

# continuing education for pharmacists

## Dietary Supplementation of Vitamin D, Calcium, Vitamin E, Omega-3 Fatty Acids

Mona T. Thompson, R.Ph.,  
PharmD

*Dr. Thompson has no relevant financial relationships to disclose.*

**Goal.** The goal of this lesson is to provide information on select vitamins and supplements, with emphasis on the current consumption recommendations in adults.

**Objectives.** At the conclusion of this lesson, successful participants should be able to:

1. list the recommended daily allowance, adequate intake, and tolerable upper intake level for each supplement discussed;
2. recognize the health benefits that each supplement provides, as well as the risk of excessive use;
3. identify the current indications for which supplementation is supported, based on recent evidence-based literature; and
4. demonstrate an understanding of pertinent patient counseling advice regarding selection and use of over-the-counter (OTC) supplements, including drug-drug interactions, and regulatory information.

### Background and General Information Regarding Supplementation

The Office of Dietary Supplements (ODS), which operates within the National Institute of Health (NIH), reported that in 2004, Americans spent 20.3 billion dollars on dietary supplements. Among Americans 20 years of age and older, 52 percent reportedly are taking at least one supplement with the greatest percentage found in adults greater than 60 years. In addition, in 2007,

a survey conducted by the Centers for Disease Control and Prevention (CDC) found that 22 billion out-of-pocket dollars were spent by Americans on complementary and alternative medicine self-care products. In the midst of a media influenced, information overloaded, and self-care, health-seeking population, it is important that health care professionals assist the lay public in deciphering the data in order to make sound and healthy decisions about OTC supplementation.

In order to assess and guide nutrient intake, the Food and Nutrition Board (FNB) has developed reference intake values. These Dietary Reference Intakes (DRIs) are defined in Table 1.

It is important to note that while dietary supplements are regulated by the Food and Drug Administration (FDA), they are not regulated in the same manner that medications are. In fact, dietary supplements do not require pre-market review or approval. Manufacturers do have a responsibility to ensure that their products are safe and that the labeling is clear and truthful. However, they do

not need to provide this information to the FDA prior to marketing. Supplement manufacturers are also permitted to print health benefit claims on the label as long as it is followed by the words, "This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease." Consumers should be advised that not all supplements may be manufactured to the same standard. A list of independent organizations that offer "seals of approval" can be found in Table 2. These organizations only test the product to verify that it is free of contaminants and contains the ingredients listed on the label. They do not test the product for safety or efficacy.

### Vitamin D

Vitamin D is a fat-soluble vitamin that is obtained endogenously when ultraviolet radiation strikes the skin initiating synthesis, or when it is consumed through food and supplements. In supplements and food, vitamin D is available as ergocalciferol and cholecalciferol. The forms are considered equiva-

Table 1  
Dietary reference intakes

Recommended Dietary Allowance (RDA)	Average daily level of intake sufficient to meet the nutrient requirements of nearly all healthy people
Adequate Intake (AI)	Established when evidence is insufficient to develop an RDA and is set at a level assumed to ensure nutritional adequacy
Tolerable Upper Intake Level (UL)	Maximum daily intake unlikely to cause adverse health effects

**Table 2**  
**Organizations that verify dietary supplement manufacturing**

Organization	Website
Consumer Lab	www.consumerlab.com
U.S. Pharmacopeia Dietary Supplement Verification Program	www.usp.org/USPVerified/dietary Supplements/
Natural Products Association TruLabel Program	www.npainfo.org

lent and effectively raise [25(OH)D] levels, the physiologically active form of vitamin D, also known as calcitriol. It is the result of two hydroxylation steps that occur first in the liver and second in the kidney.

Vitamin D is most commonly known for its role in allowing the absorption of calcium from the gut, and for enabling normal bone growth and bone remodeling by osteoclasts and osteoblasts. It has an accepted role in the prevention and treatment of osteoporosis, and clinical trials have confirmed its role in decreasing bone fractures. Other functions of vitamin D include adjusting cell growth, neuromuscular and immune function, and reduction of inflammation.

