Upon successful completion of this article, the pharmacist should be able to:
1. Understand why patients seek self-care with selected vitamins, minerals, and nutraceuticals.
2. Understand the role of the pharmacist in assisting patients in the rational choice and therapeutic use of these agents.
3. Understand the clinical data surrounding the therapeutic use of selected vitamins, minerals, and nutraceuticals.
4. Describe the clinical activity, benefit and toxicity associated with selected vitamins, minerals, and nutraceuticals.
5. Demonstrate the ability to counsel patients on the rational therapeutic use of selected vitamins, minerals, and nutraceuticals.

The concept that vitamins, minerals, and nutraceuticals possess therapeutic utility is not new, but it has evolved in recent times. In addition to preventing nutritional deficiency states, selected vitamins, minerals, and nutraceuticals are now used therapeutically to prevent or treat clinical problems and diseases. The use of dietary supplements has grown as patients become more involved in self-care and realize the limitations of modern medicine. Use of dietary supplements as primary or adjunct therapy also has grown as the basic scientific knowledge regarding the interplay of diseases with dietary supplements has mushroomed.

Complicating the picture, however, is the fact that basic scientific knowledge does not always translate well when it is applied to the clinical setting. This article reviews the rational use of some dietary supplements that have been advocated to manage a variety of clinical entities, such as age-related macular degeneration, migraine headaches, pre-menstrual syndrome, hypercysteinemias, insulin resistance, diabetes, obesity, neuropathies, and erectile dysfunction. It is hoped that this discussion will provide the community pharmacist with tools to assist and counsel patients that desire to treat or prevent disease with vitamins, minerals, and nutraceuticals.

ADVANCED AMD
Non-exudative macular degeneration is a condition occurring in the elderly that starts with the accumulation of extra-cellular deposits underneath the retinal pigment epithelium. Gradually over time this can lead to central vision loss, and AMD is the leading cause of blindness in the elderly throughout the developed world. In the United States, it is estimated that more than eight million elderly persons have early AMD, and 1.3 million have advanced AMD. With the baby-boom generation just starting to enter into their golden years, the prevalence is expected to double by 2020.

Modifiable risk factors that are reported to be associated with advanced AMD are smoking and obesity. It has been proposed for many years that another modifiable factor, diet, especially one rich in antioxidants, may provide protection against AMD progression. In recent years, dietary supplementation with anti-oxidant vitamins and minerals in patients with early AMD has been aggressively investigated.

Useful Web Sites

- [www.naturaldatabase.com/](http://www.naturaldatabase.com/) The Natural Medicines Comprehensive Database was created by the editorial staff at the Therapeutic Research Center. The Natural Medicines Comprehensive Database was launched in September 1999. Since then, its research and editorial team continues to update the Database daily.
- [www.obesity.org/subs/consumeralert/](http://www.obesity.org/subs/consumeralert/) The American Obesity Association is focused on changing public policy and perceptions about obesity. It has become an authoritative source for policy makers, media, professionals and patients on the obesity epidemic.
In the Age-related Eye Disease Study (AERDS), 3,294 patients with early AMD were randomized double-blinded to daily (1) placebo, (2) zinc/copper (80 mg/2 mg), (3) anti-oxidants (vitamin C [500 mg]; vitamin E [400 IU]; beta-carotene [15 mg]) or 4) antioxidants plus zinc/copper. After an average of six years, the group receiving the combination of antioxidants plus zinc/copper showed a significant risk reduction (~25 percent) in the development of advanced AMD. While a reduction by 25 percent may seem small, it has been estimated that if all at risk individuals received supplementation this would prevent more than 300,000 cases from developing advanced AMD and visual loss over the next five years. The same study investigated whether supplementation could prevent the progression of cataracts; in this case no combination of antioxidants with or without zinc/copper was beneficial.

