***1The activities listed in this Study Guide will help guide you through the Week 10 Study materials. The preparation and activities need to be completed prior to the first deadline and before taking the weekly quiz.***

***The reading materials, videos, and website links are posted in I-Learn, W10 Study.***

**Preparing for quizzes and tests:**

* Please note that the study guides are provided to establish a baseline understanding of the lesson materials. They can help you to organize your notes and prepare for quizzes and tests. You will find that the quizzes and tests do not have questions that come directly from the study guides but will build on the concepts you are learning. These assessments will require you take the knowledge and skills you have gained and apply them to real life problems and situations.
* To increase your proficiency:
  + Look for foods in your house that are enriched or fortified. What nutrients have been added?
  + Try teaching the principles to someone else to see how well you are comprehending the lesson.

**This week’s goals:** Vitamins play important roles in regulation of body processes. Clinical deficiencies of the vitamins are not common in the United States; however, marginal deficiencies may exist and have adverse effects on a person's health. During the week, we will explore the major functions, food sources, and health concerns of the 13 vitamins.

**1. Intro to Vitamins**

**From the video *Fat-soluble and Water-soluble* and the readings *10.1 Introduction to Vitamins, 10.2 Characteristics of Vitamins*, and *Refinement* in *Chapter 5.5 Role of Grains in Health and Disease*.**

* What is an organic compound?
* Organic compounds – a chemistry term for compounds containing carbon attached to other

elements such as hydrogen, oxygen, and nitrogen. Carbohydrate, protein, lipids, and

vitamins are organic compounds. This differs from organic food which refers to how the food was grown or raised.

* What is a vitamer?
* The groups of chemically related compounds are referred to as vitamers.
* Which of the following is more likely to have higher levels of vitamins: Canned vegetables, frozen vegetables, or “fresh” vegetables purchased at the store? Why?
* Frozen veggies, because the loss of vitamin depends on heat, oxygen, time or exposure to certain substances.
* What can you do to minimize vitamin loss in foods?
* If they are handled carefully and stored at cool temperatures.
* Cut them minutes early for consumption
* Not overcook
* No add baking soda
* Small amount of water when boiled
* Canned goods have to be frozen and eaten withing a year
* How does an antioxidant protect our cells?
* They protect them by donating an electron to a free radical preventing the damage to other molecules.
* Why might a very low-fat diet affect the bioavailability of fat-soluble vitamins?

|  |  |  |
| --- | --- | --- |
|  | **Define** | **Answer the questions** |
| **Provitamin** | Is a substance found in food that can be converted into a vitamin within the body. | What is the provitamin for:  Vitamin A  Beta-carotene |
| **Antioxidant** | An antioxidant can  donate an electron to the free radical and remain stable, thus protecting the other molecules  from oxidative damage | What two vitamins and one provitamin act as antioxidants?  Vitamin C, vitamin E, and beta-carotene (a provitamin for  vitamin A) are antioxidants. |
| **Coenzyme** | A **coenzyme** is an organic non-protein compound that activates an enzyme so it can work | What vitamins have a coenzyme function?  The water-soluble vitamins and vitamin K can function as a coenzyme |
| **Bioavailability** | **Bioavailability** refers to the body’s ability to absorb the nutrient into the digestive tract and  utilize it. | How does a high dose of vitamin C affect its bioavailability?  It drop the absorption of this one by 50%. |

**Terms to Know**

Vitamers

Provitamin

Coenzyme

Bioavailability

**2. Water-Soluble Vitamins**

**From the readings *10.3 Water Soluble Vitamin,* and the reading in the *Refinement* section of *Chapter 5 5.5 Role of Grains in Health and Disease*:**

* In addition to the mineral iron, what four vitamins are added in the enrichment of grains? (Refer to *Refinement* in *5.5 Role of Grains in Health and Disease*)
* thiamin, riboflavin, niacin, folic acid
* Why did the corn-based dietary intake of people in the southern United States during the early 1900s cause pellagra? (two reasons are listed in the textbook)

First, the niacin in corn is bound and has a low bioavailability. Second,

corn is a poor source of tryptophan, the provitamin for niacin.

