tr>
<tr>
<td>- Maternal calcium supplementation</td>
<td>- Intermittent preventive treatment for malaria</td>
</tr>
<tr>
<td>- Interventions to reduce tobacco consumption or indoor air pollution</td>
<td>- Insecticide-treated bednets</td>
</tr>
<tr>
<td>Newborn babies</td>
<td></td>
</tr>
<tr>
<td>- Promotion of breastfeeding (individual and group counselling)</td>
<td>- Neonatal vitamin A supplementation</td>
</tr>
<tr>
<td></td>
<td>- Delayed cord clamping</td>
</tr>
<tr>
<td>Infants and children</td>
<td></td>
</tr>
<tr>
<td>- Promotion of breastfeeding (individual and group counselling)</td>
<td>- Conditional cash transfer programmes (with nutritional education)</td>
</tr>
<tr>
<td>- Behaviour change communication for improved complementary feeding*</td>
<td>- Deworming</td>
</tr>
<tr>
<td>- Zinc supplementation</td>
<td>- Iron fortification and supplementation programmes</td>
</tr>
<tr>
<td>- Zinc in management of diarrhoea</td>
<td>- Insecticide-treated bednets</td>
</tr>
<tr>
<td>- Vitamin A fortification or supplementation</td>
<td></td>
</tr>
<tr>
<td>- Universal salt iodisation</td>
<td></td>
</tr>
<tr>
<td>- Handwashing or hygiene interventions</td>
<td></td>
</tr>
<tr>
<td>- Treatment of severe acute malnutrition</td>
<td></td>
</tr>
</tbody>
</table>

*Additional food supplements in food-insecure populations

Source: Bhutta et al., 2008.

Interventions for maternal nutrition that have been shown to be effective include iron and folate supplements, multiple micronutrients, calcium, and balanced intake of energy and protein (Bhutta et al., 2008). Some of the supporting evidence for this was discussed above.
Dietary supplements that provide more energy were found to improve birth weight substantially, whereas protein supplements did not. In other words, what is most needed is more food. Women with the lowest weight and the lowest energy intakes are most likely to benefit. Findings on the impact of the timing of supplements (e.g., second versus third trimester) have been inconclusive. Continued supplementation of women through lactation and the next pregnancy may bring about an even greater improvement in the birth weight of her next child (Allen & Gillespie, 2001).

Although supplementation with micronutrients during pregnancy improves maternal anaemia, reduces maternal mortality, prevents birth defects, reduces preterm delivery, and improves the quality of breast milk, there is little evidence that micronutrient supplements improve birth weight. Non-nutritional interventions that can improve birth weight include reduced maternal physical activity, malarial prophylaxes, cessation of cigarette smoking (Allen & Gillespie, 2001), antimicrobial treatment, antiparasitic treatment, bed nets treated with insecticide, and social marketing regarding birth spacing and timing of marriage (in which increased age is preferred) (Alderman et al., 2004).

Dietary diversification strategies, including home gardening, livestock rearing, and dietary modifications, hold promise and are culturally relevant in addressing maternal and child undernutrition. Few of these interventions have, however, been implemented to a sufficient extent and evaluated sufficiently (Bhutta et al., 2008).

### 3.2 Health Care During Pregnancy

The WHO has proposed a minimum of four antenatal visits, scheduled at specific times during the pregnancy, to accomplish the essential level of antenatal care recommended (see Box 5.1). This is only a minimum requirement and more visits may be necessary depending on the woman’s condition and needs (WHO, 1996).

**Box 5.1: WHO Recommendations Regarding Antenatal Visits by Pregnant Women**

<table>
<thead>
<tr>
<th>First visit by the end of the fourth month (16 weeks):</th>
<th>To screen and treat anaemia, screen and treat syphilis, screen for risk factors and medical conditions that can best be addressed in early pregnancy, initiate prophylaxis where required (e.g., anaemia, malaria), and begin to develop the individualized birth plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second visit in the sixth or seventh month (24 to 28 weeks)</td>
<td></td>
</tr>
<tr>
<td>Third visit in the eighth month (32 weeks):</td>
<td>To screen for pre-eclampsia, multiple gestation, anaemia, and to further develop the individualized birth plan</td>
</tr>
<tr>
<td>Fourth visit in the ninth month (36 weeks):</td>
<td>To identify foetal lie/presentation, and to update the individualized birth plan</td>
</tr>
</tbody>
</table>


The WHO suggests that these four goal-orientated antenatal care visits may achieve similar health outcomes than more rigorous schedules. All guidelines recommend a first visit at or before 16 weeks gestation (WHO, 1996). This is substantially earlier than most women seek antenatal care in sub-Saharan Africa (SSA).

