

NUTRITION IN PREGNANCY

Aim

Explain the various nutritional needs of the mother and child during pregnancy.

EARLY PREGNANCY AND MORNING SICKNESS

Many women may not be aware of when they have fallen pregnant. This is one of the important reasons why establishing a healthy pre-conception diet is important. The very early stages of pregnancy, although the women will generally not gain much weight and the baby will still be very tiny, are none the less, nutritionally demanding and a period of rapid growth and change. One of the biggest challenges faced by women early in pregnancy is morning sickness, although for many women, this may be a misnomer as nausea may continue right through the day.

The problem with morning sickness is that it leaves a woman with little to no appetite and often, what she does consume will be eliminated from the body before it can be utilised due to vomiting (emesis). Vomiting can also leave the women dehydrated and when it is chronic can cause imbalances in blood electrolytes and other problems. Lack of nutrition can leave a woman tired, lacking vitally important nutrients, and can lead to weight loss also.

Tips to help with pregnancy nausea

- Ensure your stomach is never empty – eat lots of small (healthy) snacks through the day
- Ginger and peppermint can help alleviate nausea in some women. Simple caffeine free teas of ginger or peppermint can be good as they also hydrate. Essential oils may also help.
- Cold drinks or ice-blocks
- Flat lemonade can help relieve nausea
- Try to avoid getting up in the morning on an empty stomach. Get your partner to make you some plain wholegrain toast with a little butter to eat before you get up, or keep a stash of crackers by your bed
- Stay hydrated, keep a water bottle with you at all times and sip constantly, rather than gulping large amounts of fluid on an empty stomach
- If you are concerned about nutrients, try flavouring your water with fruit juices or taking dissolvable supplements. Fibre supplements like Metamucil can help if you are not able to keep fibre rich foods down. Smoothies, soups and yoghurts are good liquid sources of nutrition and simple mashed foods (potato, sweet potato, peas, applesauce) can all help you get nutrients
- Avoid strong aromas, and strongly scented or spiced foods such as fish, garlic and curry
- Oily foods can make nausea worse for many people
- Try a "Sea-Band" wristband, which works through acupuncture points (available at pharmacies)
- Take pregnancy supplements if you are vomiting a lot or notice signs of deficiency

If you are having trouble eating, losing weight, are not able to get your daily requirements of nutrients, or are vomiting constantly, anti-nausea prescription medications that are safe in pregnancy can be obtained from your doctor.

Severe, continuous vomiting is known as hyperemesis. Women suffering this condition can suffer injury due to the constant force and pressure exerted by vomiting (blood shot eyes due to damage of the delicate blood vessels in the eyes, blood vessel damage in the nose can cause nose bleeds also). They can also suffer damage to the throat, mouth and teeth from constant irritation by acidic stomach contents. Stomach ulcers may also occur. Nutrient intake will be severely compromised, dehydration and electrolyte imbalances also occur. Hyperemesis in pregnancy requires medical assistance and may require hospitalisation and intravenous fluids.

NUTRITION THROUGH PREGNANCY

If the mother already has a balanced diet meeting the RDIs of all essential nutrients prior to pregnancy, only minimal dietary changes are required to ensure she is getting all the nutrients required to sustain a healthy pregnancy. Particularly, calcium, iron and folate intake should be increased. During the later stages of pregnancy calcium intake becomes more important as the babies soft bones begin to mineralise and its muscles begin to contract as it moves about in the uterus. Iron intake also becomes increasingly important to support the increasing oxygen demand of the growing foetus and the mother, whose body is also growing. Late in pregnancy the woman must get sufficient iron to reduce her risk of post-partum haemorrhage and to combat the heavy blood loss in the days and weeks after delivery. The baby also needs adequate iron stores in their body to last for the first 6 months or so of life. Folate is most important in the first trimester of pregnancy.

Different nutrients have different functions in pregnancy. Although many are not required in amounts additional to the RDI for a non-pregnant adult woman, problems arise because most non-pregnant adult women are deficient in some nutrients in the first place. Below is a table explaining some nutrients and how they are important for developing foetuses.

