Blood-Pressure Difficulties After Mealtimes: Postprandial Hypotension In the Elderly

Foreword:
We thank Nutrition Dimension for allowing The Spectrum to reprint this continuing-education article. We welcome these kinds of partnerships that let us provide our members with quality CPE opportunities.

Abstract
Following meals, the elderly population is at risk for postprandial hypotension, which is defined as a decrease in systolic blood pressure of 20 mm Hg or greater within two hours of having a meal. A drop in systolic blood pressure occurring from a pre-meal level of more than 100 mm Hg to less than 90 mm Hg is also considered postprandial hypotension. The most common symptoms are sleepiness, extreme tiredness, nausea, yawning, headache, speech disturbances, and syncope. During postprandial digestion, the blood flow shifts toward the stomach and intestines with an osmotic shift of fluids, which reduces intravascular volume and diastolic ventricular filling. The baroreflex response (a homeostatic mechanism to maintain blood pressure) normally compensates to prevent a reduction in cardiac output. In the elderly, this reflex is weakened, and they are at risk for the symptoms associated with postprandial hypotension. By understanding postprandial hypotension, healthcare practitioners can assist in the diagnosis and treatment of their patients.

Learning Objectives:
At the completion of this self-study article, the participant will be able to:
- Define postprandial hypotension and its pathophysiology.
- Identify risk factors, clinical presentation, and complications.
- Discuss prevention and management of postprandial hypotension.

John was concerned about his wife, Norma. She loved to cook and eat, and was always full of energy. Now after meals she would get dizzy and tired, going to bed early instead of participating in her usual activities, which was affecting her quality of life. Both John and Norma were scared that she had a serious medical condition. Norma made an appointment to see her physician. Norma learned that her after-meal experiences were the signs of a surprisingly common condition called postprandial hypotension (PPH).

A lowering of blood pressure (BP) often occurs among older adults after a meal, in both healthy and frail individuals. This drop can lead to dizziness, syncope, and falls. A problem common in the elderly, the incidence of postprandial hypotension (PPH) increases with age. It is virtually un...
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seen in younger people, but prevalent in the elderly with high BP or disorders that impair the brain’s controlling centers for autonomic nervous system processes. It is imperative that healthcare practitioners understand the connection between food ingestion and a resulting clinically significant drop in BP.

PPH is defined as a decrease in systolic blood pressure of 20 mm Hg or greater within 2 hours of having a meal. A drop in systolic blood pressure occurring from a pre-meal level of more than 100 mm Hg to less than 90 mm Hg is also considered postprandial hypotension. While PPH may occur with any meal, it occurs more commonly with morning and noon meals. In many cases, the postprandial drop in systolic BP produces symptoms. The elderly patient can experience symptoms after a meal even when systolic BP falls less than 20 mm Hg.

Studies of older residents in long-term healthcare facilities receiving feedings by nasogastric tube (NGT) or percutaneous endoscopic gastrostomy (PEG) have shown that nearly all subjects experienced some reduction in systolic BP after receiving enteral nutrition. Of those studied, 43% had PPH. Peak time and peak level of a postprandial BP drop varies. In this study, the systolic BP began to drop 30 minutes after a meal in 68% of patients. 70% of patients showed the peak drop in systolic BP at 60 minutes. The drop can start as early as 15 minutes or as late as 90 minutes after the meal. No significant differences were noted in patients taking meals orally or via internal feedings.

There are many symptoms among older people with PPH (see Table 1).

Table 1: Symptoms of PPH

- Vision changes
- Speech disturbances
- Nausea
- Syncope
- Sleepiness
- Fatigue
- Yawning
- Headache
- Looking pale
- Restlessness
- Loss of concentration
- Chest pain
- Dizziness
- Instability
- Loss of consciousness
- Lightheadedness

Table 2: Normal age-related changes in the cardioregulatory system

- Decreased sensitivity of baroreceptors
- Loss of blood vessel compliance and ability to distend
- Increased incidence of systolic and diastolic hypertension
- Increased reliance on adequate systemic BP
- Reduced cerebral blood flow
- Impaired renal concentrating ability
- Decreased sodium concentration
- Decreased plasma renin activity and aldosterone levels
- Predisposition to intravascular volume depletion
- Increased circulating levels of catecholamines
- Reduced organ responsiveness

One study analyzed the symptoms of those admitted to a Dutch hospital; most prevalent were sleepiness, extreme tiredness, nausea, yawning, headaches, speech disturbances, and syncope. Complications associated with PPH include a higher incidence of coronary events, stroke, and total mortality. Syncope and the fall it may cause can wreak havoc on aging tissue and bones, especially among the frail. Likewise, PPH can contribute to frailty and malnutrition if an older adult begins to avoid food as a means of preventing the disturbing effects of PPH.

Although clinicians described the hypotensive effect of meal ingestion as early as 1935, PPH was first recognized as a clinical problem in 1977 in a patient with Parkinson’s disease. Moreover, PPH is distinct from orthostatic (postural) hypotension, which occurs with a position change from supine to standing. Although distinct, these two types of hypotension may overlap in the same patient. Patients who have impaired brain control centers, such as those with Parkinson’s disease, multiple system atrophy, and diabetes, may lose the ability to maintain BP with changes in blood volume.

Pathophysiology of Postprandial Hypotension

Understanding the normal response of the cardiovascular system to a meal and its underlying mechanisms, along with normal age-related changes in the cardiovascular system, is crucial to understanding the pathophysiology of PPH (see Table 2).

As the body focuses its energies on digestion during and after a meal, splanchnic blood flow from the spleen and visceral organs to the stomach and intestines increases. Systolic BP tends to drop as a result, causing a decrease in systemic vascular resistance. An osmotic shift of fluid into the gut during digestion enhances this process by reducing intravascular volume and diastolic ventricular filling. Cardiac output then decreases. Normally, the baroreflex, a homeostatic

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mechanism to maintain BP, compensates for these effects by increasing heart rate and output and promoting vascular resistance and peripheral vasoconstriction. In older adults, all these compensatory mechanisms are weaker than they are in young adults.11

Because the baroreflex and other compensatory mechanisms are less efficient, compensation for the normal tendency of systolic BP to fall after eating does not occur.

Meal Composition

The composition of the meal can affect PPH, although more research is needed to clarify this mechanism, as studies have shown conflicting results. Simple carbohydrates, particularly glucose (which stimulates insulin release), were found to play a significant role in PPH. In contrast to glucose, one study found that other carbohydrates, such as fructose or xylose, along with fats and proteins, have no effect on the drop in BP.2,13 Another study showed that ingestion of glucose at high volumes was found to reduce the drop in BP. This study emphasized that results depend on the rate of gastric emptying of food into the duodenum, as well as on the drink volume.14

Gastric emptying may be altered in the elderly, in persons with diabetes, and often as a result of polypharmacy found in the elderly.

Although glucose appears to have the strongest effect on lowering BP in PPH, fat has shown comparable effects but with a delayed response. A fall in systolic BP was found in a study to be slower after a meal containing fats and protein than it was after a meal that did not. This was theorized to be a function of the time taken to digest these nutrients to free fatty acids and amino acids, respectively.15

Table 3: Management of PPH.1,9,10,13,17,20–23

<table>
<thead>
<tr>
<th>As the healthcare practitioner, you can:</th>
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<tbody>
<tr>
<td>1. Include evaluation for PPH as a part of the care plan for geriatric patients.</td>
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<tr>
<td>2. Inform patients at risk about symptoms associated with meal-induced hypotension.</td>
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<tr>
<td>3. Adjust size and composition of patient meals.</td>
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<td>4. Consider pharmacological agents as needed.</td>
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<th>You can encourage patients to:</th>
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<tr>
<td>5. Eat frequent, small meals instead of few, large meals.</td>
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<tr>
<td>6. Eat a low-carbohydrate diet with fewer readily digestible carbohydrates, such as starches, and encourage a high fiber diet.</td>
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<tr>
<td>7. Walk after meals/sit or lie down after walking to avoid falls.</td>
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<tr>
<td>8. Avoid alcoholic beverages before and after meals.</td>
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<tr>
<td>9. Avoid prolonged standing or bathing after eating.</td>
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<tr>
<td>10. Maintain an appropriate intravascular volume:</td>
</tr>
<tr>
<td>• Ensure adequate fluid intake, including just before or during a meal.</td>
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<tr>
<td>• Encourage 12 to 18 ounces of water 15 minutes prior to meals.</td>
</tr>
<tr>
<td>• Ensure adequate salt intake when possible.</td>
</tr>
<tr>
<td>• Replacement of glucose or sucrose with fructose may be beneficial.</td>
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</table>