A pregnancy education week held each year in February and the world breast-feeding week in August are two strategies on the WHO health calendar that aim to create community awareness through quality information and education on the topics of safe pregnancy and the importance of breast-feeding. Information is available at the following websites:

Another WHO initiative is Making Pregnancy Safer (MPS). This proposes a way to make pregnancy and childbirth safer for women and their newborns in order to speed up the reduction of maternal and perinatal mortality and morbidity. The major focus is the developing world, as that is where 98% of such deaths occur. For information about the programme, see http://www.who.int/making_pregnancy_safer/en.

Studies have shown that maternal and neonatal deaths commonly occur within the first 3 to 7 days after delivery. When discharged following delivery, mothers should visit a clinic within this period (Beksinka et al., 2006).

3.3 Millennium Development Goals and Maternal Health
Among recent efforts to eradicate poverty and address the world’s most pressing health issues are the Millennium Development Goals (MDGs) of the United Nations (see http://www.un.org/millenniumgoals/). These are discussed more fully in Chapter 1. Four of the eight goals relate directly and the others indirectly to women and children. Goal 5 is specifically dedicated to maternal health, with set targets and indicators to improve maternal health (see Box 5.2).

Box 5.2: Recommended Targets and Indicators for Millennium Development Goal 4

<table>
<thead>
<tr>
<th>Goal</th>
<th>- Reduce child mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targets</td>
<td>- Reduce by two-thirds the mortality rate among children under five</td>
</tr>
<tr>
<td>Indicators</td>
<td>- Under-five mortality rate</td>
</tr>
<tr>
<td></td>
<td>- Infant mortality rate</td>
</tr>
<tr>
<td></td>
<td>- Proportion of one-year-old children immunized against measles</td>
</tr>
</tbody>
</table>


In 2010, the WHO published a report that detailed progress towards achieving the MDGs (WHO, 2012). This report revealed that maternal mortality in Africa fell by 42% between 1990 and 2010. However, many countries on the continent saw no progress. Efforts should therefore be stepped up significantly to achieve this goal.

4. LACTATION
In this section we look at lactation from the perspective of meeting the mother’s nutritional challenges. Later in the chapter we examine breast-feeding in terms of optimal feeding of the infant.

4.1. Assessment of Nutritional Status
The nutritional demands on the mother of lactation are high, and nutritional assessment should be incorporated routinely into the medical care of breast-feeding women. The ABCD approach is once again valuable, but should always be tailored to the setting and available resources. The nutritional status of the lactating mother depends on many factors, including past nutritional status, weight gain during pregnancy, immediate post-partum weight loss, duration and intensity of lactation, dietary intake, and physical activity (WHO Expert Committee, 1995).

4.1.1. Anthropometry
Owing to a lack of reference data, anthropometric measurements cannot be used effectively to assess the nutritional status of a lactating woman. Possible indicators that may become available when more research has been done include maternal body weight and skinfold thickness changes over a short period of time, maternal calf circumference, and poor infant growth during exclusive breast-feeding (WHO Expert Committee, 1995).

BMI may be a useful indicator of post-partum nutritional status. An estimated cut-off for BMI of 20.3
at one month post-partum for women with a height of 150 cm has been suggested. BMI may be expected to gradually decrease throughout the first 6 months of lactation, at which point the non-pregnant, non-lactating value of 18.5 can be used as a cut-off for identifying women at risk (WHO Expert Committee, 1995).

4.1.2 Biochemical values
As before, because of a lack of research regarding biochemical values in lactating women, these values should be interpreted with caution.

4.1.3 Clinical signs
During lactation the same clinical evaluation can be done as for any woman, but specific attention should again be paid to signs of vitamin deficiencies, as in pregnancy, especially regarding vitamin A (night blindness), iron (anaemia, bleeding gums), and iodine (goitre). General signs of malnutrition and fluid retention should also be investigated.

