Optimal nutrition during pregnancy and lactation

Abstract
A healthy diet before, during, and after pregnancy improves maternal health, and decreases the risk of pregnancy complications, birth defects, and chronic diseases in children in later adulthood.

Introduction
During pregnancy, a woman experiences a very intense period of growth and development. Therefore, optimal nutrition is vital, as the mother's nutritional status plays a critical role in the outcome of the pregnancy, and in foetal growth and development. A healthy diet improves maternal health, and decreases the risk of pregnancy complications, birth defects, and chronic diseases in children in later adulthood. The mother's nutritional status influences the composition of her breast milk, making optimal nutrition during lactation important for the growth and development of the infant.

Acceptable weight gain during pregnancy
Both high and low gestational weight gains are independently associated with an increased risk of childhood obesity, suggesting that influences occurring very early in life contribute to obesity onset.

The majority of weight gain during pregnancy is mostly due to maternal reproductive tissues, fluid, blood, and "maternal stores", which mostly comprise body fat. These fat stores are an energy reserve during pregnancy and lactation. Less than half of the weight gained is attributed to the foetus, placenta and amniotic fluid. Pre-pregnancy weight status influences the relationship between weight gain during pregnancy and birthweight. The most important factors for intrauterine growth retardation (IUGR) include low-energy intake, low gestational weight gain, and low preconception body mass index (BMI).

Therefore, recommendations for pre-pregnancy weight gain during pregnancy should be given according to pre-pregnancy BMI to improve pregnancy outcomes, avoid post-pregnancy weight retention, and decrease the risk of chronic diseases in the child in adulthood.

Table I provides the revised gestational weight gain guidelines of the United States Institute of Medicine (IOM).

<table>
<thead>
<tr>
<th>Pre-pregnancy body mass index</th>
<th>Body mass index (kg/m²)</th>
<th>Total weight gain (kg)</th>
<th>Rates of weight gain (kg/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
<td>13-18</td>
<td>0.45</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5-24.9</td>
<td>11-16</td>
<td>0.45</td>
</tr>
<tr>
<td>Overweight</td>
<td>25-29.9</td>
<td>7-11</td>
<td>0.27</td>
</tr>
<tr>
<td>Obese</td>
<td>≥ 30</td>
<td>5-9</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Inadequate nutrient and energy intake also influence the volume of milk production, and possibly cause breastfeeding malnutrition, or "failure to thrive" in the infant. The composition of milk is usually not compromised over a short period of time, but a maternal diet lacking protein and energy could decrease milk production.

Nutrient requirements during pregnancy and lactation

Energy
Energy requirements increase during pregnancy, as a result of foetal growth and increased maternal body weight. Energy metabolism is altered, and responses...
by women who seem to enter pregnancy in similar nutritional states, vary widely. The increased energy needs of pregnant women vary from 210-570 kJ per day, and an additional 340 kJ/day during the second trimester, and 452 kJ/day for the third, is recommended.10 Energy and nutrient needs are higher in multiple pregnancies due to increased maternal blood volume and extracellular fluid and uterine, placental and foetal growth.1

Lactating women need to increase the consumed energy and overall nutrient intake to satisfy the requirements for milk synthesis, based on BMI, and amount of weight gained during pregnancy. The recommended dietary allowances for the first six months of lactation is 1 868 kJ, and for the next six months 1 680 kJ greater than that of non-pregnant females, while overweight or obese mothers need not add additional energy.11

**Protein**

Shifts in protein metabolism are complex, and change gradually throughout gestation, ensuring that nitrogen conservation for foetal growth is optimised during the last quarter of pregnancy.9 An additional 25 g of daily protein is recommended.1,10

**Carbohydrate and dietary fibre**

Approximately 50-65% of total energy intake should be sourced from carbohydrates, and a daily minimum of 175 g during pregnancy, and 210 g during breastfeeding is required to meet the foetal brain's glucose requirement.1,10 High-fibre carbohydrates are recommended for their documented benefits, including phytochemical content and regulation of bowel movement.1

**Essential fatty acids**

The dietary reference intakes requirements for linoleic acid are 13 g/day, 1.4 g/day for alpha-linolenic acid during pregnancy, and 1.3 g/day during lactation.10