Nutrient	Recommended Intake	Role in foetal development
Calcium	1000-1300mg	Bone and tooth development, nerve, muscle and heart development and function, blood clotting
Chromium	30mcg	Regulates blood sugar levels, important for tissue formation because it stimulates protein synthesis
Copper	1mg	Development of the cardiovascular, skeletal and nervous systems
Fluoride	3mg	Crucial for tooth formation which starts in the first trimester and continues throughout the remainder of pregnancy
Folate/Folic Acid	600-800mcg especially in the first trimester, 400mcg pre-conception	Proper development and closure of the spinal cord and canal from the neural crest early in pregnancy. Important for DNA synthesis and brain function
Iodine	220mcg	Nervous system development (deficiency in pregnancy strongly linked to cretonism in children) and also important for metabolic regulation
Iron	30mcg	Particularly important in second and third trimesters for oxygen supply and subsequent energy production required to fuel growth, important for bone formation
Magnesium	350mg	Bone and tooth development, blood sugar regulation and tissue growth
Manganese	2mg	Important in bone mineralisation, and also in pancreatic development and metabolism of fats and carbohydrates
Pantothenic Acid	safe limit 6mg (no set RDI)	Important for adrenal function, metabolism and also immune function
Phosphorus	700mg	Important for bone and tooth mineralisation, heart function and blood clotting
Potassium	safe limit 2000mg (no set RDI)	Important in developing muscles and heart and also for nerve function
Riboflavin	1.4mg	Required for proper growth and also development of a variety of tissues including the skin. Important for good vision.
Thiamine	1.4mg	Very important for carbohydrate metabolism and

		brain development. Also important for the developing heart and nervous system
Vitamin A	2500IU	Important for the development of mucous membranes and the eyes as well as immune system development
Vitamin B6	1.9mg	Important for metabolism and energy production, also needed for production of new blood cells and heart and nervous system development
Vitamin B12	4-6mcg	Important for metabolism and energy production, for red blood cell production and nerve development
Vitamin C	60-70mg	Crucial for immune function, collagen production, bone and tooth development and tissue repair. Important in pregnant women with substance abuse problems or who smoke for protection of the foetus from toxins and free radicals
Vitamin D	400IU	Most important function is in bone and teeth development, aids in absorption of calcium also
Zinc	11mg	Very important for cell division and tissue development

Caloric Intake in Pregnancy

One of the most common myths surrounding pregnancy is that a woman must eat for two. While it is true that she is supplying all the growing baby's nutrients, for the majority of the pregnancy, the growing baby is tiny. Early pregnancy is characterised by development and maturation of tissues, organs and body systems, it is only in the latter stages of pregnancy that significantly growth in length and weight really occur. A 1lb, or 0.5kg foetus certainly does not need the same amount of calories as a fully grown adult!

A pregnant woman of average physical fitness and activity levels will need only a moderate increase in her daily calorie intake. The first trimester should see a woman consuming a similar amount of calories as she was pre-pregnancy. The foetus at this stage is tiny and the mother, although her body is changing will not need much extra calories yet. By the second trimester, after the placenta has formed and the mothers' body is changing more rapidly and blood flow and supply is increasing, approximately 300 calories extra per day will be needed to meet energy requirements. For athletic women up to 500 calories extra may be needed.

While a moderate increase in caloric intake is important, more important is the source of the additional calories. Pregnancy can leave a woman less sensitive to insulin than normal, meaning she is less able to cope with the fluctuations in blood sugar levels brought on by simple sugars. Calories should not be sourced from foods that are not also rich in other essential nutrients. Empty calories from fast foods, sweets and junk food are not recommended, instead, fruits and dairy, which contain sugars (fructose and lactose respectively) that do not cause such dramatic changes in blood sugar as glucose and sucrose, and which also contain a variety of other important nutrients, make excellent calorie sources.

Calorie demands in pregnancy

After the first three months, you must eat at least 300 calories more than when you were pregnant; if you are maintaining athletic activity, this increases to 500 calories. It is also recommended that you slightly increase the amount of protein you eat. Dairy products are also an excellent choice to meet your increased calorie demands, as they contain not only protein but also calcium. Balance out your diet with nutrient-rich fruits and vegetables.