4.2 Nutritional Risks During Lactation
4.2.1 Dietary intake and lifestyle factors
A breast-feeding woman needs more energy from carbohydrates, fats, essential fatty acids, and protein as well as additional vitamins and minerals (FAO, 2001; Sharbaugh et al., 2005; Shabert, 2004). Most breast-feeding women need to increase not only their energy intake, but also all the nutrients that make up their diet, in order to satisfy the additional requirements for milk synthesis. However, the increase will be minimal for some women, depending on their BMI and the amount of weight gained during pregnancy. The recommended dietary allowance for energy during lactation (in addition to the RDA for non-pregnant females) is 330 kcal (1386 kJ) for the first 6 months post-partum and 400 kcal (1680 kJ) for the second 6 months (Shabert, 2004). Overweight or obese mothers may not need to add the extra energy.

During lactation, questions should be asked specifically about possible nutrition-related health problems and risks that lactating women may face, including the use of alcohol, tobacco, and other potentially harmful substances. The consumption of alcohol during breast-feeding is not as detrimental as during pregnancy, but alcohol consumed by the mother can enter her breast milk and could therefore pass to the infant. (For a discussion, see La Leche League International, “What About Alcohol and Breastfeeding?” (http://www.llli.org/faq/alcohol.html.) Although modest alcohol intake on the part of a breast-feeding mother is unlikely to harm her child, excessive consumption should be avoided. Too much alcohol may displace much-needed nutrients in the lactating mother’s diet, and money spent on alcohol decreases the money available for food.

4.2.2 Undernutrition
Maternal nutritional status and diet can directly impact breast-feeding. The composition of the milk is usually not compromised in the short term. However, over a longer period, an inadequate intake of protein, other nutrients, and energy can cause a decreased volume of milk production and possibly cause breast-feeding malnutrition, or “failure to thrive,” in the infant (Sharbaugh et al., 2005).

Prolonged breast-feeding often results in maternal folate deficiency. Pregnancy and lactation are often linked to this deficiency that, in turn, is a common cause of megaloblastic anaemia. This is especially important in women from deprived socio-economic backgrounds who have suboptimal diets, closely spaced pregnancies, and long periods of continuous breast-feeding (Ingram et al., 1999).

4.2.3 Overnutrition
Maternal obesity can adversely affect initiation and continuation of breast-feeding. Excessive weight gain during pregnancy and its complications, such as complicated delivery, gestational diabetes, caesarean birth, macrosomia (birth weight >4000 grams), may also contribute to difficulty in initiation of breast-feeding. Latching (attachment of baby’s mouth to mother’s breast) and positioning of the infant could also be
problematic for the obese mother. Rasmussen & Kjolhede (2004) found that overweight or obese women had a lower prolactin response to infant suckling, which can compromise milk production and lead to early cessation of breast-feeding. Overweight or obese mothers should be identified in order to receive specialized care to prevent early lactation failure.

4.3 Breast-feeding and Maternal Health

Breast-feeding contributes to the health and well-being of mothers, including hormonal, physical, and psychosocial benefits (Brown, 2002; Kramer et al., 2001). Frequent breast-feeding helps to delay the return of fertility of the mother and thus helps to space children (Brown, 2002; Kramer et al., 2001; UNICEF et al., 2010). Furthermore, early contact between mother and infant increases the mother’s self-confidence and bonding with her baby (Savage King, 1992) and reduces the risk of ovarian and breast cancer (Brown, 2002; Kramer et al., 2001).

Breast-feeding has several other health benefits for the mother. It may reduce the risk of post-partum haemorrhage (Savage King, 1992), a condition indicated as a leading cause of death of women. It enhances fat loss in the early post-partum weeks (Kramer et al., 1993; Kjos et al., 1993) and helps the mother to lose weight if continued beyond 6 months (Dewey et al., 1993). Breast-feeding also improves blood glucose control and increases high-density lipoprotein cholesterol levels in women with gestational diabetes (Dewey et al., 1993). More recently, breast-feeding has also been associated with a reduced risk of the mother developing type 2 diabetes (Stuebe et al., 2005).

As breast-feeding is both a safe and economical way of feeding, it therefore improves family and national resources (Kramer et al., 2001). Additionally, as breast-feeding requires no packaging and produces no waste, it is environmentally friendly (Kramer et al., 2001; Baumslag & Michels, 1995).