When added to a meal, guar gum, which is a naturally occurring, gel-forming carbohydrate of vegetable origin, slows gastric emptying and reduces PPH.16 Gastrointestinal (GI) peptides, such as calcitonin gene-related peptide, have been found to increase in the blood of patients with PPH, suggesting they may also play a significant role in the disorder. Stimulated by the release of glucose, calcitonin gene-related peptide is a strong vasodilatory hormone.8,17

Despite advances, clinicians and researchers do not fully understand PPH’s complex pathophysiology. It is clear, however, that factors affecting PPH include normal changes associated with aging; certain disease processes, such as cardiovascular and neurological; meal choices; and others, such as GI peptides.5,6,18

Populations at Risk

All older adults are at risk for PPH because many changes occur in the cardio regulatory system as a normal part of aging (see Table 2).11,12 When coupled with the normal stressors of meal digestion, these changes can sometimes lead to a mild form of PPH. The most severe drop in systolic BP after a meal occurs in older adults with Parkinson’s disease, paraplegia, diabetes mellitus, peripheral neuropathy, cardiovascular disease, and renal failure treated with hemodialysis. Insulin is known to cause vasodilation by stimulating sympathetic nervous system activity, which creates the speculation that insulin influences PPH as well.11,19

Age-related illnesses, multiple-drug use, significant variability in systolic BP during the day, and treatment with diuretics all can increase the risk index for PPH.6,11 Table 3 lists the strategies for managing PPH.

PPH appears with increased frequency in older adults with Parkinson’s disease. In addition, PPH manifests itself more severely in elderly people with hypertension compared with those with normal BP. Those with hypertension already have impaired BP homeostasis and regulation of blood flow to the brain and cannot adjust fast enough to small changes in BP. Moreover, the hypotensive effect of many cardiovascular medications—

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creases the likelihood of PPH. Patients who undergo dialysis may experience hypotension primarily because of the fluid removal, and a meal during dialysis may aggravate the hypotension.\textsuperscript{1,6,11}

**Assess and Intervene**

Healthcare practitioners play an important role in assessing patients for PPH. They must consider PPH as a possible cause of symptoms of dizziness, a history of falls or syncope, or other cerebral cardiac ischemic symptoms that occur within two hours of a meal. Recommending BP monitoring is effective, especially before and after the morning or noon meal, which are the times most commonly associated with PPH.\textsuperscript{1,3,24} Because older adults’ BP varies significantly during the day, ambulatory BP monitoring can detect any sudden changes. Commercial monitors can be programmed to take BP readings every 15 minutes during the day and every 30 minutes at night for 24 hours. Those with a pattern of falls or syncope are excellent candidates for ambulatory BP testing, since studies have shown that 25% of elderly patients with syncopal symptoms have PPH.\textsuperscript{10,25}

When healthcare practitioners review the patient’s medication history, they must keep in mind that drugs such as furosemide, nitrates, and antihypertensive medications pose a risk for those already identified with PPH.\textsuperscript{2,10} In addition, assessing for signs of dehydration is critical, since it can precipitate PPH.

Those who experience a minimal and asymptomatic reduction in postprandial BP do not require treatment. However, a systolic BP decrease of 20 mm Hg or more is serious, and requires interventions to reduce the risk of postprandial dizziness, syncope, falls, and other problems. Table 4 lists some of the specific interventions for managing PPH.

Lowering the carbohydrate content of meals and offering frequent, small meals over the course of the day instead of three large ones is an effective, inexpensive measure to prevent PPH. Adequate fluid intake and lower doses of diuretics are other simple interventions.\textsuperscript{1} With advancing age, the conservation of renal salt and water decreases, and older adults often restrict their salt intake, setting the stage for hypovolemia. All these factors might precipitate PPH. In this population, it may be necessary to encourage the use of some salt. Resistance to this suggestion is likely, as many have been told repeatedly to lower salt intake. Healthcare practitioners can also advise elders predisposed to PPH to avoid alcohol before and after meals to prevent or minimize vasodilation.\textsuperscript{11,20} Drugs that can exacerbate PPH, such as nitrates and diuretics, should also be prescribed in the lowest dose and frequency possible.\textsuperscript{1,20}

Recent evidence has reported that drinking water before or with meals can help reduce PPH, although confirmation will require further testing. Possible mechanisms include minimizing the shift of blood from systemic to splanchnic circulation.\textsuperscript{21} It is also postulated that the intake of water can increase gastric distention, which was found to minimize the effects of PPH in the elderly. One study measured the hypotensive effects of glucose after the consumption of a drink containing a controlled glucose load at different fluid volumes (consumption of a 600-mL drink with 75 g of glucose compared with a 200-mL drink containing 25 g of glucose). The increased volume of the 600-mL drink increased systolic BP, diminishing the effect of

### Table 4: Nonpharmacological and pharmacological management of postprandial hypotension\textsuperscript{20,22,26,27}

<table>
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<tr>
<th>Drug</th>
<th>Dose</th>
<th>Adverse Effects</th>
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<tr>
<td>Caffeine</td>
<td>250 mg/d (2 cups/d) 30 minutes before/during meals.</td>
<td>Diarrhea, tremor, tachycardia, GI distress, restlessness.</td>
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<tr>
<td>Octreotide (Sandostatin)</td>
<td>Dose to be adjusted by primary care provider.</td>
<td>Diarrhea, nausea, alopecia.</td>
</tr>
<tr>
<td>Low doses of nonsteroidal anti-inflammatory drugs (NSAIDs) before a meal</td>
<td>Dose to be adjusted by primary care provider.</td>
<td>Common side effects: Nausea, vomiting, stomach pain, heartburn, constipation, diarrhea, dizziness, headache, drowsiness. Serious side effects: Kidney failure, liver failure, stomach ulcers, prolonged bleeding after an injury or surgery. May also cause fluid retention, leading to edema.</td>
</tr>
<tr>
<td>Acarbose (Precose)</td>
<td>Dose to be adjusted by primary care provider.</td>
<td>Abdominal pain, diarrhea, flatulence.</td>
</tr>
<tr>
<td>Voglibose</td>
<td>Dose to be adjusted by primary care provider.</td>
<td>Abdominal pain, diarrhea, flatulence.</td>
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### Note

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PPH. Increasing fluids with meals can be tricky in an older population. The fluid will extend the stomach and create a feeling of fullness. The end result can be a decrease in food intake that may contribute to a poorer nutritional status.

For up to two hours after meals, older adults should avoid excessive exercise. At the same time, walking after a meal can be beneficial because it increases BP and heart rate. It is recommended that older adult patients sit or lie down as soon as they finish walking, since the rise in BP from activity may drop when they stop. Likewise, prolonged standing or bathing after a meal can cause vasodilation from warm water and increase the drop in BP. Patient and family education is key in preventing PPH and the falls and syncope that may follow.

When simple remedies don’t provide relief, or if symptoms are severe, carefully adjusted drug doses to normalize BP might improve PPH. However, any antihypertensive medications must be administered between meals, rather than just before meals, to prevent an additional hypotensive effect. Pharmacists and practitioner alerting systems can be helpful in flagging concomitant and possibly unnecessary multiple antihypertensives.

Many conflicting studies on caffeine’s role in the prevention of PPH symptoms and related cardiovascular disease mortality have been published. One recent study indicates that while caffeinated beverages reduce the risk of heart disease mortality, the effect cannot be clearly related to reduction of PPH. However, many authors recommend that caffeine should be taken in the morning with food or before meals to prevent symptoms of PPH. In fact, caffeine therapy with 250 mg (two cups of coffee) in the morning has been suggested to prevent post-prandial BP from dropping below its baseline value. To avoid insomnia in older people, caffeine should be taken only in the morning.