For exercisers in particular, taking your daily prenatal vitamin is extremely important, as you especially need additional B vitamins, calcium, and iron to support your active lifestyle. Folate is the B vitamin essential to pregnancy. Do not take any other vitamins or supplements not recommended by your doctor, as these can be harmful to the baby. You must be especially careful of vitamins A and K, which at high doses can contribute to birth defects.

Daily nutritional needs of active pregnant women

Iron	50 mg
Calcium	1,500 mg
Thiamine (B1)	1.5 mg
Niacin	18 mg
Riboflavin (B2)	1.6 mg
Pyridoxine (B6)	2.3 mg
Cyanocobalamin (B12)	6 mcg
Pantothenic acid	6 mg
Folate	600 mcg
Vitamin C	60-70 mg
Magnesium	360 mg
Vitamin D	400 IU
Vitamin A	2800 IU
Vitamin E	10-20mg
Zinc	20 mg

Fluid Intake

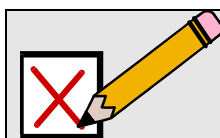
Pregnant women start to increase their blood volume as early as 6-8 weeks. Blood volume is at its maximum early in the third trimester and remains high until the end of pregnancy. It is important not only for oxygen delivery, but also because the woman will lose large amounts of blood in the post-partum period. By 6 months gestation a pregnant woman will have up to 2L more blood than pre-pregnancy. A large part of blood is composed of water. Pregnant women must therefore be very careful to maintain their fluid intake and not to become dehydrated. As a woman nears term, dehydration can trigger pre-mature labour. By staying hydrated a pregnant woman is less likely to suffer from headaches and a variety of other symptoms.

Fluid intake is also important for amniotic fluid, which is primarily composed of water. Amniotic fluid is constantly replenished to keep it fresh, and to remove things such as urine which the baby produces when its renal system is developed. Water is required for this constant replenishment. Additionally, urinary tract infections, very common in pregnant women are less likely if the woman is well hydrated. In dehydration the urine is much more concentrated if there is perineal damage after birth, concentrated urine can cause pain and a burning sensation, dilute urine does not, or at least, causes much less pain. (Imagine pouring salt water on a cut, compared to fresh water). Pregnant women should aim to consume at least 2L of fluid a day, avoiding caffeinated drinks and sugary drinks which cause the body to lose more water. If exercising regularly, more water will need to be consumed to compensate for sweating, about 500ml.

As the foetus grows larger, the woman's bladder will have much less room in which to expand as it fills with urine. This means that pregnant women, especially in the last trimester will need to urinate much more frequently. This can be annoying, but should not deter a pregnant woman from ensuring she is drinking enough.

Omega-3 Fatty Acid

Omega-3 is important for foetal brain development and research is on-going to understand other benefits it may have during pregnancy. In the later stages of pregnancy, omega-3 deficiency dramatically increases a woman's chances of pre-term labour and delivery. Omega-3 is also believed to be important in the prevention of post natal depression.



SELF ASSESSMENT

Perform the self assessment test titled 'Self Assessment Test 3.1.'
If you answer incorrectly, review the notes and try the test again.

FOODS TO AVOID WHILE PREGNANT

Pregnant women need to limit their intake of foods rich in Vitamin A, K and mercury as well as severely restricting, or avoiding alcohol, as all have been linked to birth defects. Additionally, there are some foods which should be avoided entirely. These include undercooked meats and seafood (especially shellfish), unpasteurised dairy products, pate and soft cheeses like brie and camembert and also deli meats and raw egg.

Bacterial Infection

Foods not recommended for pregnant women are typically dangerous because they are more likely to harbour pathogenic bacteria. During pregnancy a woman's immune system is less effective than normal, making her more susceptible to infection. The main bacterial infections to be concerned about for women are as follows:

Campylobacteriosis

Caused by the campylobacter species of bacteria. It is found in uncooked, undercooked and unpasteurised foods. It cannot thrive in high salt, acidic conditions or conditions where there is little or no water. It is destroyed by heat. It can survive very well in low oxygen.