Contra-indications to breast-feeding are uncommon. Medical contra-indications include: a number of over-the-counter and prescription drugs; recreational drugs; certain metabolic disorders; and HIV/AIDS under certain circumstances (see Section 5.5).

Inconsistent information and a perceived lack of support from health professionals are barriers to initiating and continuing breast-feeding. Other barriers include insufficient maternity leave, facilities at work not supportive of breast-feeding, negative emotions about breast-feeding, embarrassment about breast-feeding in public, not knowing the volume of milk the infant is receiving, fathers feeling left out from the feeding of the baby, and lack of support from family and friends (Brown, 2002; Savage King, 1992).

4.4 Nutrition Interventions and Programmes for Lactating Mothers

4.4.1 Breast-feeding as a right

It is clear from human rights law that the mother has a right to breast-feed if this is her choice. Some also hold that the infant has the right to be breast-fed. However, this imposes a corresponding duty on the mother, which she may be unable to perform for a variety of reasons that are beyond her control. A mother is therefore entitled to expect that the people and institutions that surround her, including the government, will work to protect, respect, and fulfil her rights so as to enable her to practise breast-feeding (see Box 5.3).

With regard to facilitating women’s ability to breast-feed, it is useful to think in terms of nested “rings of responsibilities” belonging to a range of actors who encircle the mother at different degrees of distance (Kent, 2000). The actors may include her family, her local community, her employer (if she has one), and hospitals and health services, as well as the state authorities in charge of policies pertaining to breast-feeding. Helsing (2005) suggests that we may think of mothers as having a “conditioned moral duty” to breast-feed their infants. In this view, society as a whole must join mothers in fulfilling their breast-feeding goals. Policies should spell out the necessary action to be taken. A combination of relevant binding human rights instruments and other conventions, as well as a series of voluntary codes and agreements, have the potential to firmly protect the human rights and choices of mothers and babies, thus safeguarding their right to an equal chance of getting a good start in life.
Box 5.3: The Obligations of Governments Regarding Breast-Feeding

To respect:
- Mother’s and baby’s right to practise breast-feeding
- The practical womanly wisdom and skills in lactation management inherited through the millennia and conveyed through extended networks of families and supportive networks

To protect:
- Mothers and babies from factors hindering or constraining the practice of breast-feeding
- Mothers and health workers from misleading information about breast-feeding and human milk
- Mothers’ confidence in their own ability to breast-feed and health workers’ confidence in their ability to assist

To fulfil (facilitate):
- The initiation and maintenance of breast-feeding
- The practice of breast-feeding for women who are in paid employment
- The practice of breast-feeding in emergency situations, by priority provision of food for mothers rather than cow’s (or other) milk for babies


4.4.2 The Baby Friendly Hospital Initiative (BFHI)

In 1991, the WHO and the United Nations Children’s Fund (UNICEF) launched the Baby-Friendly Hospital Initiative (BFHI), a global effort aimed at ensuring that maternity services of all sorts support efforts of mothers to practise exclusive breast-feeding of their infants from birth. (For further information, see http://www.who.int/nutrition/topics/bfhi/en/.) In order to be designated a “baby-friendly” facility, a hospital or other maternity service must have implemented the “Ten Steps to Successful Breast-Feeding” (see Box 5.4).

In 2009, when the BFHI guidelines were reviewed, three new criteria were added, the third of which is optional: (1) compliance with the WHO’s International Code of Marketing of Breast-Milk Substitutes (WHO, 1981); (2) provisions for mother-friendly care; and (3) the ability to provide information and referrals regarding HIV and infant feeding. (For further discussion, see WHO/UNICEF, 2009, section 1.3.)

4.4.3 Breast-feeding support groups

Step 10 of the ten steps to successful breast-feeding listed in Box 5.4 specifically encourages the establishment of breast-feeding support groups. One organization that offers peer-counselling programmes that provide this kind of support to mothers is La Leche League International (http://www.llli.org). The value of such support, in which mothers offer advice and encouragement to other mothers or mothers-to-be, should not be underestimated. It can contribute to prolonged breast-feeding, and it can also intensify the efforts to promote and protect the right to breast-feeding on a global scale.