While some foods naturally contain vitamin D (skin of salmon, tuna, and mackerel; cheese; and egg yolks), fortified foods such as milk, orange juice, yogurt and breakfast cereals provide most of the vitamin D in the American diet. An eight-ounce glass of milk contains 125 IU of vitamin D.

Also, sun exposure initiates vitamin D synthesis in the body, although it is difficult to predict the amount. Sunscreen, which is recommended by the American Academy of Dermatology to reduce the risk of skin cancer, can reduce the amount of vitamin D produced from sun exposure.

Groups at risk of vitamin D deficiency include older adults, and persons with limited skin exposure, dark skin, or malabsorption of vitamin D; obese individuals or those who have undergone gastric bypass

surgery, as well as those who are taking medications that accelerate the metabolism of vitamin D.

Vitamin D has recently gained the attention of the medical, public health, and lay communities for its potential anti-cancer benefits, as well as in the prevention and treatment of other conditions including diabetes, glucose intolerance, hypertension, multiple sclerosis, and cardiovascular disease.

The Institute of Medicine (IOM) assembled a committee to essentially determine which health outcomes are influenced by vitamin D (and/or calcium), how much vitamin D (and calcium) is needed, and how much vitamin D is too much. In November of 2010, the IOM released a report concluding that bone health was the only outcome that was supported by research and established a cause and effect,

dose-response relationship with vitamin D (and calcium) intake.

For cancer, cardiovascular disease, diabetes, falls, autoimmune disorders, and other extraskeletal disease outcomes, the evidence was inconsistent and inconclusive. Therefore, despite the eagerness to treat subpar vitamin D levels, the additional proclaimed benefits must still be viewed as hypothesis. Large scale randomized clinical trials, designed with these primary outcomes mentioned, have not yet been conducted and are desired. The IOM report also suggested a U-shaped risk analysis curve for several outcomes related to vitamin D proposing that moderate serum levels of vitamin D may be optimal, and that the risk of disease increased at both low and high levels of vitamin D. Most experts agree that serum concentration of [25(OH)D] should be maintained between 20-40ng/ml (level greater than 20 supports healthy bones), and new data suggest that there may be health risks associated with levels above 50ng/ml.

The committee also updated the DRIs for both calcium and vitamin D which had been last examined in 1997. The adult values are listed in Table 3 and reflect the total amount that should be consumed through diet and supplementation.

Various repletion regimens

**Table 3**  
**Calcium and vitamin D dietary reference intakes by life stage**

Life stage and gender	Calcium		Vitamin D	
	RDA* (mg/day)	UL (IU/day)	RDA* (mg/day)	UL (mg/day)
19-30 yr (M+F)	1000	2500	600	4000
31-50 yr (M+F)	1000	2500	600	4000
51-70 yr (M)	1000	2000	600	4000
51-70 (F)	1200	2000	600	4000
71+ (M+F)	1200	2000	800	4000
19-50 yr pregnant or lactating	1000	2500	600	4000

Chart adapted from IOM Report on Calcium and Vitamin D Requirements. M = male. F= female.

\*RDA represents intake that covers > or = 97.5 percent of population for that life stage.

have been found to be effective for vitamin D deficient adults. Adults with [25(OH)D] serum levels <20ng/ml are often repleted with 50,000 units (calciferol or ergocalciferol) weekly for six to eight weeks, followed by 600 to 800 units daily. Patients specifically treated for vitamin D deficiency do require follow-up [25(OH)D] serum testing, and the dose may require further adjustment. However, healthy adults consuming 600 to 800 units/day for supplementation do not require lab monitoring.

Excessive vitamin D supplementation is associated with negative consequences. It can cause anorexia, weight loss, polyuria, and heart arrhythmias. It can also raise blood levels of calcium leading to vascular and tissue calcification damaging the heart, blood vessels, and kidneys.

## Calcium

Calcium is an essential dietary mineral that is commonly found in milk, yogurt, cheese, and dark green vegetables. Many foods are also fortified with calcium such as orange juice, cereal and bread. An eight ounce glass of milk or fortified orange juice contains 300mg of elemental calcium. It is not produced by the body and, therefore, must be consumed through food and supplements. Calcium is a major component of bones and teeth and is needed for proper function of the heart, muscle, and nerves.

