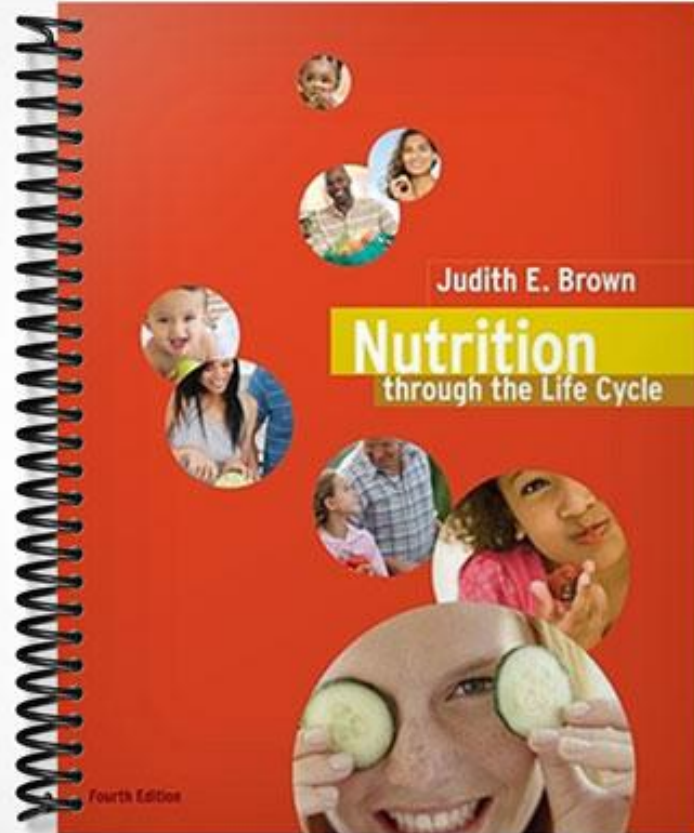


# SOLUTIONS MANUAL



# Instructor's Manual<sup>1</sup> for Chapter 2 – Preconception Nutrition

## Learning Objectives

### **Knowledge**

- Define key words: fertility, infertility and subfertility; fecundity and infecundity; miscarriage, endocrine, embryo, fetus, menstrual cycle, corpus luteum, prostaglandins, androgens, pelvic inflammatory disease, leptin, body mass index, amenorrhea, anovulatory cycles, carotenemia and neural tube defects.
- Describe the two phases of a menstrual cycle, including the effects of hormonal changes on nutritional status.
- Identify three factors that impair fertility in women.
- Identify three factors that impair fertility in men.
- Identify five nutritional exposures before and very early in pregnancy that disrupt fetal growth and development.

### **Skill**

- Discriminate the fertility outcome differences between acute undernutrition and chronic undernutrition.
- Give dietary recommendations to women considering pregnancy using the MyPyramid Food Guide.

### **Awareness**

- Acknowledge the circumstances needed to support community programs that promote nutritional health for couples contemplating a pregnancy.
- Appreciate the possible and known nutrition-related side effects of oral, injectable, and implantable contraceptives.
- Understand the importance of body composition, adequate weight and nutrient status when planning for conception.

## Lecture Launchers

- **Caffeine as contraceptive?** High intakes of caffeine “may delay conception”; see page 61. Help students understand what “high levels of caffeine” mean by bringing two visuals: a 16-oz coffee shop take-out cup would provide the roughly 300 mg of caffeine that decreased chances of conception by 27% per cycle in one of the studies cited; 32 oz (a quart) provides over 500 mg caffeine that cut conception rates in half over a 10-month period in another study. [Table 2.5, Caffeine content of foods and beverages shows values.]
- **Highlight factors related to impaired fertility** in men and women listed in Table 2.3. [Delays in contraception attributed to caffeine also provide an excellent opportunity to explore the levels and quality of researched links between nutrition and conception. When is the evidence enough to make public recommendations? Do we use different standards when making recommendations during pregnancy?]

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<sup>1</sup> revised by Carrie King, University of Alaska at Anchorage; originally by U. Beate Krinke, University of Minnesota

## **Worksheet Answer Key** (worksheets appear at the end of this document)

### **Worksheet 2-1: Preconception Nutrition Counseling**

1. According to Table 2.6, oral contraceptives might cause increased blood levels of triglycerides and LDL cholesterol. Considering her family history of heart disease and type 2 diabetes, and the absence of current lab work, it would be prudent to recommend she see her health care provider to have current lipids and glucose labs drawn. Based on the results of these labs, she may want to discuss alternative forms of contraception with her provider, including changing the type of oral contraceptive.
2. BMI = 28.2 isn't associated with compromised fertility; history of iron-deficiency anemia could interfere with fertility, so she should have current iron levels checked; caffeine intake is excessive and may interfere with fertility.
3. Continue and/or increase current level of physical activity, decrease caffeine intake, have annual physicals including lab work, and follow an individualized meal plan according to MyPyramid Food Guide.