Box 5.4: The Ten Steps to Successful Breast-Feeding

1. Have a written breast-feeding policy that is routinely communicated to all health-care staff.
2. Train all health-care staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breast-feeding.
4. Place babies in skin-to-skin contact with their mothers immediately following birth for at least an hour. Encourage mothers to recognize when their babies are ready to breast-feed and offer help if needed.

5. Show mothers how to breast-feed, and how to maintain lactation even if they should be separated from their infants.

6. Give newborn infants no food and drink other than breast milk, unless medically indicated.

7. Practise rooming-in. Allow mothers and infants to remain together – 24 hours a day.

8. Encourage breast-feeding on demand.

9. Give no artificial teats or pacifiers (also called dummies or soothers) to breast-feeding infants.

10. Foster the establishment of breast-feeding support groups and refer mothers to them on discharge from the hospital or clinic.


5. HIV AND INFANT FEEDING PRACTICES

As the third of the three additional BFHI criteria suggests, the World Health Organization (WHO) is cognizant of new evidence regarding HIV and infant feeding. In collaboration with several United Nations agencies, including UNICEF, the WHO recently released a revised set of key principles and recommendations, Guidelines on HIV and Infant Feeding2010 (WHO, 2010a). These are intended to provide information to national and provincial health services and to assist them in formulating their infant feeding recommendations for HIV-positive mothers.

National or provincial health authorities must first decide whether they will primarily counsel and support mothers known to be infected with HIV to

- breast-feed and receive antiretroviral (ARV) interventions

or to

- avoid all breast-feeding.

Pregnant women and mothers who are known to be infected with the HIV virus should be informed of the infant-feeding strategy recommended by the national or provincial authority. Such strategies will improve the chances that infants exposed to HIV will not be infected with the virus, while also improving the health of HIV-infected mothers. All pregnant women and mothers should have access to skilled counselling and support so that they receive reliable information about appropriate infant-feeding practices and about ARV interventions that can promote the HIV-free survival of infants.

Mothers whose HIV status is unknown can receive the same counselling as mothers who are known to be uninfected: to exclusively breast-feed their infants for the first 6 months of life and then introduce complementary foods while continuing breast-feeding for at least another 24 months. However, mothers whose status is unknown should be offered HIV testing. Mothers who are not infected with HIV should be counselled about ways to prevent HIV infection and about the services that are available to help them to remain uninfected, such as services that distribute free condoms (WHO, 2010a).

The issue of drug treatment for HIV-infected women in relation to breast-feeding is discussed more fully in Chapter 10.

DISCUSSION QUESTIONS AND EXERCISES

1. A 22-year-old pregnant woman with pre-pregnancy weight of 43 kg and height of 1.6 m presents to the clinic. She smells of cigarette smoke but says that she does not smoke. How would you handle this case?

2. Imagine you are a manager of a national nutrition programme. With specific reference to your country setting, describe how you would incorporate the interventions that have been shown to be effective for maternal
undernutrition and nutrition-related outcomes. Base your answer on the UNICEF conceptual framework for understanding the causes of malnutrition described in section 2.4 of Chapter 1, and refer to the malnutrition poverty cycle, illustrated in Figure 5.1 above.

3. You are a lecturer in community nutrition at a university in a developing country. You have been invited to give a presentation to a group of visiting gynaecologists and obstetricians, most of them from quite affluent countries. The topic is the recent addition of new criteria to the WHO’s Baby-Friendly Hospital Initiative. Discuss how you will describe these new criteria and explain to the doctors why they are important. In addition, explain what actions have been carried out in your country to implement the BFHI and what still needs to be done.

REFERENCES


King JC. 2003. The risk of maternal nutritional depletion and poor outcomes increases in early or closely spaced pregnancies. *J Nutr*, 133: 1732–6S.


doi:10.15215/aupress/9781927356111.01


ADDITIONAL RESOURCES


The following websites also provide a wealth of up-to-date information:

La Leche League International: http://www.llli.org/
1,000 Days: http://www.thousanddays.org/
WHO, Maternal, Newborn, Child and Adolescent Health:
http://www.who.int/maternal_child_adolescent/en/

ACKNOWLEDGEMENTS

This chapter is based on a chapter in an earlier book:


We acknowledge the contribution of Irene Labuschagne, who was an author of the previous version of this chapter.

doi:10.15215/aupress/9781927356111.01