Octreotide (Sandostatin), a drug used to treat symptomatic PPH, is expensive and requires frequent subcutaneous injections before meals. It may cause diarrhea, nausea, gastric bloating, flatulence and even alopecia (see Table 4). In addition, because of the drug’s low pH, injections can be painful. Only the most severely affected are candidates for Octreotide; its long-term safety and efficacy are unknown. Octreotide is thought to prevent the increase of splanchnic blood flow to the intestine with delayed gastric emptying. Other options include low doses of NSAIDs taken before a meal, which may be helpful because they cause salt to be retained and thereby increase blood volume.

The role of Voglibose and Acarbose (Precose) in reduction of PPH has been examined. These medications given to patients with severe autonomic failure reduce severity of PPH, according to recent studies. They are oral alpha-glucosidase inhibitors, which slow gastric emptying; this decreases the demand on digestive circulation and thereby maintains a steady post-prandial BP. They have a few adverse effects, such as abdominal pain and bloating, diarrhea, and flatulence (see Table 4).20

Step In Early
Healthcare practitioners are in an excellent position to teach older adults and their families and caregivers about PPH. Because aging and certain diseases, particularly cardiovascular and neurological problems, put older

Healthy Aging
Dietetic Practice Group

Our Mission
Leading the future of dietetics in healthy aging.

Our Vision
Healthy Aging DPG members are the most valued source of food, nutrition and wellness information and services for older adults.

Congratulations to Shirley Y. Chao, PhD, RD, LDN

HA DPG member and past-chair Shirley Chao has been recognized by Today’s Dietitian as one of ten exemplary dietitians who have done exceptional work in the dietetics field. In her 20 years as the director of nutrition for the Massachusetts Executive Office of Elder Affairs, Shirley has helped set policies that have bettered the lives of approximately 75,000 independent-living older adults annually. Congratulations!
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adults at risk for a drop in systolic BP after a meal, astute assessment and early recognition can have far-reaching consequences. Early detection can help decrease or eliminate syncope and falls in many elderly people, and in some cases prevent stroke, falls, myocardial infarction, and even death.

—Wiera Malozemoff, RN, MS, CS; Tracey B. Long, RN, BSN, MS, CDE; Colleen Manning Osten, RD, LD.

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Editor’s note: Decreased blood sodium concentration, which is a normal age-related change, can lead to secondary medical concerns, such as hypotension. Dietetics practitioners should proceed cautiously when determining sodium-intake recommendations for individual clients.

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Tracey B. Long, RN, BSN, MS, CDE, is on the faculty at the College of Southern Nevada School of Nursing.
Colleen Manning Osten, RD, LD, is a freelance writer with many years of clinical nutrition and foodservice experience in a variety of settings.

References
Click here to see the references for this article.

CPE CREDIT
This article has been approved for 1 hour of CPE credit upon successful completion of a quiz. At the conclusion of each month, the quizzes are reviewed and those successfully scoring 80% will receive their CPE certificate via email.
This free CPE credit is available for all Healthy Aging DPG members until May 28, 2017.
Click here to take the quiz.

To see this article’s clinical vignette about postprandial hypertension, go to page 7.

May 28 Is National Senior Health & Fitness Day®

For more than 10,000 older Americans, May 28 will be a day of change and positive, health-related affirmations. During this year’s National Senior Health & Fitness Day, older Americans around the country will participate in health and fitness events tied to the theme, Make a move towards better health! Sponsored activities will be held at over 1,000 locations—banks, malls, parks, and other venues—making this event one of the largest in the country.

Interested in sponsoring an event in your area? The event website offers you videos of past events, press releases, and access to the event’s monthly e-newsletter.

If you plan to sponsor an event, please let us know how it went, so we can share your experience with our members.
Conchetta always loved to eat, and the food at her nursing home was good, with abundant fresh fruit, vegetables, and fish; and tender, well-seasoned meat. Mealtime was her favorite part of the day, and she usually completed her meals, although she rarely finished her beverages. Over the past week, she told her friends she’d been feeling kind of weak after she ate. A few times, she had slumped over in her wheelchair and became unresponsive for a short while. Still, she recovered quickly and then felt fine.

As a 77-year-old woman with a host of health problems, Conchetta blamed old age for her symptoms. She was quick to count off her troubles on her fingers whenever anyone asked, citing Parkinson’s disease, hypertension, angina pectoris, and osteoporosis. She knew all the names of her medications, which included levodopa-carbidopa (Sinemet), hydrochlorothiazide (HCTZ), aspirin, Diltiazem, calcium, and vitamin D.

1. What factors in this case study would lead to a consideration of PPH as a possible diagnosis for Conchetta’s recent experiences after meals?
A. She is being treated for hypertension, is older than 65, and consumes too much salt on her meat.
B. She is being treated for hypertension, is older than 65, and appears weak immediately following meals.
C. She is older than 65, appears weak immediately following meals, and consumes too much salt on her meat.
D. She is being treated for hypertension, appears weak immediately following meals, and consumes too much salt on her meat.

Answer: B. All older adults are at some risk for PPH because many age-related changes occur in the cardioregulatory system. Those with hypertension already have impaired BP homeostasis and regulation of blood flow to the brain and cannot adjust fast enough to small changes in BP. The most common symptoms are sleepiness, extreme tiredness, nausea, yawning, headache, speech disturbances, and syncope.

2. What would you recommend for Conchetta’s hydration needs?
A. 20 ounces of water with her meal.
B. 12 to 18 ounces of water 15 minutes after her meal.
C. 12 to 18 ounces of water 15 minutes before her meal.
D. 20 ounces of water throughout the day.

Answer: C. Ensure adequate fluid intake just before or during a meal. Adequate fluid intake would be 12 to 18 ounces of water 15 minutes prior to meals.

3. The composition of Conchetta’s meals may attenuate PPH. What type of diet would be appropriate?
A. Low fat, low sodium.
B. Small, frequent meals, with no added sugar.
C. High protein, high calorie.
D. Regular/general, with a caffeine restriction.

Answer: B. Glucose appears to have the strongest effect on lowering BP in PPH. Lowering the carbohydrate content of meals and offering frequent, small meals over the course of the day instead of three large ones is an effective, inexpensive measure to prevent PPH.

4. Which of the following should be included in Conchetta’s nutrition care plan?
A. Take a shower after meals to relax.
B. Monitor BP before and after meals.
C. Include high-calorie snacks at least once a day.
D. Dysphagia evaluation.

Answer: B. BP monitoring is effective in diagnosing PPH, especially monitoring before and after the morning or noon meal—the meals most commonly associated with PPH.
Chair’s Message
Mary Herrstrom, RDN, LDN

It’s hard to believe that my year as chair is coming to a close. In case you are wondering what the Executive Committee (EC) has been up to all year, here is a recap:

• Development of the Certified Gerontological Specialist (CSG) Help Desk,
• Website reconfiguration and enhancement of navigation and member content,
• Six great webinars (with free CPEUs),
• Expanded media presence with Twitter and LinkedIn,
• Professional-development grants,
• New-member orientation,
• FNCE activities: a member breakfast, networking events, and a Spotlight session, and
• A member demographic survey sent last December to our membership.

As I mentioned in the last newsletter, the EC is actively exploring our DPG’s identity: What does it mean to be the DPG focused on healthy aging? The member response rate to the demographic survey was outstanding and has greatly helped us with our endeavor. The EC uses this data to visualize our membership’s characteristics and amend our mission, vision, and strategic plan to reflect the needs of our current members and align with the goals of the Academy. As it turns out, the majority of members are comfortable with our current name. However, in order to attract new members and sponsorship, we must continue to promote the abilities of our members and the benefits offered by the Healthy Aging DPG. This work will continue into the 2014–2015 year.

Before I pass the gavel into the competent hands of Maria Mahar, MA, RD, CDN, I want to thank the EC members for all their hard work and amazing ideas over the past year. Being a part of this group has truly been a privilege, and I have a renewed sense of admiration for each member of the EC. I also want to extend my thanks to the many volunteers who work with the EC directors. Their willingness to contribute time, energy, and creativity to our many projects is what makes the Healthy Aging DPG a vibrant group.

Two of our veteran newsletter volunteers are “retiring” this year: Les Rosenzweig, MS, RD, CDN; and Michelle Hunter, RD. Les and Michelle, I want to give you a special thank-you for your many years of service and dedication to our newsletter. And to all of our members, thank you for having me. It’s been a wonderful year.