In recent years, calcium has been studied for its potential role in cancer prevention, specifically colorectal cancer. Numerous large scale randomized studies have been conducted to determine if an association between calcium supplementation ranging from 500-2000mg/day and colorectal cancer existed. Although the studies did not consistently result in a statistical difference in colorectal cancer risk reduction, the World Cancer Research Fund/American Institute for Cancer Research published a report in 2007 concluding that calcium probably has a protective effect against colorectal cancer.

Other studies suggest that high calcium intake may increase the risk of prostate cancer while the available information regarding a relationship between calcium and breast cancer is inconsistent. Presently, the National Cancer Institute does not recommend calcium supplements to reduce the incidence of colorectal or any other type of cancer due to inconsistent data.

In patients requiring calcium supplementation for the prevention or treatment of osteoporosis, calcium carbonate and calcium citrate are most often used. Calcium carbonate is generally more affordable. It is absorbed better when taken with a meal, and requires the presence of chloride. Calcium citrate is well absorbed in both the fasting and fed state. Its absorption is not affected in patients taking proton pump inhibitors or H2 blockers where chloride is decreased.

Recommended dietary allowances for calcium are based on elemental calcium and are listed on Table 3. Calcium carbonate contains only 40 percent elemental calcium which means that a 1250mg tablet actually delivers 500mg of calcium. Doses greater than 500mg of elemental calcium should be divided.

While calcium supplementation is generally considered safe when the UL (tolerable upper intake level) is not exceeded, those consuming calcium supplements in addition to substantial amounts through the diet, or even multivitamin products, may be at risk of developing kidney stones. Other risks of excessive calcium consumption, especially in the presence of kidney disease, include hypercalcemia and kidney failure. Excessive intake of milk and some types of antacids (which contain calcium carbonate or sodium bicarbonate) over an extended period of time can result in milk-alkali syndrome, an acquired condition in which there are high levels of calcium and a shift in the body's acid/base balance towards alkaline (metabolic alkalosis). This

**Table 4**  
**Potential indicators of adverse outcomes associated with excess intake of calcium and vitamin D**

### Calcium

Hypercalcemia  
Hypercalciuria  
Vascular and soft tissue calcification  
Nephrolithiasis (kidney stones)  
Prostate cancer  
Interactions with iron and zinc  
Constipation

### Vitamin D

Intoxication and related hypercalcemia and hypercalciuria  
Elevated serum calcium  
Emerging evidence for all cause mortality, cancer, cardiovascular risk, falls, and fractures

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condition can also lead to calcium deposits in the kidneys and other tissues, as well as kidney failure. Table 4 includes adverse outcomes associated with excessive intake of calcium and vitamin D.

## Vitamin E

Vitamin E is a fat-soluble antioxidant that is found naturally in some foods, added to others, and available as a dietary supplement. It occurs in eight different forms, while only the alpha-tocopherol form is recognized to meet human requirements. Nuts, seeds, vegetable oils, green leafy vegetables, and fortified cereals are the best sources of alpha-tocopherol. Vitamin E deficiency is rare and obvious deficiency symptoms have not been found in healthy individuals who obtain little vitamin E from their diets.

Vitamin E's potential to prevent and treat disease is based on its function as an antioxidant, as well as its role in the anti-inflammatory processes, inhibition of platelet aggregation, and immune enhancement. Antioxidants protect cells from the damaging effects of free radicals, which are molecules that contain an un-

**Table 5**  
**Adult dietary reference intake for vitamin E**

	<b>Male</b>	<b>Female</b>	<b>Pregnant</b>	<b>Lactating</b>
RDA (14 yrs+)	15mg (22.4 IU)	15mg (22.4 IU)	15mg (22.4 IU)	19mg (28.4 IU)
UL (14-18 yrs)	800mg (1200 IU)	800mg (1200 IU)	800mg (1200 IU)	800mg (1200 IU)
UL (19 yrs+)	1000mg (1500 IU)	1000mg (1500 IU)	1000mg (1500 IU)	1000mg (1500 IU)

UL refers to all forms of supplemental alpha-tocopherol

shared electron. Free radicals damage cells and may contribute to the development of cardiovascular disease and cancer. Unshared electrons are highly energetic and react rapidly with oxygen to form reactive oxygen species (ROS). The body forms ROS endogenously when it converts food to energy, and antioxidants might protect cells from the damaging effects of ROS. As an antioxidant, vitamin E stops the production of ROS formed when fat undergoes oxidation. In addition, vitamin E increases the expression of two enzymes that suppress arachidonic acid metabolism, which increases the release of prostacyclin from the endothelium, leading to dilated blood vessels and inhibition of platelet aggregation.