**Worksheet 2-2: Iron and Vitamin C Intake** – Answers will be individualized.

## **Textbook Case Study Answer Key<sup>2</sup>**

### **Case Study 2.1: Cyclic Infertility with Weight Loss and Gain**

1. Underweight.
2. No. (BMI correlates with body fat content in groups of people, but does not indicate an individual's level of body fat.)
3. There could be several different reasons why Tonya stopped menstruating. One reason could be her loss of body fat and alterations in reproductive hormone levels that are sensitive to body fat content. The case for this being the fact is strengthened by the return of menstruation and ovulation after Tonya gained weight. This case is not the only clinical picture observed in women experiencing amenorrhea after weight loss. In some cases, FSH is low and LH release and levels normal; other cases are characterized by elevated estrogen levels; and so on. Each case must be considered individually.
4. It likely decreased.
5. Fertility-enhancing drugs may not induce ovulation in underweight women; becoming pregnant while underweight increased the likelihood of adverse pregnancy outcomes; and the initial treatment approach recommended for weight-related amenorrhea is weight gain.

### **Case Study 2.2: Male Infertility**

1. Mr. Trigger's BMI is 37.2 kg/m<sup>2</sup>.
2. Obesity due to excessive energy intake and inadequate physical activity.

Note: The nutrition care process emphasizes prioritizing and focusing on one diagnosis. Part of the diagnosing step is to consider the etiology/cause behind the nutrition diagnosis/problem.

3. Students should identify evidence-based methods for achieving sustainable weight loss, increases in physical activity level, or methods that address both. The intervention would focus on the obesity problem. It would aim to reduce the client's extra calorie intake and to implement effective methods for increasing physical activity.

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<sup>2</sup> Contributed by Judith E. Brown.

4. Examples of nutrition-related indicators that could be used to monitor and evaluate the interventions:
  - Weight, BMI, weight loss
  - Physical activity level
  - Achievement of behavioral change goals or other changes related to the selected interventions
  - Normal sperm count
  - Quality of life indicators
  - Client adherence to nutrition care plan

## **Chapter Outline**

### **I. Introduction**

Chapter 2 develops a vocabulary that will be new for many students. Thirty-three words are defined in the margins of “Preconception Nutrition.” Students with biology, anatomy and physiology expertise will have an edge over those who are not familiar with reproductive processes.

### **II. Preconception Overview**

This section distinguishes between the definitions of fertility (actual production of children, typically as rate or number of children born per 1000 women aged 15-44) and fecundity (the biological capacity to bear children). The common meaning of infertility (biological inability to bear children) is used throughout. Regular, unprotected intercourse leads to a 25-30% chance of pregnancy within one menstrual cycle in healthy couples; however, up to 39% of conceptions do not continue to develop a fetus due to resorption into the uterine wall or miscarriage in the first 20 weeks of pregnancy. An important concept emphasized by Table 2.1 (p. 53), 2010 Nutrition Objectives, is that goals for preconceptional health apply to men and to women.

### **III. Reproductive Physiology**

Section highlights are presented in Illustrations 2.1 and 2.2 (p. 54, 55). Females are born with a full set of ova that are used up by menopause, whereas males are born with sperm-producing capabilities that last throughout the life span. The rise and fall of estrogen and progesterone affect menstrual cycles in women; in males, reproduction is an ongoing rather than a cyclic process. Testosterone stimulates the maturation of sperm, which takes 70-80 days. Table 2.2 (p. 56) provides an overview of hormones that affect reproduction.

### **IV. Sources of Disruptions in Fertility**

Endocrine abnormalities and “unknown causes” are the leading infertility diagnoses. Sources of disruption are summarized in Table 2.3 (p. 57).