Call for Information: Conferences and Events

The Healthy Aging DPG calendar contains events of interest to RDNs, RDs, and DTRs who work with older adults. If you would like to suggest a conference or event for our calendar, please email Robin Dahm with your information. The event must focus on the nutritional and physical health of older adults.

MARK YOUR CALENDAR:
UPCOMING CONFERENCES & EVENTS

Click here for a list of upcoming conferences, workshops, webinars, and other events related to healthy aging.
On Your Colleagues

Spotlighting: Alyssa Koomas, MS, MPH, RD

Editor’s note: Alyssa Koomas, MS, MPH, RD, was the first recipient of the Healthy Aging DPG Community Based Applied Research/Best Practice Award. In our previous newsletter, The Spectrum published the resulting research article based on the work funded with this award: “Use of an Automatic Telephone Message System (ATMS) to Deliver Nutrition Education to Home-Delivered Meal Participants in the Elderly Nutrition Program.” Note that two HA DPG members and officeholders also participated in this research and co-authored the resulting article: Amy Sheeley, PhD, RD, LDN, HA DPG Director of Web/Social Media; and Shirley Chao, PhD, RD, LDN, HA DPG Past Chair.

Many RDs and RDs follow
a straightforward nutrition/dietetics pathway to registration and practice. Others, such as Alyssa, take a less traditional route. We asked Alyssa about her unique path to becoming an RD, how her interests, education, and work experiences in other fields ultimately steered her in the direction of nutrition.

DW: How did you first become interested in the field of nutrition?

AK: My path to nutrition started with a passion for environmental issues at a very young age. At 13, I chose a diet that minimized my impact on the ecosystem and started an environmental club in high school.

DW: You studied abroad and then earned a BS in Environmental Science from the University of California, Berkeley. These experiences intertwined—tell us about them.

AK: My undergraduate courses provided me with a breadth and depth of knowledge in conservation and international development, piquing my interest in complex global issues and their downstream effects. I wanted to understand the root causes of environmental degradation, malnutrition, and major public-health issues. My education, coupled with my experience studying abroad in Chile and a six-month trip to India after graduation, expanded my myopic focus on environmentalism, to see the interconnectedness of environmental degradation on a global scale, farming practices and human rights, nutrition and public health.

DW: So you broadened your thinking to incorporate the nutrition arena?

AK: It became apparent to me that the small fraction of people who concern themselves with environmental issues could be greatly increased if these issues were intertwined with something that felt more relevant, issues that resonated with their daily lives. Thus I found my way to nutrition, as everyone eats and our food choices directly impact the environment and our health.

DW: Tell me about your studies in nutrition. I understand that you earned two master’s degrees before you completed your dietetic internship.

AK: In 2011, I completed dual master’s degrees in Nutrition and Public Health at Tufts University (a Master of Public Health, [MPH] in Nutrition from the School of Medicine and a MS in Food Policy & Applied Nutrition from the Friedman School of Nutrition Science & Policy). I then completed my dietetic internship at Simmons College.

My education presented a pathway to a healthier and more sustainable country, and armed me with the tools and skillset to play an active role in bringing them to fruition. Promotion of sustainable agriculture supports the land, farmers, and communities eating the food. It’s a win for environmentalism, a win for the local economy, and a win for nutrition and public health. I found myself especially interested in supporting policy changes at the local, regional, and national levels that facilitate these practices, and evidence-based interventions that prompt behavior changes to drive demand for healthy options.

DW: As part of your dietetic internship, you served a rotation at the Massachusetts Executive Office of Elder Affairs (MA EOA) in Boston. What did you do there?

AK: During my rotation at MA EOA, I had the good fortune to work with Shirley Chao, PhD, RD, LDN; and Amy Sheeley, PhD, RD, LDN; both of whom continued on page 10
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are passionate experts in their field of elder affairs. They seem to have endless energy for promoting health to older adults. This rotation was my first experience focusing on older adults, and I learned that the people who work in this field are extremely dedicated, caring, and light-hearted.

While at MA EOEAA, I designed and conducted a survey about best practices in nutrition education delivery to homebound seniors. The responders were a national sample of state nutritionists working with Older Americans Act clientele. I loved the wealth of ideas that were shared when we asked, “What do you think would be a more effective way to reach older adults with nutrition education?” It was amazing to read the responses and see how different experts on opposite sides of the country had come up with similar ideas. These data prompted us to pilot a project that tested the efficacy of a phone-based nutrition education program for homebound older adults, with the goal of evaluating and sharing this approach. (Editor’s note: The Spectrum published an article about this project in our winter 2014 newsletter: “Use of an Automatic Telephone Message System (ATMS) to Deliver Nutrition Education to Home-Delivered Meal Participants in the Elderly Nutrition Program.”)

Without funding from the Healthy Aging DPG, this community-based study to investigate a potential best practice could not have happened. The project broadened my understanding of nutrition across the lifespan, and it honed my skills in research methods, survey development, and evaluation. As a team, the state nutritionists and I investigated current service provisions and identified potential gaps that needed further research. Yet similar to several of my own past experiences, I found that many state nutritionists work in “silos” that limit interaction across disciplines and restrict practice. It is important that they be able to collaborate in a multidisciplinary, interdisciplinary milieu to enhance best practices. It is equally important that they share the results with their RDN and DTR colleagues so they too can adapt the findings to their own situations and contribute to enhanced service provisions.

Most importantly, my experience at MAEOEA solidified my passion for conducting and evaluating community-based interventions, with the end goal of promoting evidence-based policy decisions to support the health of Americans of all ages.

DW: What is your current project?
AK: After completing my studies, I was fortunate to take on the role of Regional Project Manager for Healthy Kids Out of School, an initiative of ChildObesity180. The goal of this Tufts University organization is to reverse the trend of childhood obesity in one generation’s time. I work with 11 out-of-school-time (OST) organizations (such as 4-H, youth soccer, Boy Scouts, and Pop Warner) to promote healthy habits during their meeting times with children and evaluate the effectiveness of our work. The OST program leaders serve as role models to tens of millions of children across the country, and have the opportunity to set children on a healthy path for life. By exposing children to healthy foods and physical activity at a young age, we’re planting the seeds for a healthy nation that places value on good food grown in good soil. I hope that future generations of dietetics practitioners working with older adults will see the long-term benefits of our work as these children carry healthy habits into adulthood and beyond.

SP: What do you like to do in your spare time?
AK: I love riding my bicycle, whether it’s to and from work (even during these winter months in Boston) or on a longer tour. My favorite trips have been by bicycle and have taken me down the west coast of the U.S., around the Gaspe Peninsula in Quebec, and across Cuba. An added perk of traveling by bicycle is constantly working up an appetite to try new foods. Like many dietitians, I love cooking and growing food—really, I’m a fan of anything food-related. I also enjoy sewing, quilting, hiking, being outside, riding trains, and people-watching. People are just fascinating to watch.

—Dian Weddle, PhD, RDN, FADA; HA DPG Membership Director and Awards Chair.

Need Awards Money to Fund Your Research?

The Healthy Aging DPG Community Based Applied Research/Best Practice Award encourages applied research projects that improve the nutritional status, well-being, and independence of community-residing older adults. Ideally, the $4,000 award will be used to solve and identify problems pertaining to dietetic practice, program administration, service/care coordination, and/or behavioral practices of older adults. The award is administered by the Academy of Nutrition and Dietetics Foundation.
The Effects of Lutein and Zeaxanthin Supplementation On Age-Related Macular Degeneration

ABSTRACT

Purpose: To determine the impact of supplemental lutein and zeaxanthin on macular pigment optical density (MPOD) and on the progression of age-related macular degeneration (AMD).

Methods: A systematic literature search from 2011 to 2013 was conducted utilizing electronic databases MEDLINE, Cochrane Library, UpToDate, Trip, and PubMed. The key words used were lutein, macular degeneration, retinal pigments, densitometry, dietary supplements, xanthophylls, zeaxanthin, and carotenoids. Each study was critically appraised following the steps outlined in the Academy of Nutrition and Dietetics Evidence Analysis Manual, and a grade was assigned indicating the overall strength of the evidence supporting the conclusion statements.