In 2003, the Agency for Healthcare Research and Quality (AHRQ) published two evidence reports resulting from extensive literature searches examining the effects of vitamin E (as well as vitamin C and coenzyme Q10). The first report was focused on the prevention and treatment of cancer, and the second looked at the prevention and treatment of cardiovascular disease (CVD) or modifications of known risk factors for CVD. Neither evaluation concluded with support for vitamin E supplementation.

More recently, the SELECT (Selenium and Vitamin E Cancer Prevention Trial) trial was prematurely halted in 2008. The trial was designed to show a 25 percent reduction in prostate cancer with each supplement alone or in combination. When the Independent Data and Safety Monitoring Committee met in 2008 to review an

average of five and one-half years of data, they found that the vitamin E or selenium taken alone, or in combination with each other, did not prevent prostate cancer. Therefore, study participants were told to discontinue their supplements. While no statistically significant differences were found between the groups, there was a larger number of cases of prostate cancer in men taking vitamin E alone. This difference could have occurred by chance.

Another published clinical trial in 2008 that examined the use of vitamin E (400 IU every other day) and/or vitamin C (500mg daily) in men's cardiovascular health found no effect on the incidence of major cardiovascular events, myocardial infarction, stroke, or cardiovascular mortality. In addition, the use of vitamin E was associated with a significantly increased risk of hemorrhagic stroke.

However, a formulation consisting of vitamin E (400 IU), vitamin C (500mg), beta-carotene (15mg), zinc (80mg), and copper (2mg) was clinically proven to slow the progression of age-related macular degeneration (AMD), which is the most common cause of significant vision loss in older adults. The Age-Related Eye Disease Study (AREDS) was a large randomized trial that concluded that participants with early-stage AMD could slow the progression of their disease by taking this combination for an average of 6.3 years, compared to participants taking a placebo. The specific combination is now marketed by Bausch and Lomb under the trademark PreserVision® eye vitamin and is recommended

only for those with intermediate AMD in one or both eyes, or advanced AMD in one eye. AMD diagnosis must be confirmed by an eye care professional.

Most vitamin E supplements provide at least 100 IU of the nutrient, which

is substantially greater than the RDAs. Excessive intake of alpha-tocopherol supplementation may cause hemorrhagic effects. Table 5 lists the established adequate intake and upper tolerable limit for vitamin E.

### **Omega-3 Fatty Acids (Fish Oil)**

The supplement omega-3 fatty acids is known in most households as the term "fish oils." Alpha-linolenic acid (ALA) is a polyunsaturated fatty acid structurally recognized as an omega-3 fatty acid. It is converted in the body to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). EPA and DHA are found in fatty cold water fish such as salmon, mackerel, and herring; hence the term *fish oils*. In addition, ALA is also present in leafy green vegetables, nuts, vegetable oils such as canola and soy, and flaxseed and flaxseed oil.

Linoleic acid (LA) is classified as an omega-6 fatty acid with a slightly different structure and is converted to arachidonic acid (AA). AA is further converted to leukotrienes and prostaglandins which play a role in inflammation and will be discussed later in this lesson. Omega-6 fatty acids are more convenient to eat as LA is found in meat as well as soybean, safflower, sunflower, and corn oils and processed foods.

Neither form can be synthesized by the body and both are an important part of our diet. Most Americans consume far more omega-6 fatty acids than is required and not enough omega-3. The IOM has established the adult adequate intake for ALA and LA as 1.1-1.6g/

day and 11-17g/day respectively. Official DRIs are not available for DHA and EPA. It is not known whether a desirable ratio of omega-3 to omega-6 fatty acids exist, or to what extent excessive intakes of omega-6 fatty acids interfere with the benefits of omega-3 consumption since their byproducts are metabolized by the same pathways and competition may exist.