### **V. Nutrition-Related Disruptions in Fertility**

Undernutrition can be chronic or long term and is associated with delivery of small, frail infants with a high likelihood of death in the first year. There is a 10-fold infant death rate difference between poor and developed countries, although studying chronic undernutrition is complicated by factors such as varying contraceptive practices, ages of puberty and marriage, and breastfeeding duration. Acute undernutrition is related to lower birthrates. Examples of acute undernutrition are famine and food shortages due to war, crop failures, and poor hunting conditions. Births increase after the food shortage is resolved, but it can take up to a year for menstrual cycles to return to normal. Other factors affecting fertility are discussed: body fat, weight loss, exercise, certain dietary patterns such as vegetarianism, carotenemia, preconception iron status, and high caffeine and alcohol

intake. Nutritional factors affecting male fertility include weight loss of 10-15% below normal, low zinc status, lack of antioxidant nutrients, high level alcohol intake, and exposure to heavy metals.

#### VI. **Nutrition and Contraceptives**

Options to prevent conception increased greatly in the 1960s. Hormonal contraceptives have implications for nutrition; Table 2.6 (p. 62) summarizes nutrition-related side effects such as increased rates of thromboembolism and lower levels of vitamin B<sub>12</sub> and weight gain.

#### VII. **Other Preconceptual Nutrition Concerns**

The nutritional exposures prior to conception and very early in pregnancy that can disrupt the fetus's growth and development are summarized in Table 2.7. This section also covers folate status prior to conception and the risk of neural tube defects in the developing fetus. Recommended dietary intakes for preconceptional women are discussed and MyPyramid Food Guide recommendations are provided in Table 2.8.

#### VIII. **Model Preconceptional Nutrition Programs**

WIC is a USDA program designed to improve reproductive health (p. 66). A program to decrease iron deficiency in Indonesia is an international example of improving preconception nutrition (p. 66). "Starting pregnancy in the best health status possible" (p. 66) enhances reproductive outcomes, but it is not a guarantee for a perfect newborn.

#### IX. **Nutrition Programs and Services Delivery Before Pregnancy**

The Nutrition Care Process are nutrition care standards developed by the American Dietetic Association to serve as guidelines for the delivery of nutrition services. Preconception services are tailored to the nutrition needs of women before pregnancy, and to the nutrition and reproductive health needs of men.

### **Internet Resources At-a-Glance**

#### ***In textbook***

- **General Nutrition**
  - Asian Food Information Center: [www.afic.org](http://www.afic.org)
  - Fast Food Facts: <http://www.foodfacts.info/>
  
- **Science of Nutrition**
  - Merck Manual of Diagnosis and Therapy: <http://www.merck.com/mmpe/index.html>
  - National Library of Medicine (PubMed): [www.ncbi.nlm.nih.gov/pubmed](http://www.ncbi.nlm.nih.gov/pubmed)
  
- **Preconception Nutrition**
  - Medscape Ob/Gyn & Women's Health: <http://www.medscape.com/womenshealth>
  - National Women's Health Information Center: [www.4women.gov](http://www.4women.gov)
  - The BabyCenter Company: [www.babycenter.com](http://www.babycenter.com)
  
- **Public Food & Nutrition Programs**
  - WIC: <http://www.fns.usda.gov/wic/>
  
- **Nationwide Priorities & Nutritional Health**
  - Statistics – Centers for Disease Control/National Center for Health Statistics: [www.cdc.gov/nchs](http://www.cdc.gov/nchs)

### **Additional sites and updates**

- A. The Merck Manual of Diagnosis and Therapy – [www.merck.com/mrkshared/mmanual](http://www.merck.com/mrkshared/mmanual)
- Use the left navigation bar, index or search box to find information about a topic or treatment of interest.
- B. Medscape Women’s Health Journal
- This free-to-the-consumer website provides automatic updates on women’s health, fertility and contraception topics. You must, however, subscribe and enter a password. To begin, you must go to [www.medscape.com](http://www.medscape.com). After registration, you can link to Women’s Health and have access to scientific and pharmaceutical literature and newspaper resources. Companies submit pre-publication abstracts to this site, i.e., before they are published in peer-reviewed journals.