Results: The literature search generated eight randomized control trials, and one prospective, nonrandomized supplement study. Significant increases in MPOD were seen after 6 months of supplementation, with the greatest increases observed in those supplemented with 20 mg of lutein per day. Subjects with lower MPOD levels at baseline had greater increases after supplementation. Subjects supplemented with both lutein and zeaxanthin fared worse in raising MPOD levels when compared to those supplemented solely with lutein. Studies showed a trend toward improvement in visual function after supplementation; and positive correlations were noted between increased MPOD and visual performance in AMD subjects. Changes in MPOD predicted the amount of improvement in visual-function variables.

Conclusion: This review indicated strong evidence (Grade I) that MPOD levels were positively responsive to supplementation with oral lutein and zeaxanthin for a period of 6 months or longer, and fair evidence (Grade II) that significant increases in MPOD may provide benefits in visual function and protect against the progression of AMD.

INTRODUCTION

Age-related macular degeneration (AMD) is an ocular disorder associated with aging. AMD gradually destroys sharp, central vision and is a leading cause of vision impairment and blindness in older adults.1 AMD is a disease that affects the retina of the eye, particularly the macula and its central fovea.

The retina and fovea are highly metabolically active and contain large portions of polyunsaturated fatty acids, making them susceptible to oxidative stress.2 They are highly exposed to energetic visible light, which activates oxygen within the retina and peroxidizes the lipids. Over time, the ability of the retinal pigment epithelium (RPE) to digest this cellular material is decreased, causing the oxidized lipids to accumulate underneath the RPE and cause irreversible damage to various cell structures. This cumulative oxidative damage is believed to be in part responsible for the pathogenesis of AMD.2,3

Nonexudative (dry) macular degeneration occurs slowly. The large accumulation of the oxidized lipids causes drusen (yellow deposits) to break down the photoreceptors of the macula, compromising sensory perception.1 Wet (exudative) macular degeneration occurs with the formation of new blood vessels growing under the macula. These weak blood vessels begin to leak, elevating the macula from its normal position in the back of the eye. This results in scarring of the retina and acute vision loss. Primary symptoms of AMD are blurring of central vision, metamorphopsia, and reduced vision. Risk factors for AMD include age, smoking, hypertension, and a positive family history. Currently there are no known treatments for the advanced stages of AMD.1,2,4

Lutein and its stereoisomer zeaxanthin belong to the xanthophyll carotenoid class, which is a group of plant pigments found in dark-green leafy vegetables, corn, fruit, and egg yolks.5 Lutein and zeaxanthin are widely distributed in a number of human tissues but are the only carotenoids concentrated within the retinal and lenticular tissue. They are found at high levels within the fovea and macula of the eye, and are termed macular pigment (MP).2,5

Lutein and zeaxanthin are thought to play a role in protecting against ocular disorders through passive short-wave light filtration and antioxidant activity.2 Short-wave light, or blue wavelengths, cause the most damage to the retina by oxidative stress and free-radical damage. Lutein and zeaxanthin act as filters through which these wavelengths must pass before reaching the tissue, thus allowing the MP to absorb and attenuate short-wave light and protect the retina. The conjugated double bonds of these two isomers allow them to function as antioxidants, helping to quench singlet oxygen, scavenge reactive free radicals, and inhibit lipid peroxidation.2,3

Without a cure for AMD, research is directing efforts toward prevention
by slowing down the effects of aging that cause the actual ocular disorder. Increasing macular pigment and decreasing the reactions of reactive oxygen segments can be an initial step in slowing the progression of AMD.2,5

**REVIEW OF LITERATURE**

Intervention studies such as The Veterans Lutein Antioxidant Supplementation Trial (LAST)6 and the Age-Related Eye Disease Study (AREDS)7 have suggested that supplemental or dietary intake of carotenoids and other antioxidants can improve visual function and decrease the risk of AMD. A more-recent systematic review and meta-analysis of six cohort studies conducted by La Ma and colleagues3 found that dietary intake of lutein and zeaxanthin may help protect against late AMD, but is not associated with a reduced risk of developing early AMD. Other studies outside of La Ma’s review3 have found positive associations between carotenoids and a reduced risk of AMD. An observational case-control series by Obana et al.8 compared macular carotenoid levels of normal Japanese subjects to Japanese patients with age-related maculopathy (ARM). The levels of macular carotenoids became significantly lower with increasing age as well as with the progression of ARM. MP levels were also found to be higher among those with better visual acuity, indicating that lower levels of macular pigments may be a risk for ARM.8 Another strong association was seen within the Muenster Aging and Retina Study (MARS)9 between serum levels of lutein and macular pigment optical density (MPOD). During this 2.6-year follow-up longitudinal study of 369 participants, those who had used lutein or zeaxanthin supplementation had a significantly higher MPOD (p<0.0001).

Current research provides strong evidence that lutein and its isomer zeaxanthin may help protect against age-related ocular disorders. However, questions still arise about which specific stage of AMD is most benefited by carotenoids, and about the amount of supplementation needed to see a change in MP levels.

**METHODS**

A systematic literature search was conducted for studies addressing the impact of supplemental lutein and zeaxanthin on macular pigment optical density and on the progression of age-related macular degeneration. The electronic databases Cochrane Library, UpToDate, Trip, and PubMed were searched for publications from June 2011 through 2013 using the following key words: lutein, macular degeneration, retinal pigments, density, dietary supplements, xanthophylls, zeaxanthin, and carotenoids. A search utilizing MEDLINE was also done through a library inquiry performed by Mary Ann Huslig, MLS, at the UT Southwestern Library. Inclusion criteria were: adults ages 18 years and older, a population size of ≥20 participants, randomized clinical controlled trials, large observational studies, and cohort case-control studies. Exclusion criteria were: subjects <18 years old, interventions other than lutein and zeaxanthin supplementation, and studies with a dropout rate ≥20%.

Following the steps outlined in the Academy of Nutrition and Dietetics Evidence Analysis Manual,10 each study was critically appraised. An expert panel assigned a grade indicating the overall strength of the evidence supporting the conclusion statements. The Academy’s criteria consider quality, consistency, quantity, clinical impact, and generalizability when assigning the grades: Grade I (good/strong) to Grade III (limited/weak) to Grade V (Grade Not Assignable due to no evidence). Appendix 1 outlines the details of each study.

**RESULTS**

Of the 34 studies generated by the literature search, nine were included for evidence analysis. The remaining 25 studies were excluded because they either did not have an intervention of lutein and zeaxanthin supplementation, or because MPOD and visual function were not primary outcomes. Three11–12 of the nine included studies covered the same trial while reporting on different outcomes.

Table 1 outlines the characteristics of each study. Of the nine studies, seven were double-blinded randomized control trials (RCT),11–17 one was a prospective non-randomized supplement study,18 and one was a single-masked RCT.19 Three trials14,15,19 were conducted in Ireland, one in the USA,16 one in China,11–13 one in London,18 and one in Austria.17 The number of subjects in each study ranged from 36 to 322; most of the studies contained both men and women, with only one18 consisting entirely of women.

Four trials14,15,18,19 consisted of healthy subjects without ocular disorders, four contained populations with early AMD,11–13,17 and one included subjects that had mild to moderate AMD.16 Most of the studies had a follow-up rate of at least 80%, with only one having a follow-up rate of 79%.17 The primary outcomes of interest included MPOD, visual function, and serum responses to lutein and zeaxanthin supplementation. One study15 also investigated the effects of supplementation on inflammation; another assessed the safety of supplementation.14

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Macular Degeneration
continued from page 12

Table 1: Characteristics of lutein and zeaxanthin supplementation studies.