The role of omega-3 fatty acids, specifically the fish oils DHA and EPA, in the reduction of cardiovascular disease has been well accepted. In the 1970s, it was noted that populations with high fish consumption, such as Eskimos, experienced relatively low cardiovascular mortality.

A systematic review of studies examining the dietary and supplemental omega-3 fatty acids affect on primary and secondary cardiovascular outcomes was conducted by the Tufts Evidence Practice Center and funded by the AHRQ. The evidence supported the hypothesis that the consumption of omega-3 fatty acid supplements, fish and fish oil reduces all cause mortality and outcomes such as sudden death, cardiac death, and myocardial infarction, with the strongest evidence in support of fish and fish oil. These physiologic effects of fish oil consumption are thought to occur within weeks of routine consumption and are likely a result of altered cell membrane fluidity and receptor responses following the incorporation of polyunsaturated fatty acids into cell membranes. At typical dietary intakes, antiarrhythmic effects predominate, which is presumed to be responsible for the decreased incidence of sudden cardiac death and CVD. At higher doses, such as 2000mg to 4000mg/day, serum triglyceride levels may be reduced by as much as 25 to 30 percent in a dose dependent fashion. Also, evidence has shown that fish oil consumption lowers systolic BP by approximately 3 to 5mm Hg, and diastolic BP by approximately 2 to 3mm Hg. This is due to reductions in systemic vascular resistance,

with a dose-response that appears more linear at lower (dietary) doses, and plateaus at higher (supplement) doses. Although not found to be statistically significant, heart rate may also be reduced by 1.6 beats per minute. The clinical risk decrease associated with reduced triglycerides is a result of a higher dose and longer duration of supplementation than what is required to reduce coronary mortality.

More recently fish oil supplementation, specifically DHA, has gained the attention of pregnant women. DHA is a necessary structural component of the brain and eye. While data are limited, they suggest that fish oil supplements and dietary fish consumption during the pre- and post-natal periods possess benefits on neurodevelopment and cognitive outcome of offspring. However, prenatal fish intake remains controversial as most fish are contaminated with organic methyl mercury. Exposure to mercury in fetal life causes widespread neurological damage, such as delayed developmental milestones, blindness, deafness, and cerebral palsy. Methyl mercury is well absorbed following ingestion and readily crosses the blood brain barrier and placenta. It cannot be cooked out of fish.

Table 6 summarizes the EPA (Environmental Protection Agency) and FDA joint consumer advisory to assist pregnant and lactating mothers achieve the benefit of DHA, while minimizing the health risks caused by methyl mercury and other contaminants. Presently, worldwide expert panels have recommended that pregnant and lactating women should aim to achieve an average dietary DHA intake of at least 200mg to 300mg/day from a fish that is known to contain low levels of mercury.

Supplements containing either fish oil or DHA synthesized by algae are also available in a variety of doses and special formulations for pregnant women. Because these supplements are low in mercury and contaminants, they provide an attractive alternative to fish

### Table 6 Joint EPA and FDA dietary fish intake advisory

The following advisory has been issued for women who might become pregnant, women who are pregnant, and nursing mothers.

1. Do not eat shark, swordfish, or king mackerel. They contain high levels of mercury.
2. Eat up to 12 ounces (2 meals) per week of a variety of fish and shellfish that are low in mercury. Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish.  
*NOTE.* Albacore "white" tuna has more mercury than canned light tuna – limit albacore consumption to 6 ounces (1 meal) per week.
3. Check with local advisories about the safety of fish caught by family and friends in local lakes, rivers, and coastal areas. If no advice is available, limit weekly consumption to 6 ounces (1 meal) for that week.

Adapted from "What you need to know about mercury in fish and shellfish" from the EPA and FDA

consumption even though some dietary consumption of fish is still recommended by experts.

EPA and DHA are hypothesized to reduce the synthesis of the proinflammatory substances, prostaglandins and leukotrienes, by competitive inhibition. These lipid compounds are otherwise a product of the oxidation of arachidonic acid. Therefore, fish oils have been postulated to play a role in several inflammatory diseases such as asthma, rheumatoid arthritis, inflammatory bowel disease, and systemic lupus erythematosus. Currently, no conclusions have been drawn based on scientific evidence that support supplementation for these diseases with the exception that these fatty acids can reduce joint tenderness and the need for corticosteroids in rheumatoid arthritis.