Ocuvite PreserVision is a commercial preparation that contains a combination of anti-oxidants and Zn/Cu similar to that studied in the AERDS trial. The suggested dose is two tablets two times a day. If taken as suggested, the formulation provides 452 mg of vitamin C, 400 IU of vitamin E, 69.6 mg of Zn, 1.6 mg of Cu, and 28,640 IU of vitamin A beta-carotene, at a cost of about $14 per month. Important counseling tips include (but are not limited to) the following:

- Take as directed every day to derive full benefit from the formulation. This is intended to be long-term therapy.
- The anti-oxidant/Zn-Cu combination found in ocuvite PreserVision has been tested and shown to prevent the development of advanced AMD in patients with early AMD. It has not been tested in other groups; there is no data that supports using this supplement in patients with other eye disorders (cataracts, for example) or patients with normal eyes.
- Smokers should not use this supplement unless directed by their physician. Beta-carotene supplementation has been shown to increase the risk of lung cancer in smokers.
- It is suggested that you continue to take a normal multivitamin such as Centrum along with Ocuvite PreserVision. (Patients received daily multivitamins along with the anti-oxidant/Zn-Cu combination in the AERDS trial.)

Lutein and zeaxanthin, known as ocular pigments, are dietary carotenoids that decline in ocular concentration with aging and have been positively associated with better night and daytime vision. Whether these carotenoids improve visual performance or prevent advanced AMD is a matter of debate and clinical study. In counseling patients about lutein/zeaxanthin eye supplements, pharmacist should tell them that the rationale for use of these carotenoids is conjectural and not based on clinical studies in humans, but, ongoing studies should provide an answer in the future.

**Table 1. Migraine Prophylaxis**

<table>
<thead>
<tr>
<th>Study/Design</th>
<th>Dose/Regimen</th>
<th>N =</th>
<th>50% Response</th>
<th>P =</th>
<th>Comment</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoQ10 vs. placebo</td>
<td>100 mg tid</td>
<td>42</td>
<td>47.6% vs 14.4%</td>
<td>0.02</td>
<td>NNT=3</td>
<td>Neurology 2005</td>
</tr>
<tr>
<td>Riboflavin [B2] vs placebo</td>
<td>400 mg qd</td>
<td>55</td>
<td>59% vs 15%</td>
<td>0.002</td>
<td>NNT = 2.3</td>
<td>Neurology 1998</td>
</tr>
<tr>
<td>Mg citrate vs placebo</td>
<td>600 mg qd</td>
<td>68</td>
<td>55.6% vs 31.3%</td>
<td>0.149</td>
<td>Excluded drop-outs, 7% Mg patients dropped due to toxicity</td>
<td>Cephalalgia 1996</td>
</tr>
</tbody>
</table>

*RDBPCT = randomized double-blind placebo controlled trial; NRACT = non-randomized active agent comparative trial; NNT = number needed to treat; N.S.S. = not statistically significant.*
Riboflavin (vitamin B2) and Coenzyme Q10 (Co-Q10) both improve mitochondrial energy metabolism. Mitochondrial dysfunction resulting in impaired oxygen metabolism has been proposed as a pathogenic factor in migraine headaches. While the quantity of well-controlled clinical trials is limited for B2 and Co-Q10, they both demonstrate minimal short-term toxicity. Long-term toxicity data, however, is not available. Also, as with all dietary supplements, studies are performed with specific formulations that may not be mirrored in commercially available products. Laboratory and clinical studies have associated low serum magnesium concentrations with migraine headache, and conversely the administration of magnesium in deficient patients results in alleviating headache pain. However, attempts to study both oral and intravenous magnesium in well-designed trials in patients with migraine have been disappointing, and magnesium in high doses is associated with diarrhea, diminished reflexes, and gastrointestinal distress.