### **Exploring the Internet: E-Trips**

- A. Determine the amount of folic acid in the foods you ate in the last 24 hours. How does that compare with the recommendations for a male or female your age? Use the online address from Chapter 1 to enter foods and obtain the folic acid content: <http://www.ars.usda.gov/Services/docs.htm?docid=12096> (What’s in the Foods You Eat search tool). Go to the Fast Food Facts website at <http://www.foodfacts.info/> to obtain nutrient information for foods served at fast food restaurants. Identify a typical meal you might order and obtain the amount of folic acid in your favorite fast-food order.
- B. Use the Babycenter Company online address ([www.babycenter.com](http://www.babycenter.com)) to obtain a recommendation about preconceptual nutrition. Evaluate their consumer advice with the science presented in this chapter or in the literature. Record the search terms you used to gather the information in both the scientific literature and the online website. Which of the terms that you used are ones that you think a consumer might use?
- C. Use the National Library of Medicine (NLM) MeSH (i.e., Medical Subject Heading or MeSH) database and under the heading of “PubMed Services” found on the left-hand side of the website ([www.ncbi.nlm.nih.gov/pubmed](http://www.ncbi.nlm.nih.gov/pubmed)). Enter the following terms from the chapter and report if the textbook term is the same as the search term for finding current research on pre-conceptual nutrition topics. Also report the NLM definition for the term and the year the term was added as an official “MeSH term.” Finally, identify some possible terms to use when searching for “contraception.”

#### Body mass index

*An indicator of body density as determined by the relationship of BODY WEIGHT to BODY HEIGHT. BMI=weight (kg)/height squared (m<sup>2</sup>). BMI correlates with body fat (ADIPOSE TISSUE). Their relationship varies with age and gender. For adults, BMI falls into these categories: below 18.5 (underweight); 18.5-24.9 (normal); 25.0-29.9 (overweight); 30.0 and above (obese).*

*Year introduced: 1990*

#### Fertility

*The capacity to conceive or to induce conception. It may refer to either the male or female. No year of entry noted.*

#### Infertility

*Inability to reproduce after a specified period of unprotected intercourse. Reproductive sterility is permanent infertility.*

*Year introduced: 1983*

### Subfertility

*There is no MeSH term as written; Instead, the MeSH text word recommendation is to search for subfecundity.*

### Prostaglandins

*A group of compounds derived from unsaturated 20-carbon fatty acids, primarily arachidonic acid, via the cyclooxygenase pathway. They are extremely potent mediators of a diverse group of physiological processes.*

*Year introduced: 1966; Note, there are 15 prostaglandin types that are acceptable MeSH search terms.*

### Neural tube defects

*Congenital malformations of the central nervous system and adjacent structures related to defective neural tube closure during the first trimester of pregnancy generally occurring between days 18-29 of gestation. Ectodermal and mesodermal malformations (mainly involving the skull and vertebrae) may occur as a result of defects of neural tube closure. (From Joynt, Clinical Neurology, 1992, Ch55, pp31-41)*

*Year introduced: 1979*

### Contraception:

*Prevention of CONCEPTION by blocking fertility temporarily, or permanently (STERILIZATION, REPRODUCTIVE). Common means of reversible contraception include NATURAL FAMILY PLANNING METHODS; CONTRACEPTIVE AGENTS; or CONTRACEPTIVE DEVICES.*

*Year introduced: 1963*

- D. Visit the Asian Food Information Center at [www.afic.org](http://www.afic.org). Complete a search for BMI or body mass index. Identify the statements they make regarding the differences in the relationship between BMI and body fat in Dutch Caucasians and Asians populations.

## Discussion Questions

- A. Distinguish between fecundity (biological capacity to bear children), infertility (lack of conception after one year of unprotected intercourse), and being subfertile.
1. Discuss the main reasons for often-delayed conception in 18% of married couples in the U.S. (p. 52).
  2. Identify what helps and harms men and women who wish to have children; describe practices that support robust pregnancy outcomes. How can a comparison of reproductive health practices and outcomes among communities and nations be used to understand conceptual health? [Spot problems, identify trends, and prevent poor outcomes.]
- B. What makes nutritional aspects of reproduction different for males and females? Have students elaborate on any or all of the following statements:
1. Hormones differ between males and females.
  2. Body composition, i.e. percent of body fat, differs between males and females.
  3. Women carry the developing fetus through gestation whereas males do not.
  4. Women are born with a full complement of eggs that runs out around menopause whereas men can produce sperm indefinitely, even if number or viability of sperm declines.