As previously mentioned, fish oil supplements are available in various doses and formulations. Currently, one prescription formu-

**Table 7**  
**Select drug interactions with vitamins D and E, calcium, and fish oil**

Supplement	Second agent	Interaction
Vitamin D	Cholestyramine	Reduced vitamin D absorption
	Orlistat	Reduced vitamin D absorption
	Phenobarbital	Altered vitamin D absorption
Calcium	Phenobarbital	Reduced calcium absorption
	Phenytoin	Reduced calcium absorption
	Prednisone	Interferes with calcium absorption
	Quinolone antibiotics	Decreased absorption of quinolone antibiotic
	Iron Thyroid hormones	Reduced iron absorption Reduced levels and effect of thyroid hormone
Vitamin E	Vitamin K antagonists (warfarin)	May increase the effect of warfarin
	Chemotherapy	May reduce efficacy of chemotherapy by inhibiting oxidative damage to cancerous cells
	Tipranavir oral solution	Oral solution contains vitamin E; therefore additional vitamin E should be avoided
Fish Oil	Antiplatelets/ Anticoagulants	Fish oil may prolong bleeding time and may enhance antiplatelet/anticoagulant effect

lation is available. LOVAZA® (omega-3-acid ethyl esters) is indicated as an adjunct to diet to reduce triglyceride (TG) levels in adult patients with severe ( $\geq 500\text{mg/dL}$ ) hypertriglyceridemia. It is available in a 1gm soft gelatin capsule; the daily recommended dose is 4gm which can be divided in two doses if desired. LOVAZA® contains ethyl esters of omega-3 fatty acids obtained from several fish sources. Therefore, as with other fish oil supplements, patients with allergies to fish and/or shellfish are at an increased risk of allergic reactions and should use the product with caution.

Consumption of fish oil is generally safe. Side effects are generally mild and include eructation (belching), dyspepsia, vomiting, diarrhea, and taste pervasion (fishy taste). High dose fish oil (3-15mg/day) does increase bleeding time; however, it has not been associated with higher rates of clinical bleeding. Consumers taking other medications that alter coagulation should be monitored and take

fish oils under the supervision of a healthcare provider.

### Summary

In summary, dietary supplementation has dramatically increased over the last decade and consumers are taking a more active role in self care and preventing disease. Pharmacists can play an important role in assisting the lay public in understanding not only the safety profiles of these supplements but also the indications for which supplementation is supported. All supplements are not alike and pharmacists should aid consumers in selecting products from reliable manufacturers.

Calcium and vitamin D are currently indicated for skeletal disease only and play a critical role in bone health. Large scale randomized trials are underway to determine the role that vitamin D may play in cardiovascular disease. While antioxidant therapy seemed promising at one time, vitamin E studies have failed to provide consistent data in their role in the prevention of

cardiovascular disease and cancer. Yet, a combination product containing vitamin E has been shown to slow the progression of age-related macular degeneration. Finally, fish oils are widely accepted for their contribution to cardiovascular health and reduction of sudden death, cardiac death, and myocardial infarction. DHA consumption (preferably from dietary fish) is generally recommended for pregnant and lactating mothers for its beneficial role in the eye, neurodevelopment, and cognitive outcome of the offspring.

Select known drug interactions with the agents listed in the lesson are listed in Table 7.

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*The author, the Ohio Pharmacists Foundation and the Ohio Pharmacists Association disclaim any liability to you or your patients resulting from reliance solely upon the information contained herein. Bibliography for additional reading and inquiry is available upon request.*

This lesson is a knowledge-based CE activity and is targeted to pharmacists in all practice settings. To receive CE credit, your quiz must be postmarked no later than August 15, 2014. A passing grade of 80% must be attained.

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# continuing education quiz

## Dietary Supplementation of Vitamin D, Calcium, Vitamin E, Omega-3 Fatty Acids

- According to the Food and Nutrition Board, the recommended dietary allowance (RDA) for a supplement is:
  - the maximum daily intake unlikely to cause adverse health effects.
  - the average daily level of intake sufficient to meet the nutrient requirements of nearly all healthy people.
  - the daily intake amount recommended by the manufacturer.

