Details the specific nutritional needs of the developing fetus and the mother; stresses importance of pre- and post-conceptional nutrition to prevent birth defects; explains nutrient transfer from chorionic sac to placenta; provides guidance on conducting nutrition assessment of a pregnant woman. Topics include critical times during development, fetal nourishment, nutrient needs during pregnancy, macronutrients, weight gain, consequences of maternal malnutrition, energy cost of pregnancy, veganism, hyperemesis, and pica.

MODULE OBJECTIVES- After completing this self directed learning module on nutrition during pregnancy, the student will be able to:

- Relate the impact of maternal nutrition on early fetal development
- Describe the role of the placenta in fetal nourishment.
- Describe the effect of pregnancy on nutrient requirements
- Assess and advise pregnant women on their dietary needs and habits
- Cite appropriate weight gain standards for pregnancy

Module Outline:
Getting Started
Module Objectives
Critical Times During Development
  Times of Critical Nutrient Needs
  Pre-conceptional Nutrition
  Neural Tube Closure
  Nutrient Deficiency and Birth Defects
  Sources of Folate
Fetal Nourishment
  Function of the Yolk Sac
  Function of the Placenta
  Transfer of Fat-Soluble Vitamins Across the Placenta
  Iron Transfer to the Fetus
Nutrient Needs During Pregnancy
  Fetal Dependence on Maternal Nutrients
  Changes in Maternal Nutrient Needs
  Folate
  Iron
  Calcium
  Protein Nutritional Supplements for Pregnancy
  Suggested Content of Prenatal Supplements
Protein
  Rate of Fetal Protein Accretion
  Transfer of Amino Acids to the Fetus
Carbohydrates
Carbohydrate Needs
Transfer of Glucose to the Fetus: Early Pregnancy
Transfer of Glucose to the Fetus: Late Pregnancy

Fats
Fat Intake
Transfer of Lipids/Fatty Acids to the Fetus

Weight Gain
Monitoring Weight Gain
Recommended Weight Gain during Pregnancy
Normal Rates of Weight Gain
Excess Maternal Weight Gain

Maternal Malnutrition
Outcomes of Maternal Malnutrition
Outcomes of Maternal Malnutrition: Overview
Interactive Exercise: Maternal Malnutrition

Maternal Diet Patterns
Dietary Factors and Potential Impacts
Energy Cost of Pregnancy
Energy Assessment
Overall Balance: Assessment and Advice
Veganism

Special Concerns
Nutritional Management of Physiological Changes
Hyperemesis
Pica

Integrated Practice (Preconception Case)

Objectives, Key Concepts, and Key Concept Summaries by Topic

Topic: Critical Times During Development

Objective:
Identify the birth defects that can occur from nutrient deficiencies during pregnancy.

Key Concept:
Optimal maternal nutrition during pregnancy lowers the risk of birth defects.

Low maternal intakes of vitamins needed for DNA synthesis and neural tube closure
(e.g., folate, vitamins B12 and B6) may cause severe birth defects, especially during the
first few weeks of pregnancy. Genetic variation in maternal vitamin metabolism may also
increase the risk of birth defects. The neural tube closes by day 28, before many women
even realize that they are pregnant. All women of childbearing age should take a
supplement containing 400 micrograms of folic acid whether they are planning a
pregnancy or not.
Nutrients are provided by the yolk sac first and the placenta later.
During the first weeks, the embryo gets all nutrients from fluids secreted by the yolk sac. Glucose, amino acids, vitamins and other essential compounds are absorbed by the embryo’s yolk sac, by both passive and active transport mechanisms. Towards the end of the first trimester the placenta takes over the maternal-fetal exchange of nutrients, fluids and gases.

Nutrition in Pregnancy Handouts

**Topic: Nutrient Needs During Pregnancy**

**Objective:**
Describe the effect of pregnancy on nutrient requirements, and offer dietary advice to pregnant women.

**Key Concept:**
Maternal diet and nutrient stores together provide for fetal needs. Folate, iron, calcium, and protein intakes have important health consequences for both the mother and fetus. Knowing dietary sources of these nutrients will help healthcare providers quickly assess maternal intake and offer practical guidance for meeting nutrient recommendations. Many women require supplements during pregnancy; always include recommendations for supplementation in the initial dietary assessment.

**Topic: Protein**

**Objective:**
Explain the need for adequate protein intake during pregnancy and the transport of amino acids across the placenta.

**Key Concept:**
The transfer of amino acids increases to meet fetal demands for protein during pregnancy. Fetal requirements for protein increase sharply midway through pregnancy and peak toward the end. To meet the high fetal demands for protein, specific transporters in the syntrophoblast layer of the placental membrane move amino acids from the maternal side to the fetal side.

**Topic: Carbohydrates**

**Objective:**
Describe the maternal requirements for carbohydrates and the fetal use of glucose during pregnancy.

**Key Concept:**
Glucose serves as the main energy source for the fetus. The rapid use of glucose by the fetus, coupled with the relatively high concentration of glucose in maternal blood, promotes facilitated diffusion of glucose across the placenta. As fetal use of glucose increases, the mother may have to break down her own protein for gluconeogenesis.

**Topic: Fats**

**Objective:**
Describe the transfer of fats to the fetus and the role of fatty acids in fetal development.
Key Concept:
The fetus takes up fats primarily for energy and neural development. During pregnancy, maternal fat intake provides essential fatty acids, fat-soluble vitamins, and energy to the mother and developing fetus. Fatty acids, cholesterol, and other lipophilic substances enter the syncytiotrophoblast via specific receptors and are secreted into fetal blood with newly synthesized lipoproteins. The fetal brain requires docosahexaenoic acid (DHA) and other essential fatty acids for normal growth and development.