In a recent review of migraine prophylaxis in the American Family Physician, it was recommended that agents such as B2 and coQ10 be reserved as second line prevention after established prescription-only agents such as propranolol and amitriptyline have been tried. As second line agents, B2 and coQ10 are possibly effective and are relatively safe. If taken as recommended the cost of therapy per month is about $60 for coQ10 and $5-$10 for riboflavin, respectively. In counseling patients on the use of these agents, include the following points:

1. High dose riboflavin (400 mg qd) and coQ10 (100 mg tid) are possibly effective in the prevention of migraine and short-term toxicity is minimal.
2. Maximum benefit usually takes two to four months to achieve.
3. Long-term therapy (more than six months) at these doses is not studied and long-term toxicities are unknown. Therefore, discuss use of these agents with your doctor before using them.
4. Always purchase dietary supplements from a reputable source that is recommended by your pharmacist.

**PREVENTION OF PRE-MENSTRUAL SYNDROME (PMS)**

Up to 40 percent of women of child-bearing age suffer from PMS, and 3-5 percent experience a severe form known as premenstrual dysphoric disorder (PMDD). To have PMS, a woman must suffer at least one moderate to severe mood symptom and at least one physical symptom. These symptoms must result in functional impairment. Symptoms also must be present during the luteal phase of the menstrual cycle and abate by day four of menses. A variety of vitamins, minerals, and nutraceuticals such as vitamin B6, vitamin E, magnesium, calcium and γ-linolenic acid have been advocated for prevention of PMS, but only calcium has been shown consistently in well-designed clinical studies to be effective and safe in this disorder.

The rationale for calcium supplementation in the prevention of PMS is multi-factorial. Studies demonstrate that calcium levels fluctuate throughout the menstrual cycle and some data suggest that women with PMS may have greater derangements in calcium homeostasis. It also has been proposed that aberrant calcium homeostasis results in a variety of psychological disturbances, such as irritability, depression, and anxiety, and that calcium supplementation helps to alleviate these symptoms.

In one large randomized, double-blind, placebo-controlled trial, calcium carbonate 1,200 mg (elemental Ca++)/day administered to women with PMS for three menstrual cycles resulted in an overall 48 percent reduction in PMS symptoms, including negative mood, water retention, food cravings, and pain. Other smaller studies have reported similar results. Chronic calcium is well-tolerated and calcium supplementation provides the added benefit of helping to maintain bone density. For women seeking self-treatment of mild-moderate PMS, a trial of three to four months of calcium carbonate 1,200 mg/day is a reasonable and effective/safe first step. It also may be a helpful adjunct for women with severe PMS that must be treated with prescription drug therapy. Some counseling points to consider:

- Calcium carbonate or calcium citrate may be used. The effective dose is 1,200 mg of elemental calcium per day divided into two to three doses.
- No more than 600 mg of elemental calcium should be taken at one time.
- Calcium carbonate should be taken with meals; calcium citrate can be taken regardless of meals.
- Optimal benefit from calcium takes three to four months to achieve.
- Most patients will experience approximately a 50 percent
decrease in symptoms, but not all symptoms will completely go away.
• It is helpful to monitor symptoms with a daily diary.

**Erectile Dysfunction**
Some form of erectile dysfunction (ED) is estimated to occur in approximately 50 percent of men between the ages of 40 and 70. At the same time it is estimated that worldwide only 10 percent of men seek medical help for the condition. While there are several pathologic mechanisms that contribute to ED, the majority of drugs used in this condition enhance nitric oxide (NO) production due to NO’s key role in normal penile vasodilation. L-arginine, a semi-essential amino acid, is the biologic precursor of NO and is sold as a dietary supplement to enhance sexual performance. While laboratory studies demonstrate that supraphysiologic doses of L-arginine enhance NO production and erectile response in animals, clinical data in humans has been mixed. It would appear from looking at the few well-designed studies that best results may be achieved with high doses (5–6 gms per day) of L-arginine, administered three to four weeks in men that produce low levels of NO. L-arginine has also been studied in numerous other NO associated clinical maladies such as congestive heart failure, angina pectoris, atherosclerosis, coronary heart disease, hypertension, intermittent claudication, type 1 diabetes, and AIDS cachexia.