- An important counseling point for pharmacists to convey to patients regarding supplements is that:
  - they are regulated by FDA in the same manner as prescription medications.
  - independent organizations test for safety and efficacy and offer "seals of approval."
  - they are regulated by FDA, but safety information need not be provided prior to marketing.

- All of the following individuals are at risk of vitamin D deficiency EXCEPT:
  - those with limited skin exposure.
  - those who have undergone gastric bypass surgery.
  - those who are obese.
  - those with light skin color.

- In a recent IOM report, the only outcome establishing a cause and effect relationship with vitamin D and calcium intake was:
  - cancer.
  - bone health.
  - cardiovascular disease.
  - AMD.

- Based on current available literature, most experts agree that serum concentration of vitamin D, [25(OH)D], should be maintained between:
  - 50-100ng/ml.
  - 10-20ng/ml.
  - 100-150ng/ml.
  - 20-40ng/ml.

- The current RDA for calcium/vitamin D, respectively, for a 51-year-old female is:
  - 1200mg/600 IU.
  - 1000mg/400 IU.

Completely fill in the lettered box corresponding to your answer.

- |                    |                     |                     |
|--------------------|---------------------|---------------------|
| 1. [a] [b] [c]     | 6. [a] [b]          | 11. [a] [b] [c] [d] |
| 2. [a] [b] [c]     | 7. [a] [b] [c] [d]  | 12. [a] [b] [c] [d] |
| 3. [a] [b] [c] [d] | 8. [a] [b] [c]      | 13. [a] [b] [c] [d] |
| 4. [a] [b] [c] [d] | 9. [a] [b] [c] [d]  | 14. [a] [b] [c] [d] |
| 5. [a] [b] [c] [d] | 10. [a] [b] [c] [d] | 15. [a] [b] [c]     |

I am enclosing \$5 for this month's quiz made payable to: *Ohio Pharmacists Association*.

- Rate this lesson: (Excellent) 5 4 3 2 1 (Poor)
- Did it meet each of its objectives?  yes  no  
If no, list any unmet \_\_\_\_\_
- Was the content balanced and without commercial bias?  
 yes  no
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- Comments/future topics welcome.

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- Although the National Cancer Institute does not recommend calcium supplementation for the prevention of any type of cancer, there is evidence suggesting it may have a protective effect against:
  - breast cancer.
  - prostate cancer.
  - colorectal cancer.
  - ovarian cancer.
- Calcium citrate:
  - is generally more affordable than calcium carbonate.
  - does not require the presence of chloride in order to be absorbed.
  - is not well absorbed in the fasting state.
- Excessive calcium consumption may lead to:
  - anorexia.
  - bruising.
  - kidney stones.
  - drowsiness.
- Vitamin E's potential to prevent and treat disease is based on its function as an:
  - antioxidant.
  - antiarrhythmic.
  - antihypertensive.
  - antilipidemic.
- In a recent clinical trial examining the use of vitamin E and/or vitamin C, there was a significant increase in the risk of:
  - renal disease.
  - colorectal cancer.
  - hemorrhagic stroke.
  - rheumatoid arthritis.
- The Age-Related Eye Disease Study (AREDS) concluded that participants with early-stage AMD could slow the progression of their disease by taking a combination product containing which of the following?
  - Vitamin E
  - Calcium
  - Vitamin D
  - Omega-3 Fatty Acids
- Fish oils have been postulated to play a role in:
  - multiple sclerosis.
  - rheumatoid arthritis.
  - osteoarthritis.
  - Alzheimer's disease.
- LOVAZA® (omega-3-acid ethyl esters) is indicated for:
  - hypertension, 1gram once daily.
  - angina, 2grams twice daily.
  - hypertension, 4grams once daily.
  - hypertriglyceridemia, 4grams once daily or 2grams twice daily.
- Patients consuming fish oil supplements should be counseled on which of the following potential side effects?
  - Kidney stones, hypercalcemia, milk-alkali syndrome
  - Anorexia, weight loss, polyuria
  - Belching, vomiting, diarrhea, fishy taste