* What is the difference in bioavailability between folate and folic acid?
* Folic acide is has more bioavaiblity.
* Why is folic acid added to enriched grains and cereal products?
* Because of neural tube defects on babies, and anencephaly.
* What is Macrocytic Anemia and how is it related to folate deficiency?
* Without sufficient folate red blood cells wont divide causing macrocytic anemia.
* What is the role of the intrinsic factor in the digestion and absorption of vitamin B-12?
* Without it only one percent of B12 could be aborsed it works as a transporter.
* Why are people over the age of 50 years recommended to meet their RDA for vitamin B-12 from fortified foods or supplements?
* It is estimated that 10 to 30 percent of people over 50 years of age have atrophic gastritis (inflammation of the stomach lining) which results in low stomach acid secretion. Causing malabsorption.
* What adjustment needs to be made to vitamin C’s RDA for a person who smokes?
* More Vitamin c due to radicals in smoking

**Terms to Know**

Beri-Beri

Wernicke-Korsakoff Syndrome

Pellagra

Microcytic anemia

Macrocytic anemia

Neural tube defect

Spina bifida

Intrinsic factor

Pernicious anemia

Collagen

Scurvy

**From the reading 10.3 Water-Soluble Vitamins complete the following table:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Vitamin** | **Food Sources** | **Major functions** | **Concerns** |
| ***Thiamin*** | Thiamin food sources include whole grains, enriched grains, pork, and fish. Food groups that do  not contain much thiamin include dairy and most fruits | Coenzyme  Thiamin acts as a coenzyme in carbohydrate metabolism to help convert pyruvate to acetyl CoA.  Thiamin acts as a coenzyme in carbohydrate metabolism to help convert pyruvate to acetyl CoA.  Energy Metabolism  Brain functions, muscle contraction, nerve tissue repair, and the  immune system | Deficiency disease: 1. Beriberi 2. Werincke-Korsakoff Syndrome |
| ***Riboflavin*** | Riboflavin food sources include milk, cheese,  meat, eggs, whole grains, and enriched grains | Riboflavin, also known as vitamin B2, is an essential component of  coenzymes FAD and FMN  Play major roles in energy  (ATP) production, cellular function, and growth  The riboflavin  coenzymes have several other roles including the synthesis of niacin  from the provitamin tryptophan and the activation of vitamin B6.  Energy Metabolism | What happens to Riboflavin when it is exposed to light?  Riboflavin is relatively stable during cooking but can rapidly break down  when exposed to light |
| ***Niacin*** | Excellent food sources of niacin include chicken, tuna, turkey, beef, and fish. Other good sources  include peanuts, whole grains, and enriched grains (niacin is one of the five nutrients added back  to the enriched grains).  Trytophan is the provitamin for niacin | Niacin is a component of the coenzymes NADH and NADPH, which are involved in  the catabolism and anabolism of carbohydrates, lipids, and proteins.  The NADH coenzyme is a  carrier of the high energy electrons produced in glycolysis and the citric acid cycle and transfers  them to the electron-transport chain to make ATP. NADPH is required for the anabolic pathways  of fatty acid and cholesterol synthesis.18  Energy Metabolism | Deficiency: pellagra  What are the 4 D’s of niacin deficiency?  The symptoms of pellagra  have been referred to as the three D’s: dermatitis, diarrhea, and dementia.  Death, a fourth D, can occur if the pellagra is not treated.  Toxicity concerns:  However, taking higher doses of nicotinic acid in supplements  can cause flushing, a vasodilatory effect that causes a reddened flush on the face, arms, and chest  often accompanied by a burning, itching sensation.  Other symptoms from high doses of  nicotinic acid include gastrointestinal problems, liver dysfunction, and impaired glucose  tolerance. |
| ***Biotin*** | Good food sources of biotin include peanuts, liver, eggs, and dairy foods. Meat and fruit are poor  sources of biotin. | Biotin acts as a coenzyme in several of the energy metabolism pathways. It is also needed for the  synthesis of glucose. | why do raw eggs lower biotin’s bioavailability, but cooked eggs do not?  In raw egg whites, there is a protein called avidin which tightly binds to biotin and makes it unavailable for absorption. When the egg white is cooked, the protein is denatured and broken down, thus releasing the biotin |