Omega 3 (n-3) plays a vital role in the baby's brain development, especially during pregnancy and breastfeeding. The European Commission recommends an average docosahexanoic acid (DHA) intake of at least 200 mg/day to reduce the risk of early pre-term birth, and to ensure adequate DHA deposition in the brain and other tissues during critical developmental periods. The recommended DHA intake can be reached by consuming one to two portions of oily sea fish per week.11 Currently, there is no consensus regarding the supplementation of n-3 fatty acids, or DHA, for pregnant women. Available supplements vary in terms of claimed and measured eicosapentaenoic acid (EPA) and DHA content, as well as numbers of capsules, and price, to meet dietary recommendations. A recent study showed that mercury was virtually absent from the oils in the commercially available South African n-3 fatty acid supplements.12

**Micronutrients**

A deficient intake of most micronutrients may impact negatively on maternal health and foetal development.13 During pregnancy, there is an increased requirement for iron, folate, zinc, selenium, chromium, iodine, riboflavin, niacin, vitamins A, B₆, B₁₂, C, and pantothenic acid.2,10,13 Large doses of vitamin A should be avoided as they may increase the risk of birth defects.13

During breastfeeding, requirements for iron, zinc, selenium, chromium, iodine, thiamine, riboflavin, niacin, folate, vitamins A, B₆, B₁₂, C, and E are increased.10

Prenatal multivitamin supplementation (without vitamin A) reduce the risks of low birthweight, and small-for-gestational-age birth size.14 Since food intake does not always guarantee 400 µg of daily folic acid,15 a pregnancy specific supplement containing 400-600 µg folic acid per day is advised. The South African Department of Health has introduced compulsory folate and iron supplements to all pregnant women attending antenatal clinics, to reduce or prevent anaemia in pregnant women. Multiple micronutrient supplementation is preferable to single iron and folic acid supplementation, especially in countries where multiple deficiencies are prevalent.16 Multivitamin and mineral supplements are indicated for pregnant and breastfeeding women who fail to consume a healthy varied diet; vegans; those who consume no, or small amounts of animal foods; women carrying two or more foetuses; and those who smoke, or abuse alcohol or drugs.2

Based on the dietary reference intakes, calcium supplementation of ~1.5-2 g per day is indicated if three to four portions of low-fat dairy is not consumed.11 During pregnancy, calcium supplementation is associated with a reduced risk of gestational hypertension, pre-eclampsia, neonatal mortality, and pre-term birth.17

**Special precautions and food safety**

Due to increased progesterone levels during pregnancy, women are more susceptible to foodborne illness. Listeriosis is associated with spontaneous abortion and stillbirth, and pregnant women should avoid raw fish, oysters, unpasteurised milk.18 The protozoan, Toxoplasma gondii (in raw and undercooked meats, surfaces of fruit and vegetables and animals), is transferred from mother to foetus, and causes blindness, mental retardation, seizures and death.19

Although pregnant women should aim to eat two to three portions of fish per week, shark, swordfish, king mackerel and tilefish should be avoided because of high mercury levels.20
Use of other substances

Alcohol intake during pregnancy is associated with major neurological and developmental birth defects, and can lead to foetal alcohol syndrome. Excessive caffeine intake above 300 mg/day should be avoided, as it is associated with spontaneous miscarriage and low birthweight, while smoking and use of illicit drugs lead to spontaneous abortion, low birthweight and developmental problems.2

Conclusion

A healthy diet and lifestyle during pregnancy and lactation is important to ensure optimal pregnancy outcomes. Healthy weight gain, according to the mother’s pre-pregnancy BMI, will aid in improving pregnancy outcomes, decrease post-pregnancy weight retention, and the risk of the child acquiring chronic diseases in the future.

Pregnant and lactating women have increased energy and protein requirements, and two to three portions of fish per week is recommended to obtain the required DHA levels for optimal brain development. A pregnancy-specific supplement containing 400 µg folic acid and 27 mg iron is advised. Attention to food safety is important, because of increased susceptibility to foodborne pathogens during pregnancy. Lastly alcohol, smoking, and illicit drugs, must be avoided, to protect the unborn infant.

References