Listeriosis

Along with salmonella, listeria bacteria are probably the best known causes of food poisoning, particularly in pregnant women. Unlike most other bacteria, it can survive in a wide range of acidic and also slightly alkaline conditions, in high salt, in cold temperatures and also with little or no oxygen. Listeria present in food will continue to grow slowly even when refrigerated. Unlike many bacteria, salt preservation does not stop listeria growth. This means that deli and processed meats, as well as uncooked or undercooked meats, raw and smoked seafood are all potential sources of listeria.

Salmonellosis

Caused by the salmonella bacterium. It is most common in high protein foods that are undercooked or in the case of dairy products, unpasteurised. It may be found in cold salads, some raw vegetables and undercooked eggs also. It is readily destroyed by extremes of temperature – refrigeration or cooking.

Toxoplasmosis

Toxoplasma gondii is a fairly hardy bacterium that is found in undercooked or raw meats and also unwashed vegetables and fruits, as it resides naturally in soils. Cats very often carry the bacteria in their gut and pregnant women should, wherever possible avoid changing cat litter trays. Gardening also poses a potential risk to pregnant women, but good hygiene practises, including thorough washing of hands with hot soapy water after gardening.

As a general rule, pregnant women should:

- Avoid all rare or raw meats
- Avoid raw and smoked seafood
- Avoid raw milk and raw milk products including cheeses such as brie, camembert and feta
- Avoid deli meats and processed meats – listeria can survive despite their high salt content, and pregnant women are best to avoid the high salt, preservative and artificial colourings in these foods
- Thoroughly scrub all fresh fruit and vegetables and avoid buying fruit and vegetables that have not been washed
- Take care with poultry and eggs, ensuring they are both fully cooked through. Avoid soft yolked egg dishes.
- Be wary of raw salads ensuring that ingredients have been properly washed and prepared

In terms of food safety pregnant women should be aware that:

- Buffets are not a good idea. You don't know how long food has been there, whether other customers have practised good hygiene and washed their hands, or whether foods have been kept at the correct temperature.
- Wash hands thoroughly after using the toilet, gardening, changing nappies, preparing food etc
- Most bacteria favour similar conditions – body temperature (37C), low salt and oxygen, neutral or near neutral pH and moisture. Avoid holding foods at temperatures between 30 and 60C.
- If symptoms suggestive of food poisoning or bacterial infection develop get medical assistance as soon as possible. Most bacteria cross the placenta easily and can cause miscarriage, still birth, birth defects and even developmental problems after birth. Symptoms include:
 - Fever
 - Chills
 - Diarrhoea
 - Stomach pain
 - Abdominal cramps
 - Vomiting
 - Nausea
 - Rashes
 - Headaches
 - Swollen lymph nodes (under jaw, under arms, in groin)

Hypervitaminosis

Vitamin A

Pregnant women should avoid consuming more than 3000mcg or 10,000IU of vitamin A in pregnancy. Liver and other organ meats are best avoided because they are so rich in vitamin A. The safest way to obtain vitamin A is to consume plant foods rich in beta-carotene. Beta-carotene will then be converted as your body needs, into vitamin A. High vitamin A intake increases the risk of birth defects, particularly if high intake occurs in the first 2 months of pregnancy. When taking vitamin supplements pregnant women should avoid those containing vitamin A (retinol) and women using prescription acne treatments should stop using them and consult their doctor for guidance as soon as they discover they are pregnant, or prior to conception for planned pregnancies. Prescription acne creams contain significant amounts of retinol.

Vitamin C

Pregnant women are recommended to consume 60-70mg a day of vitamin C (also known as ascorbate or ascorbic acid). Higher intake during pregnancy generally causes no harm and may be beneficial as the immune system is less effective during this time. Some women, those with substance abuse problems or smokers may be advised to take slightly more vitamin C. Such women should obtain medical advice. Vitamin C in very high doses has not been found to cause toxicity however it is not recommended in pregnancy as after exposure to such high vitamin C in utero, the newborn baby may develop rebound scurvy if the high vitamin C intake is not maintained. Breast milk and formulas would not contain the vitamin C required to prevent rebound scurvy.