Short-term, adverse effects of L-arginine even in large doses, have not been reported. Long-term safety data is not available and it is generally agreed, based on hypothetical grounds, that L-arginine not be used in patients with a history of herpes infection, asthma, or cancer. Large doses (5–6 gms/day) cost the consumer approximately $32–$37 per month.

Helpful counseling tips for the consumer include the following:
• Well-designed clinical data evaluating the utility of L-arginine in ED is mixed and requires further study.
• Long-term safety data is not available.
• Best results have been seen in patients depleted in NO who use large doses (5–6 gms) every day for three to four weeks.
• Do not use L-arginine if you have a history of herpes infection, asthma, or cancer.
• Do not combine L-arginine with other ED agents. Combining L-arginine with other agents used in ED (Viagra, yohimbine, ginseng, ginkgo) have either not been studied or have been poorly studied.
• If you have cardiovascular disease, diabetes, AIDS or any serious chronic disease, consult your physician before using L-arginine.

**OBESITY**
Obesity is commonly defined as having a very high amount of body fat in relation to lean body mass, or a Body Mass Index (BMI) of 30 or higher. In 2001, 21 states reported that 15-19 percent of the state’s population was obese, 27 states reported that 20-24 percent of the population was obese, and one state reported that 25 percent or greater of its population was obese. It is commonly stated that the prevalence of obesity has doubled in the last 30 years and that 33-50 percent of adults are either overweight or obese. This epidemic has led a greater number of people to seek over-the-counter (OTC) diet aids to help control their weight. OTC vitamins, minerals, or nutraceuticals that are commonly present in these weight loss products are listed in Table 2 (left) and are classified by proposed mechanism.

Laboratory studies demonstrate that chromium is an essential co-factor for insulin activity and results in less body fat and increased lean body mass. It also improves insulin sensitivity and decreases insulin resistance. In human studies, a recent meta-analysis of blinded, randomized controlled trials concluded that daily chromium picolinate creates a relatively small (about 2.5 lbs.) weight loss relative to placebo over a period of two to three months. At typical doses of 500 mcg once or twice a day, chromium picolinate appears to be well tolerated when administered on a short-term (months) basis; insufficient evidence is available to advocate long-term (years)

<table>
<thead>
<tr>
<th>Table 2. Weight Loss Supplements: Vitamins, Minerals, and Nutraceuticals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Mechanism</td>
</tr>
<tr>
<td>Modulate Carbohydrate Metabolism</td>
</tr>
<tr>
<td>☑ Fat Metabolism or ☑ Fat Synthesis or ☐ Protein Breakdown</td>
</tr>
</tbody>
</table>
administration. In case reports, acute rhabdomyolysis, renal failure and exanthematous pustulosis have occurred in individual patients taking chromium picolinate. However, the relationship as to causation is unclear.

Along with weight loss, chromium is reported by the Natural Medicines Comprehensive Database to be possibly effective but inconclusive as adjunct therapy in type-2 diabetes and dyslipidemia. Again, the safety of long-term therapy is unknown. The cost of 500 mcg once or twice a day is $2-$4 per month.

The number of patients with type 2 diabetes is growing yearly in part due to the increasing prevalence of obesity. Whereas, type 2 diabetes was once restricted to the adult population, with the current epidemic of obesity in juveniles it is now becoming commonplace to hear of children as young as 5 with type 2 diabetes. With growing numbers of diabetes patients, end organ damage is becoming more common.

Microvascular, macrovascular, and neuropathic sequelae lead to blindness, renal damage cardiovascular disease, and neuropathies. It is well known that to prevent diabetic end-organ damage, the key to prevention is control of blood glucose. Unfortunately, even with strict adherence to regimens and insulin pump technology, many diabetes patients suffer unfavorable consequences from the disease.