- C. What are the relationships between body weight and conception? Discuss the national health goals found in Healthy People 2010, Table 2.1 as they affect conception.
1. Define a healthy weight range, using body mass index (found inside text cover). Would BMI change in a woman who was in her late forties and planning on becoming pregnant? That is, does age affect our perception of what a healthy weight range is? Why or why not?
  2. Definitions of what constitutes a healthy weight vary. The BMI is not a strong enough measure to yield consistent interpretations about optimal weight, although NIH has published national guidelines. Unlike the atomic clock, to which people around the world calibrate their computers and watches, the BMI is meant to be used as a general guide; in this case, for conception and optimal pregnancy outcome.
  3. Healthy weight is also a cultural issue. Perceptions of beauty and desirable body shape vary from culture to culture. A country or community where many people with various cultural backgrounds live has a more difficult time developing relevant population guidelines regarding a “healthy weight.”
  4. Obesity and underweight both decrease ability to conceive (Table 2.3). Weight loss of 10-15% of normal weight is related to infertility in men and women. To explain what 15% of normal weight means, point out that a 100-pound person would now weigh 85 pounds and a 150-pound person would now weigh 122.5 pounds (a decrease of several clothing sizes).
  5. Weight-related factors that impact fertility are summarized in Table 2.3: negative energy balance, too little body fat, excessive body fat, anorexia nervosa, and bulimia nervosa. Page 58 suggests that fertility is compromised when BMI is less than 20 and over 30.
  6. Summary: Evidence relating weight status to preconception nutrition suggests that a fairly broad range of body weights will support pregnancy.
- D. Discuss factors relating species survival in general, especially to food availability, conception and pregnancy outcomes. Species survival is so important that safeguards are part of our evolutionary heritage. How does “survival of the fittest” govern fetal development and pregnancy outcomes?
- E. Why is it recommended that females who are obese, over the age of 35 and smoke, have cardiovascular disease, hypertension, diabetes, or are immobilized (p. 63) use nonhormonal methods of contraception?
- F. High levels of body fat lead to increased levels of leptin and estrogen; low levels of body fat decrease leptin and estrogen (p. 58). How do these high or low hormonal levels affect fertility?
- G. Estrogen and progesterone prompt the endometrium to store glycogen and other nutrients, both during the follicular and the luteal phases. Does this nutrient-storage function of estrogen and progesterone support fertility or fecundity? Elaborate.

## **Classroom Activities**

- A. **Develop a one-page nutritional status assessment tool** (including a scoring system) for a fertility clinic. What measurements would you make and what questions would you ask



men who seek to cure their infertility? What questions would you ask women? (Refer to Tables 2.3 and 2.7 for elaboration.)

- B. You are a consulting nutritionist with Women's Health Clinic and are asked to develop nutrition focused, take-home literature to be used with oral contraceptives, contraceptive injections, implants and mechanical devices (e.g. diaphragm). Pick one of the pharmaceutical or drug methods and **develop nutritional advice for women using that contraceptive method**. Compare this advice to what you would tell someone who is using a diaphragm. Be sure to include advice on foods to eat, such as a sample meal plan or food lists. (Refer to Table 2.8, MyPyramid Food Guide; see also heart disease prevention in Chapter 17.)
- C. **Develop a "Healthy Sperm Diet"** for use by the health clinic on campus. Be sure to include some of the fast foods available on or near your campus. [Text, beginning on page 60, addresses adequate zinc, high level of antioxidants, light to moderate alcohol, clean arteries, controlled diabetes, seafood and avoidance of heavy metals such as mercury.]
- D. **Multi-part questions** (this one requires homework): Before discussion, assign students an online search:
1. What can each one find out about the effectiveness of the herb black cohosh in treating menstrual disorders? Is the information they found referenced? What are the references used? Are any of the sites used linked to product sales? If so, give examples. How would a consumer know which advice can be trusted?
  2. Compile student answers (whiteboard, overheads) and discuss:
    - a. How did they devise a search strategy?
    - b. Review their findings, using each of the questions in their assignment.
  3. Summarize: If students were asked for advice regarding cohosh from their best friend, what would they suggest? What would you (their instructor) advise? What were the most credible online resources? Where could they go to verify information?
  4. How can the class apply this process to other herbal or new products?

## Worksheet 2-1: Preconception Nutrition Counseling

Catherine decided to see a registered dietitian after watching a news story about the new 2006 CDC Preconception Health Initiative (p. 66), including the recommendation that each person should make a reproductive life plan. Currently 29 years old, she has been on oral contraceptives for 10 years. She would like to have children some day, possibly in her mid-thirties, after she has established her career. Her height is 5'6" and her weight is 175#. She considers herself fairly active, exercising for about 30 minutes three times per week. Due to being a busy professional, she admits to drinking close to 40 ounces of coffee most days and only occasionally drinks alcohol. Her personal health history includes iron-deficiency anemia at age 25, although she thinks this has resolved; her family history includes heart disease and type two diabetes; both of her parents are still living. No recent lab work is available.

Her questions for the dietitian are:

1. Should she change her method of contraception for nutrition or other health reasons?
2. Are there any risk factors for impaired fertility in her current health status?
3. What recommendations do you have to help her meet her long-term goal of having children someday?