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Subjects</th>
<th>Duration (Weeks)</th>
<th>Dependent Variables</th>
<th>Study Quality*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connolly et al. (2011)14</td>
<td>44 healthy men and women aged 18–61 years in Ireland</td>
<td>24</td>
<td>MPOD, serum carotenoids, clinical pathology analysis†</td>
<td>Class: A + (Positive)</td>
</tr>
<tr>
<td>Graydon et al. (2011)15</td>
<td>132 healthy men and women aged 21–72 years in Ireland</td>
<td>8</td>
<td>MPL, ICAM-1, VCAM-1, F2-isoprostanes; serum levels of lutein, zeaxanthin, vitamins A and E</td>
<td>Class: A + (Neutral)</td>
</tr>
<tr>
<td>Richer et al. (2011)16</td>
<td>60 men and women with AMD aged 74.9 ±10 years in the USA</td>
<td>52</td>
<td>MPOD, subjective visual function, cataract lens opacification, skin carotenoid levels, presence of lipofuscin, macular visual function</td>
<td>Class: A + (Positive)</td>
</tr>
<tr>
<td>Weigert et al. (2011)17</td>
<td>126 men and women with AMD aged 50–90 years in Austria</td>
<td>24</td>
<td>MPOD, MDLT, visual acuity, IOP, BP, pulse rate</td>
<td>Class: A + (Positive)</td>
</tr>
<tr>
<td>Hammond et al. (2012)18</td>
<td>322 healthy twin females aged 16–50 years in London</td>
<td>24</td>
<td>MPOD, serum carotenoids</td>
<td>Class: B + (Neutral)</td>
</tr>
<tr>
<td>Huang et al. (2012)11</td>
<td>108 men and women with AMD aged 50–81 years in China</td>
<td>48</td>
<td>MPOD, serum carotenoids</td>
<td>Class: A + (Positive)</td>
</tr>
<tr>
<td>Ma, Yan et al. (2012)13</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
</tr>
<tr>
<td>Ma, Dou et al. (2012)12</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Retinal function</td>
<td>Same as above</td>
</tr>
<tr>
<td>Loughman et al. (2012)19</td>
<td>36 healthy men and women aged 21–70 years in Ireland</td>
<td>24</td>
<td>MPOD, BCVA, contrast sensitivity, photorecovery, ocular straylight, serum carotenoid levels</td>
<td>Class: A + (Positive)</td>
</tr>
</tbody>
</table>

Notes: MPOD = macular pigment optical density. MPL = macular pigment level. ICAM-1 = inter-cellular adhesion molecule 1. VCAM-1 = vascular cell adhesion molecule 1. CRP = C-reactive protein. MDLT = mean differential light threshold. IOP = intraocular pressure. BP = blood pressure. BCVA = best-corrected visual acuity.

* Study quality based on Academy of Nutrition and Dietetics EAL guidelines.
† Clinical-pathology analysis includes lab values assessing renal and liver function, lipid and hematologic profiles, and markers of inflammation.

One examined the heritability of carotenoid absorption.18

MPOD Response to Lutein and Zeaxanthin Supplementation

Eight studies11,12,14–19 reported on MPOD response to lutein and zeaxanthin supplementation; Table 2 outlines the results per intervention group.

Half the studies contained intervention groups supplemented solely with lutein.11,12,16,17 Significant increases in MPOD were seen with as little as 9 to 10 mg/day of lutein; however, the greatest increases were observed in those supplemented with 20 mg/day.11,12,17 Weigert et al.17 demonstrated an increase in MPOD by 27.9% ± 2.9% (p<0.001) versus placebo through supplementation with 20 mg of lutein per day for the first three months, and 10 mg of lutein per day for the last three months. The Richer et al.16 study was the only one to supplement exclusively with zeaxanthin; MPOD increased significantly with 8 mg per day (p=0.03). Five studies11,12,15,16,18 included intervention groups supplemented with both of the carotenoids. However, only two of these five saw significant increases in MP. Hammond et al.18 showed a small rise of 1.25% in total MP volume when supplementing with 18 mg/day of lutein and 2.4 mg/day of zeaxanthin; and Huang and colleagues11 saw an increase of 0.058 DU (18.5%) with 10 mg/day of each carotenoid. Lastly, two studies14,19 reported on intervention groups that used supplements containing lutein, zeaxanthin, and meso-zeaxanthin. MPOD increased at 0.25° and 0.5° retinal eccentricity (p=0.001 and 0.01, respectively) with supplementation of 5.9 mg/day lutein, 1.2 mg/day zeaxanthin, and 10.6 mg/day of meso-zeaxanthin.14 An increase at all eccentricities (p<0.05) except at the peripheral 3° location was observed by Loughman et al.19 with 10 mg lutein, 2 mg zeaxanthin, and 10 mg meso-zeaxanthin per day.

The duration of supplementation ranged from 8 to 52 weeks, with most studies showing significant results after 24 weeks. Graydon’s pilot study15 lasted only eight weeks and was unable to observe any changes in MPOD response. The longer-duration studies11,12,16 did not appear to improve results beyond the results of those who were supplemented for only six months.

Four studies11,12,14,17 noted that subjects with lower MPOD levels at baseline had greater increases after supplementation. In the Weigert study,17 baseline MPOD was correlated with percentage change after six months of supplementation (r=−0.46, p<0.001), revealing that a lower MPOD at baseline will have a greater increase after six months. Ma, Yan et al.12 also observed that changes in MPOD after 48 weeks of supplementation were negatively correlated with baseline MPOD in all active treatment groups (r=−0.56, p<0.001). Two studies11,14 suggested that the results of subjects without noticeable increases in MPOD despite significant increases in serum levels may be attributed to a high baseline MPOD.

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suggesting that their MP had already reached saturation. One study\textsuperscript{18} reported no significant difference in MPOD response to supplementation between the highest and lowest quartiles of baseline MPOD (p=0.629 for quartile 4 versus 1).

Six of the eight studies had an average population of 55% female and 45% male. One study\textsuperscript{16} with a population of 95% male did not appear to affect MPOD results; however, Hammond et al.'s\textsuperscript{18} 100% female population had only small increases of MPOD (mean MPOD rise of 5.7%, p=0.02) that were of questionable significance despite increases in serum concentrations of 233% lutein and 633% zeaxanthin. The authors theorized that the poor response may be in part due to the all-female population, since previous studies\textsuperscript{20–22} found lower responses in women when compared to men. Health status did not appear to affect MPOD response to supplementation. All four studies\textsuperscript{11,12,16,17} that consisted of subjects with early AMD were able to significantly improve MPOD levels, indicating that those with early AMD are equally responsive to supplementation when compared to healthy subjects. After the review and analyses of studies, strong evidence (Grade I) supported the conclusion that supplementation with 6-20 mg/day of lutein and/or 2-10 mg/day of zeaxanthin for six months or longer increases macular pigment optical density in healthy subjects and in those with early age-related macular degeneration.

**Response in Visual Function to Lutein and Zeaxanthin Supplementation**

Five studies\textsuperscript{12,13,16,17,19} investigated visual function response to carotenoid supplementation. Visual acuity (VA) was a measured outcome for four\textsuperscript{12,16,17,19} of the five studies, and in addition, three assessed contrast sensitivity (CS) and glare recovery.\textsuperscript{12,16,19} Ma, Dou et al.\textsuperscript{13} exclusively assessed retinal function by measuring multifocal electroretinogram (mERG) N1P1 response densities. Only one study\textsuperscript{19} measured visual function outcomes in healthy subjects; the remaining four studies consisted of populations diagnosed with early AMD (see Table 3). The duration of supplementation ranged from 24 to 52 weeks. Ma, Yan et al.\textsuperscript{12} observed significant time effects for CS at 3, 6, and 12 cycles per degree (cycles per degree) (p=0.001, p<0.001, and p=0.005, respectively). Ma, Dou et al.\textsuperscript{13} noted that supplementation with lutein and zeaxanthin had significant time effects on improving N1P1 response ring densities in rings 1 and 2 (p<0.001 and p=0.03, respectively).

Most studies consisting of subjects with AMD reported a trend toward improvement in visual function (see continued on page 15
Table 3: Visual-function response after supplementation with carotenoids in subjects with AMD.