Current preventative and treatment strategies that can stem the tide of progressive damage or help ameliorate symptoms are inadequate. As a consequence, physicians may recommend or diabetes patients may seek to self-treat

HOMOCYSTEINEMIA AND CARDIOVASCULAR PROTECTION
Epidemiologic studies show a strong association between homocysteine levels and cardiovascular risk. It is known that homocysteine causes oxidative damage to vessels and increases the risk of thrombosis, leading to myocardial infarction and stroke. It is also well known that the daily administration of folic acid, B6 (pyridoxine), and B12 decreases levels of homocysteine by about 25 percent by facilitating its conversion to methionine.

What has been unknown until recently was whether decreasing homocysteine level with B6, B12, and folic acid supplementation would prevent myocardial infarctions, stroke, or death from cardiovascular causes. Results from two recent primary and secondary prevention studies in the New England Journal of Medicine confirm findings from other studies that decreasing homocysteine levels with vitamin B supplementation does not improve cardiovascular outcomes among high risk patients. It appears from these results that the combination of B6, B12, and folic acid for cardio-protection in at risk patients is not supported by the evidence and should not be advocated. Questions that remain to be answered are whether supplementation would help patients with extremely high homocysteine levels, and whether some other combination of vitamins and other doses may be protective. For now it’s best to just recommend a daily multivitamin as part of a healthy lifestyle of exercise, good nutrition, weight management, and yearly check-ups with a physician.

DIABETES
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Table 3. Dietary Supplements in Diabetes

<table>
<thead>
<tr>
<th>Vitamins</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin B6</td>
<td>B6 not beneficial in diabetic neuropathy in DBRPC trials. Limited data for high doses of vitamin E; do not recommend.</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>B12 – more clinical trials needed.</td>
</tr>
<tr>
<td>Vitamin E</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium picolinate</td>
<td>Cr – Inconsistent results on FBG, PPG in controlled trials.</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Mg – Minimum benefit on FBG, HgA1c in controlled trials.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nutraceuticals</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-lipoic acid</td>
<td>αLA – may be beneficial for diabetic peripheral neuropathy and insulin resistance in oral doses of 600-1,800 mg/day.</td>
</tr>
<tr>
<td>γ-linolenic acid</td>
<td>γLA – limited but inconclusive benefit for diabetic peripheral neuropathy.</td>
</tr>
<tr>
<td>conjugated-linoleic acid</td>
<td>CLA – Requires more data; limited benefit in obesity.</td>
</tr>
<tr>
<td>acetyl-L-carnitine</td>
<td>ALC – Inconsistent results.</td>
</tr>
</tbody>
</table>

FBG = fasting blood glucose, PPG = postprandial glucose

with vitamins, minerals, and nutraceuticals. Oral supplements and their effect on insulin resistance or diabetes neuropathy that have been evaluated in randomized clinical trials are listed in Table 3 (above).

A popular hypothesis that attempts to explain, in part, the molecular basis for insulin resistance and progressive diabetes damage involve oxidative stress and stress-activated signaling pathways. Inflammation and oxidative stress have been shown to be increased in type 2 diabetes patients, and patients with metabolic syndrome. Therefore, anti-oxidants such as vitamin E and alpha-lipoic acid have been investigated for their potential benefit in insulin resistance and diabetes neuropathy. Alpha-lipoic (αLA) acid is an endogenous co-factor in carbohydrate metabolism that functions as a potent mitochondrial free-radical scavenger. It is approved in Germany for the management of diabetes neuropathy, and has been used in Europe for more than 40 years for this purpose. When administered at oral doses of 600-1,800 mg/day for at least three weeks, αLA has improved insulin resistance and peripheral neuropathy in patients with type 2 diabetes in controlled clinical trials. While it would appear to have clinical potential, controlled trials defining the long-term efficacy and safety of αLA have not been completed, so caution in recommending it is advised.