Vitamin D

Although essential for proper bone and tooth development in the foetus, vitamin D intake for pregnancy does not increase over normal intake. High doses have shown to be toxic to the foetus and should be avoided. 400IU and some moderate sun exposure is sufficient for healthy foetal development.

Vitamin E

Vitamin E is much less researched and understood compared to most vitamins. It is important for thinning the blood and excess amounts can cause bleeding. Intake for pregnant women is recommended to be around 15IU or 10mg, slightly more than non-pregnant women. Chronically low intake increases the risk of pregnancy related hypertension (pre-eclampsia) and can lead to the build up of free-radical damaged fats in the arteries, increasing blood pressure.

Vitamin E is an important antioxidant but high intake (several hundred mg daily) especially when combined with very high vitamin C intake has shown in some studies an increased risk of low birth weight, miscarriage and still birth. It is generally advised to avoid supplements with vitamin E, unless the quantity is below the RDI and diet is not likely to provide adequate amounts.

Vitamin K

Vitamin K is important for normal blood clotting. Deficiency in newborns causes newborn haemorrhagic disease which can in severe cases be life-threatening. This is why it is routine to give newborns an injection of vitamin K after birth. Too much vitamin K in pregnancy, particularly in the latter stages may increase the risk of jaundice in the newborn. After birth high amounts of vitamin K can cause severe blood disorders. Like vitamin E, there is much less known about vitamin K, particularly in pregnancy, compared to most other nutrients. However, because it crosses the placenta and is also found in breast milk, and is involved in blood clotting women should be careful about how much they take. Supplements should generally be avoided.

COMPLICATIONS IN PREGNANCY RELATED TO NUTRITION

Neural tube defect

The body and basic structure of the different body systems begin to develop very early in pregnancy. One of the more common problems that can occur during this early stage are neural tube defects. The neural crest is a transient structure that sits above the neural tube in the early embryo. It is from these two structures that the spinal cord is formed along with much of the nervous tissue. Folate is critical, along with other micronutrients like zinc, in the correct differentiation of the neural crest cells. A woman lacking in folate in particular is significantly more likely to have her baby develop a neural tube defect. Conditions associated with low folate intake in early pregnancy include:

Anencephaly

This is a fatal condition where the brain does not form correctly, and regions of the scalp and skull also do not form. Typically the forebrain is missing, and this means that the baby will never be conscious. Babies with the condition are often stillborn or die very soon after birth. It is caused by failure of the neural tube to close properly.

Encephalocele

Another condition affecting the brain rather than the spinal cord and is also known as cranium bifidum. The condition is characterised by the protrusion of regions of the brain, and the membranes covering it through regions where the skull has not properly formed. It is caused by failure of the neural tube to close properly.

Spina Bifida and Meningocele

Spina bifida is a defect of the spinal cord. The spinal cord does not form fully and overlying vertebrae may also be incompletely formed. In some cases the spinal cord and the membranes covering it will bulge out (like the brain in encephalocele cases) through regions where vertebrae have not formed properly. The bulging fluid filled sac that forms is known as a meningocele if the nerves of the spinal cord are not also protruding or as a myelomeningocele if the spinal cord is also protruding. Spina bifida with a myelomeningocele is known as spina bifida cystica. Where there is no protrusion, the condition is known as spina bifida occulta, and this is the mildest form.

Maternal diabetes, obesity and pregnant women who are being treated for epilepsy are all more likely to have babies with neural tube defects.

Morning sickness

This is due to hormonal changes that occur when a woman falls pregnant. It can take the body a while to adjust to the hormone changes and prior to this nausea is a common side-effect. A variety of ways to try and manage symptoms is provided at the start of the lesson. Many people are not aware that severe morning sickness can be a very serious problem in early pregnancy.