| ***Pantothenic acid*** | Pantothenic acid is found in most foods. The name pantothenic is based on the Greek word  *pantothen* which means from all sides or everywhere. | Coenzyme A  Energy Metabolism |  |
| ***Vitamin***  ***B-6*** | Vitamin B6 is found in fish, organ meats, other meats, potatoes, and several non-citrus fruits such  as bananas. | Most of vitamin B6’s coenzyme roles are involved with protein metabolism, two of which are  facilitating deamination and transamination (discussed in the Protein chapter). Vitamin B6 also  plays a coenzyme role in the release of glucose from glycogen breakdown, the synthesis of  multiple neurotransmitters, the conversion of tryptophan to niacin, and the synthesis of  25,26  heme. | Toxicity concerns: Although vitamin B6 is a water-soluble vitamin and can be excreted in the urine, large  supplementary doses (2000 to 6000 milligrams of vitamin B6) over two to forty months can cause  neuropathy and impaired motor control.25 Supplemental doses greater than 500 milligrams per  day taken over time can cause a sensory neuropathy (tingling in hands and feet). |
| ***Folate*** | Green leafy vegetables such as spinach are good  sources of folate. Folate is also found in  liver, several leafy  vegetables,  legumes,  yeast,  asparagus,  and  orange juice. | Folate acts as a coenzyme in the synthesis of nucleic acids (DNA and RNA) and amino acid metabolism. | Low intake concerns:  A consequence of folate deficiency is macrocytic (large cell)  anemia, also called megaloblastic anemia (see Figure 7). Without adequate folate, red blood cells  are unable to produce DNA and RNA fast enough to divide properly. The result is fewer red blood  cells that are large.  ­High intake concern:  If a person takes large doses of folic acid, they will  not develop megaloblastic anemia from a vitamin B12 deficiency. However, folic acid will not  prevent the progressive damage to the neurological system that is caused by a more severe  vitamin B12 deficiency. Hence, large doses of folic acid will hide or mask the early stages of a  vitamin B12 deficiency. |
| ***Vitamin B-12*** | Reliable sources of  vitamin B12 are found in meat and animal products. Foods such as ready-to-eat cereals and soy milk are often fortified with  vitamin B12. | Vitamin B12 functions as a coenzyme for two enzymes and plays a role in fat and protein catabolism, and maintaining the myelin sheath on nerve cells. Vitamin B12 also works with folate in the synthesis of methionine (an amino acid) from homocysteine, and the synthesis of DNA and RNA | Deficiency concerns:  Early stages of a vitamin B12 deficiency are characterized by tiredness, constipation, weight loss, and megaloblastic anemia (see Figure 9). As the severity of the deficiency continues, irreversible  damage to the neurological system can cause numbness and tingling of the hands and feet,  memory loss, disorientation, and dementia.  Deficiency from lack of intrinsic factor:  The  megaloblastic anemia caused by a lack of intrinsic factor is called pernicious anemia |
| ***Vitamin C*** | Fruits and vegetables are the best sources of  vitamin C. Citrus fruits, tomatoes, and  potatoes are major contributors of vitamin C  in the United States. | It is the primary water-soluble, non-enzymatic antioxidant in  plasma and the tissues. Vitamin C also helps protect lipids from oxidative damage by aiding in the  regeneration of vitamin E, a fat-soluble vitamin that also functions as an antioxidant.  Vitamin C is necessary for the synthesis of healthy collagen in the body. Non-heme iron absorption can increase by two- to threefold in the presence of 25 to 35  milligrams of vitamin C, cardiovascular disease, cancer and common cold | Deficiency:  A vitamin C deficiency causes scurvy.  High intake concerns:  Although current evidence indicates high doses of vitamin C (greater than 3000 milligrams per  day) has low toxicity potential for the healthy person, there may be adverse gastrointestinal  effects such as diarrhea, nausea, or cramping |