At higher doses αLA may cause gastrointestinal upset, and rash has also been reported. It should not be given to patients that are thiamine (B1) deficient. Also, theoretically, caution should be exercised when αLA is co-administered with hypoglycemic agents or insulin, and its use should be avoided during cancer chemotherapy or radiation therapy. Metals such as iron and copper are chelated by αLA, so it must be administered separately from multivitamins with minerals. For 1,200 mg/ day, a month’s supply of 300 mg αLA costs about $10. Patient counseling tips include the following:

- In patients with diabetes, take αLA only after consultation with their primary care provider.
- At best, αLA is a possible adjunct to primary diabetes management, with diet, exercise, and pharmacotherapy.
- As αLA is a metal chelator, it may deplete iron stores. Monitoring of iron may be necessary with chronic administration.

- Donot co-administer αLA with multi-vitamins, minerals, or antacids. Separate administration by at least two hours.
- Patients that are thiamine (B1) depleted should receive a thiamine supplement before starting αLA.
- Theonset of benefit is delayed by approximately three weeks and may take several months to achieve maximum effects.

The use of vitamins, minerals, and nutraceuticals for therapeutic purposes is a dynamic area of clinical investigation, and it is essential that pharmacists keep abreast of progress in this area. Frequently, however, patients have the desire to self-treat with supplements before clinical data is mature and definitive. The pharmacist can help patients by providing a critical analysis of risk/benefit, and provide much needed information on the appropriate use of these agents. α-

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CONTINUING EDUCATION QUIZ

Select the correct answer.

1. P.O. is a 66-year-old patient with HTN, diabetes, peripheral neuropathy and erectile dysfunction (ED). P.O. is an avid reader, surfs the Internet daily, and frequently approaches his pharmacist about the use of vitamins, minerals, and nutraceuticals for therapeutic purposes. P.O. complains to his pharmacist that there must be more that can be done to help his medical conditions. Which of the following are reasons why P.O. desires to use dietary supplements?
   a. P.O. desires to be knowledgeable and involved in self-care.
   b. P.O. wants to discontinue all his prescription medicines.
   c. P.O. may be dissatisfied with the limitations of modern medicine.
   d. A and b.
   e. A and c.

2. P.O. takes Viagra for his ED, but has had unsatisfactory results. He asks you, his pharmacist, whether L-arginine would be a good alternative or additive to his current ED regimen. Which of the following would be reasonable counseling points?
   a. L-arginine is contraindicated in patients with HTN.
   b. Well-designed clinical data evaluating the utility of L-arginine in ED is mixed and requires further study. P.O. should consult his physician.
   c. Adding high dose L-arginine to augment Viagra is proven to be beneficial.
   d. L-arginine counteracts nitric oxide synthase, therefore potentially inhibiting the activity of Viagra.
   e. Discontinue Viagra and use L-arginine instead; it is more effective and is safer.

3. P.O. has a wife that has early age-related macular degeneration (AMD), and her ophthalmologist has recommended that she take Ocuvite PreserVision daily. P.O. asks if he should also take it to prevent AMD. Which of the following is a reasonable response?
   a. Ocuvite PreserVision contains a mixture of herbs and minerals that in general are good for preserving eye function and health.
   b. Ocuvite PreserVision contains anti-oxidant vitamins (A[beta-carotene], E, C) and minerals (Zn, Cu) that have been shown to prevent early AMD.
   c. Ocuvite PreserVision contains anti-oxidant vitamins (A [beta-carotene], E, C) and minerals (Zn, Cu) that have been shown to prevent advanced AMD in patients with early AMD.
   d. Ocuvite PreserVision is beneficial in preventing cataracts.
   e. C and d