<table>
<thead>
<tr>
<th>Study</th>
<th>n (per group)</th>
<th>Age (years)</th>
<th>L (mg/d)</th>
<th>Z (mg/d)</th>
<th>MZ (mg/d)</th>
<th>Duration (weeks)</th>
<th>Visual-Function Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richer et al.</td>
<td>10</td>
<td>73.9 ± 9</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>52</td>
<td>Low-contrast VA (+7.2 letters, p=0.04) CSF (+48%, p=0.05) Glare recovery (p=0.02)</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>74.4 ± 11</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>52</td>
<td>Low-contrast VA (+4.3 letters, p=NS) CSF (+24%, p=0.09) Glare recovery (p=0.09) Improvement in detailed high-contrast VA by 1.5 lines. Improved shape discrimination from 0.97 to 0.57 (p=0.06. 1-tail) Clearing of KVF central scotomas (p=0.057)</td>
</tr>
<tr>
<td>Weigert et al.</td>
<td>84</td>
<td>71.6 ± 8.6</td>
<td>20 mg (month 1–3)</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>Improvement in MDLT (7.3% ± 13.2%), p=0.096 VA increase 2.1 ± 0.4 letters p =0.07</td>
</tr>
<tr>
<td>Ma, Yan et al.</td>
<td>26</td>
<td>69.9 ± 8.4</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>48</td>
<td>BCVA, logMAR reduction –0.04 (p=0.75)*</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>69 ± 6.8</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>48</td>
<td>BCVA, logMAR reduction –0.02 (p=0.75)* CS increased at 3 cpd 0.18 (0.07 to 0.28)* CS increased at 6 cpd 0.21 (0.10 to 0.32)*</td>
</tr>
<tr>
<td>Ma, Dou et al.</td>
<td>26</td>
<td>69.9 ± 8.4</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>48</td>
<td>Mean increase of 18.0 in N1P1 response densities for Ring 1 (p&lt;0.05)</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>69 ± 6.8</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>48</td>
<td>Mean increase of 22.4 in N1P1 response densities for Ring 1 (p&lt;0.05)* Change of 10.6 in N1P1 response densities for ring 2†</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>68.6 ± 7</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>48</td>
<td>Mean increase of 23.5 in N1P1 response densities for Ring 1 (p&lt;0.05)*</td>
</tr>
</tbody>
</table>

Note: L=lutein, Z=zeaxanthin, MZ=meso-zeaxanthin. VA=visual acuity. CSF=contrast sensitivity function. KVF=kinetic visual fields. BCVA=best-correct visual acuity. logMAR=logarithm of minimum angle of resolution. CS=contrast sensitivity. cpd=cycles per degree. n = Number of subjects per intervention group. *P values for between-group difference in change from baseline. †Significantly (p<0.05) different from the placebo group.

Table 3) and a positive correlation between increased MPOD levels and visual parameters.

Richer et al. observed that zeaxanthin induced MPOD elevations improved cone-based visual parameters, while lutein-induced MPOD elevations improved rod-based parameters. Autofluorescence lipofuscin data (right eye) showed that with supplementation, 88% (n=44) of retinas remained the same, two worsened, and four improved. In the left eye, 88% of retinas (n=44) also remained the same, six worsened, and two improved, with a trend (p=0.07) toward benefit with zeaxanthin supplementation. Weigert’s correlation analysis showed a significant correlation between the increase in MPOD and the increase in mean differential light threshold (MDLT) (r=0.25, p=0.027), as well as a significant correlation between change in MPOD and change in VA (r=0.27, p=0.013). Another study noted that changes in MPOD also predicted the amount of improvement in visual-function variables. MPOD change was significantly associated with a reduction in logMAR (logarithm of minimum angle of resolution) levels of best-corrected visual acuity (BCVA) (r=–0.31, p<0.01) and increases in CS at 4 spatial frequencies (r=0.26–0.38, all p< 0.05). Lastly, Ma, Dou et al. observed that MPOD was positively correlated with the changes in N1P1 response densities in rings 1 and 2 for all active-treatment groups.

In healthy subjects, statistically significant improvements in visual performance measures (BVCA [p=0.008] and contrast sensitivity with and without glare) were observed for those supplemented with all three carotenoids; however, no association was noted between iris color, MPOD,
or visual performance measures ($p>0.05$). After the review and analyses of studies, fair evidence (Grade II) supported the conclusion that oral lutein and zeaxanthin supplementation appeared to raise macular pigment optical density and improve visual function in subjects with early age-related macular degeneration, suggesting that carotenoid supplementation may provide benefits in preventing the progression of age-related macular degeneration.

**DISCUSSION**
Supplementation with lutein and zeaxanthin has been shown to increase MPOD and is positively associated with improving visual performance parameters without any associated toxicity effects. MP saturation may play an important role, as some subjects failed to increase MPOD levels significantly, despite increases in serum lutein and zeaxanthin. Subjects supplemented with both lutein and zeaxanthin fared worse in raising MP levels, possibly because the carotenoids competed for the same absorption mediators. Strengths of this review were the inclusion of double-blinded randomized controlled trials, studies with a dropout rate of less than 25%, and studies containing subject groups that were a representative sample of the relevant and affected population. There were limitations to this research that need to be considered. First, a gold standard for measurement of MPOD has yet to be established; therefore the methods of measuring MPOD and visual function were not identical across the studies, possibly affecting the results of those using subjective techniques. It is also difficult to know if gender plays a role in response to supplementation, since gender differences in MP levels and VA were not compared statistically in any of the nine studies. Third, a majority of the studies assessed nutrient intake only at baseline and again at the end of the study; and two studies failed to address dietary consumption altogether, which could impact the findings, as dietary intake of carotenoids may increase MPOD and visual function. Lastly, different formulations of lutein and zeaxanthin supplements in each study may affect the bioavailability and absorption of the carotenoids.

Larger studies are needed to validate these findings on visual function and to evaluate the long-term effects of lutein and zeaxanthin supplementation on reducing the progression of late AMD.

**CONCLUSION**
The results of this review indicate that supplementation with 6–20 mg/day of lutein and/or 2–10 mg/day of zeaxanthin for six months or longer increases macular pigment optical density in healthy subjects and in those with early age-related macular degeneration. Oral lutein and zeaxanthin supplementation appear to raise macular pigment optical density and improve visual function in subjects with early age-related macular degeneration, suggesting that carotenoid supplementation may provide benefits in preventing the progression of age-related macular degeneration.

**PRACTICE RECOMMENDATIONS**
For adults diagnosed with or who are at risk for developing AMD, registered dietitian nutritionists, registered dietitians, and dietetic technicians, registered should encourage adequate dietary intake to meet the Dietary Reference Intakes (DRI) for vitamins and minerals. The dietetics practitioners should also collaborate with other members of the health care team to determine if the adult would benefit from a daily supplementation of 6–20 mg of lutein per day without any contraindications or adverse effects. —Jennifer Simmons, MCN, RD, LD, RN; JoAnn Carson, PhD, RDN, LD; Lora Day, MA, RD, LD; Bernadette Latson, MS, RD, LD.

**ACKNOWLEDGEMENTS**
Special thanks to Linda Michalsky, PhD, RD, LD; and Kara Davis, RD, LD; for their time and assistance with this review.

Jennifer Simmons, MCN, RD, LD, RN, recently received her master’s degree in clinical nutrition from UT southwestern. Jennifer plans to become an RD and work within nutrition support.

Bernadette Latson, MS, RD, LD, is a Clinical Assistant Professor in the Department of Clinical Nutrition, University of Texas Southwestern Medical Center. She holds a master’s of science degree from the University of Florida, has a Bachelor of Science degree from Texas Tech University, and continued on page 17
completed an internship in nutrition at the Jewish Hospital of Cincinnati. In addition to patient care, research, and teaching in the graduate nutrition program at UT Southwestern Medical Center, Bernadette is a frequently invited speaker in the community, where she shares her interest on the role of nutrition in aging. She has been featured in many media outlets. Bernadette, an active member of the Academy of Nutrition and Dietetics, received the 2007 Award of Excellence in Dietetics Education.

JoAnn S. Carson, PhD, RDN, is a professor and the director of the Master of Clinical Nutrition Coordinated Program at the University of Texas Southwestern Medical Center. She has chaired the Academy’s Evidence Analysis Panel on disorders of lipid metabolism. Her teaching responsibilities include a graduate-level metabolism course and direction of student research.

Lora Day, MA, RD/LD, is a clinical instructor in the Department of Clinical Nutrition, UT Southwestern School of Health Professions, Dallas, TX. She has previously worked as a member of a nutrition support team at Parkland Health and Hospital System, also in Dallas.

References
Click here to see the references used in this article.

New Name, New Benefit

In addition to expanding your professional network, you can now earn FREE CPE by participating in the new eMentoring program.

The Academy’s new name underscores the educational values our organization is committed to, and now we’re proving it.