Constipation

Constipation is the other problem seen among the pregnant woman. This can be rectified by including lot of fibrous foods in the diet such as whole grains, raw vegetables, and fruits and by drinking plenty of water. It occurs generally in the latter part of pregnancy as the expanding uterus and growing baby compress the bowel, slowing the passage of faecal material which in turn results in more water being drawn out of it, creating hard stools.

Dehydration will also worsen constipation, and likewise, increasing water intake can help ease symptoms. In the first few days post-partum constipation is a very common symptom as the digestive tract essentially switches off as the body diverts all resources to the uterus and other important areas for labour and delivery. The result is that the faecal material is held in the bowel much longer than normal. Taking a fibre supplement like Metamucil, and drinking plenty of water (water will be lost with the post-partum bleeding) is generally recommended in the days post-partum to ease constipation. It is particularly important for women who have had a long labour and who have perineal damage, and the pressure of defecating when constipated can cause pain and even further damage to the perineal area.

Gestational diabetes

Gestational diabetes mellitus increases the risk of pregnancy for the mother as well as the foetus. Insulin requirement goes up in pregnancy due to reduced insulin sensitivity and relative deficiency of insulin. Reduced insulin sensitivity in terms due to the ovarian and placental hormones and relative deficiency of insulin is due to inadequate compensatory insulin production by pancreas gland.

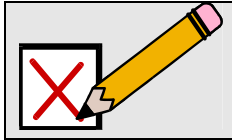
The risk of pre-eclampsia, intrauterine death, hydraminos (more fluid), macrosomia (large baby), pre maturity, neonatal hypoglycaemia (less sugar) impaired lung maturity and congenital heart disease and other congenital anomalies are increased in gestational diabetes. By controlling blood sugar the incidence of these complications can be reduced. The problem in controlling diet is that it will interfere with requirement of the increased nutrient requirements during pregnancy and the risk of developing hypoglycaemia. Hypoglycaemia is equally or more dangerous for mother and the foetus. Because of these limitations diet is not strictly controlled in mild gestational diabetes. The main principle is to have discipline in eating habit and cut out simple sugars and anything with a high glycaemic index. Total calories content can not be reduced below a certain limit with out compromising on nutrition.

Pregnancy induced hypertension

Pregnancy induced hypertension, also known as pre-eclampsia, is most common among women who are in their first pregnancy, of quite low (teenagers) or high maternal age (over 35), on inadequate diets and in those with little or no prenatal care. High blood pressure can harm the developing baby because the blood supply going to the placenta is reduced as a result the baby does not receive adequate nutrition and oxygen, and may fail to grow properly and may not be able to with stand the stress of labour. In mother, if not controlled properly it can cause eclampsia, which is a very serious condition for the mother and the baby.

Foetal Alcohol Syndrome

Alcohol, like other toxins, as well as all the baby's nutrients, pass from the blood stream of the mother, through the placenta to reach the growing baby. The amount of alcohol a pregnant woman must consume in order to cause permanent injury to their unborn baby. This is why it is currently recommended that pregnant women abstain from alcohol completely. In fact, very little is known about how the condition develops in relation to a woman's drinking habits. The syndrome itself is characterised by central nervous system damage and improper brain development. Children tend to show signs of mental retardation, such as poor cognitive functioning, poor attention span, and poor memory). It is as common in some western countries as foetal conditions like spina bifida. It can be entirely avoided by avoiding alcohol during pregnancy. Babies with FAS will have small eye openings, smooth philtrum and an unusually thin upper lip. They will also be of low birth weight and show poor rates of growth postnatally.



SELF ASSESSMENT

Perform the self assessment test titled 'Self Assessment Test 3.2.'
If you answer incorrectly, review the notes and try the test again.

SET TASK

1. For the micronutrients (excluding the vitamins) listed in the table in this lesson (see the section on nutrition through pregnancy), research and identify good food sources for each (5 or more). Spend about 30 minutes on this task.

2. Research each of the following conditions and make notes (consider particularly the impact of maternal nutrition in these conditions):

- Rebound scurvy
- Cretinism
- Macrosomia

Spend no more than an hour on this task.



ASSIGNMENT

Download and do the assignment called 'Lesson 3 Assignment'.