4. DF is a 60-year-old female with early AMD who also smokes. She failed to discuss smoking with her physician because she doesn’t want to disappoint her doctor. DF comes to the pharmacy to purchase Ocuvite PreserVision. As DF’s pharmacist you know that she has a smoking history because you have helped her purchase nicotine replacement therapy in the past. Which of the following statements is (are) reasonable advice for you to give her?
   a. Discuss the pharmacologic activity of anti-oxidant vitamins and minerals in preventing advanced AMD and blindness.
   b. Counsel DF that it is recommended that smokers NOT take Ocuvite PreserVision because of increased health risks, including an increased risk of lung cancer.
   c. Counsel DF that it is recommended that smokers take Ocuvite PreserVision because it decreases the risk of lung cancer.
   d. Suggest that DF talk with her doctor if she is still smoking.
   e. B and d

5. Patients taking Ocuvite PreserVision should NOT take a normal multivitamin daily.
   a. True
   b. False

6. P.O. (see question No. 1) also has concerns about his peripheral neuropathy. His physician has suggested that he add alpha-lipoic acid to his current regimen. P.O. comes to talk with you after selecting Natrol (alpha-lipoic acid 300 mg) from the shelf. You notice that the product labeling states, “Take one capsule daily with a meal.” What counseling advice do you give P.O.?
   a. In clinical studies an effective dose of alpha-lipoic acid has ranged from 600-1,800 mg/day. Try taking one capsule two times a day with a meal and increase the dose after three weeks if needed.
   b. Alpha-lipoic acid has no food, vitamin, or drug interactions.
   c. Alpha-lipoic acid may cause iron over-load.
   d. You should feel much better after one dose.
   e. B, c and d

7. Patients that are thiamine (B1) depleted should receive a thiamine supplement before starting alpha-lipoic acid.
   a. True
   b. False

8. Up to what percentage of the U.S. population suffers from migraine headaches?
   a. Twelve percent
   b. Fifteen percent
   c. Twenty-five percent
   d. Fifty percent
   e. Seventy-five percent
9. CC is a 25-year-old college student and mother of two preschool children who suffers from PMS, migraine headaches, and is obese (BMI=31). Her medications include Imitrex for acute migraines, amitriptyline 25 mg q hs for migraine prevention, and Jasmin oral contraception for birth control and PMS. CC has noticed that she has gained 10 pounds since starting amitriptyline. She has discontinued the amitriptyline and wants to try riboflavin for migraine prophylaxis. You notice that she was on propranolol for three months last year, but discontinued it to try riboflavin for migraine prophylaxis. You suggest:

   a. Low dose (4 mg) riboflavin is effective in the prevention of migraine.
   b. High dose riboflavin (400 mg qd) is possibly effective in the prevention of migraine and short-term toxicity is minimal.
   c. The maximum benefit may take two to four months to achieve.
   d. A and c
   e. B and c

10. CC states that the Jasmin has helped decrease bloating and water retention prior to menses, but she still is anxious and irritable. CC wants to know what OTC product you recommend to prevent PMS symptoms. You suggest:

   a. Trying 1,200 mg of elemental calcium per day divided into two or three doses for three to four months
   b. Midol PMS (pamabron [diuretic], pyrilamine maleate, acetaminophen) when symptoms arise
   c. Trying 600 mg of elemental calcium per day
   d. Trying 1,200 mg vanadium per day divided into four doses
   e. C and d

11. CC says she is serious about losing weight and asks about the virtue of chromium. She has heard that it redistributes weight from fat tissue to muscle and helps people lose weight. She asks you, her pharmacist, what she can expect if she takes chromium picolinate. You answer:

   a. Studies indicate that daily chromium picolinate at doses of 500 mcg qd-bid results in a relatively large weight loss (25 pounds) over two to three months
   b. Studies indicate that daily chromium picolinate at doses of 500 mcg qd-bid results in a relatively small weight loss (2.5 pounds) over two to three months
   c. Chromium picolinate appears to be well-tolerated when dosed over a couple of months but long-term safety is unknown.
   d. A and c
   e. B and c