**3. Fat-soluble vitamins**

**From the videos *Back to Basics – Night Blindness, Vitamin A as a Cure* and the reading *10.4 Fat-Soluble Vitamins.***

* What is night blindness? What is xerophthalmia?
* Unviability to see at night,
* Refer to Back to Basics - Night Blindness video to answer the following:
  + What food is the most abundant in the diet of the children afflicted with night blindness? Is it a good source of vitamin A?
  + White rice, it is not.
  + From Dr. Sommer’s experience, how long does it take for the cornea to “melt away”?
  + 1 day
  + After receiving vitamin A drops, how quickly did the children’s corneal ulcers heal in Dr. Somner’s study?
  + Overnight
* Other than impaired vision, what other observation did Dr. Sommer make from the survey data of night-blind children in Indonesia? (Refer to Vitamin A as a Cure video)
* They incremented their life span, dereasing the rate of death in the kids population.
* Why is vitamin D known as the “sunshine” vitamin?
* What are the two organs in the body that activate vitamin D?
* What is the function of the parathyroid hormone?
* Who is at risk for a vitamin D deficiency?
* Why do people taking the medication warfarin need to avoid vitamin K supplements?

**Terms to Know:**

Night-blindness

Xerophthalmia

Rickets

Osteomalacia

**From the reading 10.4 Fat-Soluble Vitamins complete the following table:**

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| --- | --- | --- | --- |
| **Vitamin** | **Food Sources** | **Major functions** | **Concerns** |
| ***Vitamin A*** | Carotenoids (provitamin)  The three most important members of the carotenoid family  that are vitamin A provitamins are beta-carotene, alpha-carotene, and beta-cryptoxanthin  Retinoids  Vitamin A is found in food in both the active form of the vitamin and in a provitamin form which  can be converted by the body to the active vitamin  The retinoids (preformed vitamin A) are found in animal products such as liver, fish oils, eggs, and  milk. Most of the provitamin A carotenoids come from plants that are either orange/yellow or  very dark green in color. For | Vitamin A has several roles in the body, which include maintaining vision, immunity,  reproduction, growth and cellular differentiation. | Low intake:  One of the first signs of a vitamin A deficiency is night-blindness, total blindness called xerophthalmia, vitamin A deficiency can depress the immune system, decrease  growth, impair reproduction, and lower bone mineral density, condition called follicular hyperkeratosis, which is a buildup of the keratin (a fibrous  protein) in hair follicles creating a bumpy, goose flesh appearance to the skin.  High intake concerns with the retinoids:  incidence of birth defects  What happen with high intake of beta-carotene?  he most distressing problem that can occur with high intakes of carotenoids is the skin can take on an orange hue as the carotene deposits in the fat layers under the skin. |
| ***Vitamin D*** | Vitamin D is not found in very many foods naturally. Fatty  fish, such as salmon, tuna, and mackerel, and fish liver  oils are among the best sources. Lesser amounts of  vitamin D3 are found in egg yolks and beef liver.  Mushrooms that have been exposed to UVB rays provide  vitamin D2. | key function of the activated vitamin D (calcitriol) is to regulate blood calcium levels. Calcitriol  increases calcium absorption by promoting the synthesis of calcium transporter proteins in the  cells lining the small intestine. When low calcium levels, calcitrol takes place | Low intake:  Deficiency disease in children:  Rickets, soft weak deformed bones.  Deficiency disease in adults:  Osteomalacia, similar to osteoporosis but there I no losss in bone structure.  High intake:  can cause elevated levels of calcium in the blood and lead to calcium deposits in the kidneys  and other organs of the body |
| ***Vitamin E*** | The best food sources of vitamin E are oils and  nuts. Wheat germ oil, sunflower oil, almonds,  and canola oil are among the best sources for  alpha-tocopherol. | All the forms of vitamin E have varying levels of antioxidant properties; however,  alpha-tocopherol is the only one that is recognized to meet human requirements.  The main  function of alpha-tocopherol in the body is to act as a fat-soluble antioxidant and protect cell membranes against lipid destruction caused by free radicals.  Other functions  of vitamin E Include regulation of gene  expression, immune function, and cell signaling | Deficiency concerns:  Clinical symptoms include hemolytic anemia and degeneration of nerve cells  High intake concerns:  High doses of vitamin E can antagonize vitamin K-dependent clotting factors |
| ***Vitamin K*** | Vitamin K vitamers can be categorized in the groups phylloquinone (vitamin K1) which are found  in plants, and menaquinone (vitamin K2) most of which are synthesized by bacteria in the large  65  intestine although some is found in fermented foods  Vitamin K is present in many foods. It is found in highest concentrations in green vegetables such  as broccoli, cabbage, kale, parsley, spinach, and lettuce. | Coagulation, bone health, | A deficiency may occur in adults  with malabsorption disorders and results in poor blood clotting, hemorrhage, and low bone  mineralization.  New-born babies: Newborns have low vitamin K stores because vitamin K transport across the placenta is poor |

**4. Review Stages of Change**

**In preparation for your W10 Assignment, review *1.5 Promoting Change* and then answer the following questions.**

* What is the “Stages of Change model” and how can it be used?
* The Stages of Change model can be used to develop the appropriate strategies to help guide behavior change.
* What are the five Stages of Change and its characteritics?
* Precontemplation, not thinking about change. Contemplation, thinking about change, pros and cosn, preparation, intending action within a month, actively involved change, solving problems that arise, maintenance, change for 6 months,

**5. Complete the Case Study**

Complete the *Case Study – Lynn and Folic Acid* by reading the section on *Folate* in *10.3 Water Soluble Vitamins* and following the rest of the case study directions. Then answer the following questions/items and have your responses available when you take this week’s timed quiz.

* What is the difference between folate and folic acid?
* Folate is found in food folic acid is synthetic but it is more bioavaiblityness is greater than folate.
* What are the folate recommendations for women in their child bearing years?

This is the adult woman’s RDA for folate. In order

for folic acid to help prevent neural tube defects,

a woman needs to start getting 400 micrograms

at least one month prior to getting pregnant

* What are the best food sources for folate? For folic acid?
* Folic acid
* What recommendations would you give to Lynn regarding:
  + The general nutritional balance of her dietary intake?
  + Add more or incorporate in her diet folic acid, and fortified foods to reach her RDA of folate.
  + Her current folate intake?
  + I has to be higher
  + Specific foods Lynn could add to her dietary intake to improve her folate/folic acid intake?
  + Leafy vegetables, liver, legumes.
  + What type of foods she would need to decrease her intake of so she doesn't increase her overall caloric intake?
  + Fats