Topic: Weight Gain
Objective:
Explain how maternal weight status before pregnancy determines recommended weight gain during pregnancy.
Key Concept:
Optimal weight gain during pregnancy depends on maternal pre-pregnancy weight status. All women need to gain some weight to support fetal growth, even when they are overweight or obese. Ideal weight gain during pregnancy varies from 7-18 kg (15-40 lbs), depending on the pre-pregnancy status of the mother: underweight women should gain 12.5-18 kg (28-40 lbs), normal weight women should gain 11.5-16 kg (25-35 lbs), and overweight women should gain 7-11.5 kg (15-25 lbs). Obese women should gain at least 7 kg (15 lbs) because inadequate weight gain always reflects insufficient nutrient intake. Excessive maternal weight gain increases the risk of complications for both the mother and fetus.

Topic: Maternal Malnutrition
Objective:
Explain the adverse effects of maternal malnutrition on fetal growth and development.
Key Concept:
Maternal malnutrition can lead to poor fetal outcomes. Insufficient energy, protein, carbohydrate, and vitamin/mineral intakes can impair fetal growth and development. Adverse fetal outcomes include growth retardation, inadequate brain development, insufficient nutrient storage, altered enzyme activity, and increased health risks in adulthood.

Nutrition in Pregnancy Handouts
Topic: Maternal Diet Patterns
Objective:
List factors that a pregnant woman should consider when planning how to provide extra energy for the growing fetus.
Key Concept:
Recommend nutrient-dense foods to meet the energy requirements of pregnancy. When planning a diet that will provide the extra 340-450 calories needed during the 2nd and 3rd trimesters, a pregnant woman should choose nutrient-rich foods from each of the five My Pyramid food groups. Vegans may require counseling and supplementation to prevent nutrient deficiencies. Limit caffeine intake to < 300 mg (6 oz coffee = 100 mg, 12 oz cola = 50 mg). In general, avoid alcohol during pregnancy. Increase fiber to 28
g/day and increase fluid intake. Avoid saccharin intake during pregnancy and limit the consumption of other non-nutritive sweeteners. Use salt in moderation. Food cravings and aversions are normal and usually disappear by the 4th month. Craving for non-food substances (pica) should be investigated.

**Nutrition in Pregnancy Handouts**

**Topic: Special Concerns**

**Objective:**
Describe how dietary choices may relieve pregnancy-related discomforts and medical concerns (hyperemesis and pica).

**Key Concept:**
Address nutrition-related problems that may arise during pregnancy.

A pregnant woman can modify her diet to alleviate symptoms of heartburn, constipation, and hypertension, but problems such as hyperemesis and pica may develop into serious medical concerns if untreated. Small meals may reduce nausea by stabilizing blood glucose, and supplementation may end the pica that results from nutritional deficiencies.

**Bibliography**

Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride. Institute of Medicine, National Academy Press, Washington, DC. 1997. Available at www.nap.edu


Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline. Institute of Medicine, National Academy Press, Washington, DC. 1998. Available at www.nap.edu


King, JC. The risk of maternal nutritional depletion and poor outcomes increases in early or closely spaced pregnancies. J Nutr. 2003;133(5 Suppl 2):1732S-1736S.


Welcome to NIM on line tutorial Information For Students [ Student start up]

Nutrition in Pregnancy Handouts

Select

REGISTER NOW

Registration Instructions

for Students

Fall Session

Login as a current user or:

Finding the website: http://www.nutritioninmedicine.net/portal/

Step 1) Go to: http://www.nutritioninmedicine.net/portal/

We recommend using a wired connection, or a wireless connection with a STRONG

signal.

Step 2) Choose Register Now (bottom
center).

Step 3) Create an account by entering your email address and a password (at least 6 characters long). Select Continue after each step.

Step 4) Enter your first and last names, a backup email in case your email address changes, then answer the next two questions as they appear. Continue.

Step 5) Indicate where your medical school is by choosing country, state, & name of your institution. Answer the curriculum questions, then Register.

Step 6) Enter the access code(s) given to you by your instructor, ATSU_nutrition then Submit.

Access codes are NOT case-sensitive.
Step 7) You will be given notice that

**Access is Granted.** Now Enter NIM.

Step 8) Choose Course Listings from the blue bar at the left, or the View My Courses button in the center.

Step 9) If you have entered more than one access code, you will be able to filter your course listing.

Step 10) You will see a list of modules. Select a module, then Start the Course.

GU course

It will launch in a separate window.
If the course does NOT start, check that you do not have Pop-ups blocked.

For technical concerns, please contact nimtech@unc.edu.

**EXAM RESULTS:** Make sure to make a printout or screen capture of your exam score, in case the results are lost in transmission.

**Select a module:**

Each course will require an access password; your course password for **Nutrition during Pregnancy** GU 2016 is noted below (note font case sizes).

**Password:** ATSU_nutrition

**User notes:** COURSE availability is from 09/23/2017 to 10/23/2017

As you proceed through the module you may wish to take notes. Click on the tab **User Notes** under the top navigation bar and start typing. The notes window automatically recedes without losing its content as you progress through the program and is immediately accessed by clicking again on the tab. Notes are NOT saved when you quit; you should print or email them before you quit.

**Exam results:** Each module has a post-test exam at the end. Students can take each exam multiple times if they log out and log back in. All scores are recorded with a date and time and will be included in the reports available to instructors and institutions. You can print out exam results at the end of the final test by clicking on the print option. Make sure to make the printout when you get to the end, since the results are not retained.