12. Over the counter dietary supplements are of enormous value as part of a weight management program.

   a. True
   b. False

13. LO is a 56-year-old overweight transportation consultant who smokes two packs per day; drinks two to three beers per day; loves high fat, fried foods; and has untreated mild hypertension. LO says he doesn’t have time for doctors and prefers to take care of himself. LO takes half of an aspirin per day. LO comes to you to ask about taking vitamins to protect his heart. He says a neighbor of his was put on some B vitamins after a heart attack, and he wants to take them as well. Which of the following is a correct statement regarding B vitamins and cardioprotection?

   a. The combination of 2.5 mg folic acid, 50 mg B6, and 1 mg B12 increase the level of homocysteine, an endogenous cardioprotective substance.
   b. The combination of 2.5 mg folic acid, 50 mg B6, and 1 mg B12 decreases the level of homocysteine, a powerful oxidant that can damage blood vessels.
   c. Recent studies conclude that the combination of these B vitamins does not prevent heart attacks, stroke, or cardiovascular death in patients at risk for a primary or secondary cardiovascular event.
   d. For now, LO should just take a daily multivitamin as part of a healthy lifestyle of exercise, good nutrition, weight management, and yearly check-ups.
   e. B, c and d

14. Lutein and zeaxanthin

   a. Are dietary fatty acids
   b. Are proven to improve daytime and nighttime vision in everyone
   c. Are ocular pigments that are being studied for potential benefit in patients at risk for poor night and day time vision
   d. Are weight loss agents
   e. A and d

15. Both CoQ10 and riboflavin:

   a. Improve mitochondrial energy metabolism and may help prevent migraine headaches
   b. Are effective in preventing insulin resistance
   c. Are effective in the treatment of sinus headache
   d. Improve mitochondrial energy metabolism and effectively treat acute migraine headaches
   e. C and d

16. Magnesium salts have been studied in the treatment and prevention of migraine headaches and are highly effective and non-toxic.

   a. True
   b. False
17. For PMS prevention, calcium carbonate should be taken:
   a. Irrespective of meals
   b. With meals only
   c. Should be taken with alpha-lipoic acid
   d. A and c
   e. B and c

18. The best therapeutics results from L-arginine in ED has occurred under what circumstances?
   a. Low doses taken 30 minutes prior to sexual activity
   b. In men that produce low levels of NO
   c. High doses (5-6 gms/day) daily over three to four weeks
   d. A and b
   e. B and c

19. In what disease states should the use of L-arginine be discouraged?
   a. Asthma
   b. Congestive heart failure
   c. Angina
   d. Cancer
   e. A and d

20. Conjugated linoleic acid:
   a. Promotes apoptosis in fat tissue thereby decreasing fat deposition
   b. Augments the development of lean mass with resistance training
   c. Is associated with rhabdomyolysis and renal failure in high doses
   d. Long-term safety is well described
   e. B and c

21. Is this program used to meet your mandatory C.E. requirements?
   a. Yes
   b. No

22. Type of pharmacist: a. owner b. manager c. employee

23. Age group: a. 21–30 b. 31–40 c. 41–50 d. 51–60 e. Over 60

24. Did this article achieve its stated objectives? a. Yes b. No

25. How much of this program can you apply in practice?
   a. All
   b. Some
   c. Very little
   d. None

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Quiz: Shade in your choice

1. a b c d e
   11. a b c d e
2. a b c d e
   12. a b c d e
3. a b c d e
   13. a b c d e
4. a b c d e
   14. a b c d e
5. a b c d e
   15. a b c d e
6. a b c d e
   16. a b c d e
7. a b c d e
   17. a b c d e
8. a b c d e
   18. a b c d e
9. a b c d e
   19. a b c d e
10. a b c d e
    20. a b c d e

Quiz: Circle your choice

21. Is this program used to meet your mandatory C.E. requirements? a. Yes b. No


23. Age group: a. 21–30 b. 31–40 c. 41–50 d. 51–60 e. Over 60

24. Did this article achieve its stated objectives? a. Yes b. No

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How long did it take you to complete both the reading and the quiz? _______ minutes

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