CPE is available for both mentees and mentors!

Academy eMentoring—where experience and enthusiasm merge.

Take advantage of this benefit by visiting the Mentoring Resources page at www.eatright.org
Congratulations to the Healthy Aging DPG’s incoming 2014–2015 officers!

**Chair-Elect**
Maureen Janowski, RDN, LD
Paid professional position/role: Director of Clinical Support, Morrison Senior Living/Compass Group; Palatine, IL.

**Nominating Committee**
Member at Large
Nicolle Miller, MS, MPH, RD, LDN
Paid professional position/role: Healthy Aging Specialist, North Carolina Department of Health and Human Services, Division of Aging and Adult Services; Raleigh, NC.

**Treasurer**
Amy Sheeley PhD, RD, LDN
Paid professional position/role: Nutrition Specialist, MA Executive Office of Elder Affairs (State Unit on Aging); Boston, MA.

**Nominating Committee**
Chair-Elect
Margery Gann, MS, MBA, RD, LDN, FAND
Paid professional position/role: Care Management Director, Ethos; Boston, MA.

**Membership Director**
Monica Sathymurthy, MS, RD, CDN
Paid professional position/role: Clinical Dietitian, VA NY Harbor Healthcare System, Manhattan, NY.

**External Relations Director**
Ucheoma Akubundu, PhD, RD
Paid professional position/role: Director of Project Management and Impact, Meals on Wheels Association of America, Alexandria, VA.
Thank you to the following HA DPG members for sharing their 2014 National Nutrition Month® projects. This year’s NNM theme was, “Enjoy the taste of eating right.” Each member has received a $10 Starbuck’s gift card, and all six project descriptions are included in our website’s archive of past NNM activities.

- **Sherry Hamilton, RD.** At St. Thomas Rutherford Hospital, Sherry and her food and nutrition team featured Mediterranean foods in keeping with the NNM theme.

- **Angela Kelley, MS, RD, LD.** Kelly hosted an employee healthy potluck at the Visiting Nurse Association, where she works.

- **Mary Ellen Metzger, RD, LD.** With sponsor help, Mary Ellen purchased NNM placemats and brochures. She also conducted a “Taste-It Tuesdays” feature at local congregate meal sites to introduce seniors to a variety of unfamiliar healthy foods while promoting local dietitians as nutrition experts.

- **Lana Olsson, MS, RD, CSG.** Lana presented a program, “Enjoy the Taste of Eating Right,” at the Hillcrest Independent Living Community.

- **Bonnie Caywood, RD, LD.** At her hospital, Bonnie conducted themed activities for employees and community members.

- **Beth-Anne Oliver, MS, RD, LDN.** Beth-Anne discussed NNM and the Mediterranean diet on a local radio-station talk show, as well as posted related articles on its website and on her electronic news page.

**Want to learn more about NNM?** The Academy created the annual NNM campaign, which has been running since 1973, to focus on the importance of:

- Making informed food choices,
- Developing sound eating patterns, and
- Being physically active.

Visit the Academy’s website for promotional information, products, and activities related to this campaign. You can learn how HA DPG members have tailored past NNM activities to the needs of older adults by visiting our website’s archive of past NNM activities.

**Proud of your NNM idea?** We’d love to hear from you about how you’ve celebrated NNM in the past, so that we can include it in the archive.

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**Research Works!**

The Dietetics Practice Based Research Network (DPBRN) consists of registered dietitians from various backgrounds who conduct and promote practical research in real-world settings.

DPBRN projects have included studies on energy expenditure, the value of the RD in managed care, evidence based guidelines for diabetes care, motivational interviewing to treat childhood obesity, and testing toolkits for practice.

Join the DPBRN and conduct research that moves the profession forward!

Learn how by visiting [www.eatright.org/members/dpbrn](http://www.eatright.org/members/dpbrn).

**Dietetics Practice Based Research Network** – Advancing dietetics through outcomes research.
NOW THAT THE COLD WEATHER is behind us, we are enjoying the pastel colors and soft, cool breezes that spring brings. By contrast, the HOD’s work is heating up and in forward gear. Red hot at this moment is the Mega Issue Question for spring 2014: How do we mobilize members to commit their time, talent and resources to research?

Why research? you might ask. During the HOD dialogue session on Nutrition Services Delivery and Payment: the Business of Every Academy Member (October 18 and 19, 2013), a theme emerged: the need for outcomes data to support increased reimbursement for nutrition services performed by registered dietitian nutritionists (RDNs) and dietetic technicians, registered (DTRs). To advocate for increased reimbursement, Academy members must use research to demonstrate how RDNs and DTRs improve the nation’s health through food and nutrition. As highlighted in previous HOD mega issues and backgrounders, research is not only for one area of practice. Outcomes data are needed for all areas of practice to show their value, and clinical-outcomes research is essential to the advancement of the field of nutrition and dietetics.1 By providing significant research outcomes, RDNs can increase the value, validity, funding, and respect for dietetic practices.2 The Academy has made significant efforts to encourage and educate members on the importance of research, standardized language, and evidence-based practice. Are you aware of and using the Academy resources listed in Table 1?

These resources will help dietetics practitioners use existing research

### Table 1: Research and practice tools available to Academy members.

<table>
<thead>
<tr>
<th>Academy Resources</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Website</td>
<td>The Research Website provides quick access to Academy research resources, philosophy and framework, and the Academy Knowledge Center.</td>
</tr>
<tr>
<td>Academy of Nutrition and Dietetics Health Informatics Infrastructure (ANDHII)</td>
<td>ANDHII is an online tool currently under development. It will promote efficient and accurate use of the Nutrition Care Process and the corresponding International Dietetics and Nutrition Terminology. Helps members track and report on patient outcomes, and collects impact data that dietetics practitioners can use in public-policy and quality-improvement research.</td>
</tr>
<tr>
<td>Evidence Analysis Library</td>
<td>The Academy of Nutrition and Dietetics Evidence Analysis Library (EAL®) aggregates existing literature on relevant nutrition and dietetic topics housed within an accessible, online, user-friendly library.</td>
</tr>
<tr>
<td>Dietetics Practice-Based Research Network</td>
<td>The Dietetics Practice-Based Research Network (DPBRN) is a network of nutrition and dietetics professionals and students with varying specialties and areas of expertise who are interested in studying and improving patient care. DPBRN conducts, supports, promotes, and advocates research in practice-based settings by bringing practitioners and researchers together to identify research needed in practice settings, design top-class research, obtain funding, and conduct that research in real-life practice settings. DPBRN is a free benefit of Academy membership.</td>
</tr>
<tr>
<td>Nutrition Care Process</td>
<td>The Nutrition Care Process (NCP) is a holistic, systematic approach to providing high quality nutrition care. Use of a care process provides a framework for dietetics practitioners to individualize care, taking into account the patient/client’s needs and values and using the best evidence available to make decisions.</td>
</tr>
<tr>
<td>International Dietetics and Nutrition Terminology Reference Manual</td>
<td>The International Dietetics and Nutrition Terminology Reference Manual is available in print and electronically. Standardized terminology allows dietetics practitioners in all settings to use the same words to describe things, resulting in more-precise and effective documentation and communication. Standardized terminology is essential for electronic health records and billing forms. Standardized language will also facilitate legislative efforts. Each term has a reference sheet that defines the term and important information regarding use of the term.</td>
</tr>
</tbody>
</table>

continued on page 21
in their practice as well as conduct new nutrition and dietetics research. Further outcomes research needs to be completed to reach the goals of increased value for dietetics professionals. As stated in the January 2014 article, “Research in Nutrition and Dietetics—What Can the Academy Do for You?” published in the Journal, “research allows us to move the profession and the provision of care in nutrition and dietetics forward as an evidence-based practice. Input is needed from dietetics practitioners in all settings and specialist practices: academia, private practice, business, industry, management, and new yet-unidentified areas.”

The HOD will meet in May for dialogue with targeted objectives, including, “identify ways that members can build a professional culture that encourages and embraces research.” Questions for each member to consider:

- What am I already doing in regards to research?
- How do I see myself contributing to research in the future?

The Academy and its volunteer leaders look forward to the answers to these questions, as well as your suggestions. Many thanks to HA members who responded to requests for input on this important issue.

—Sharon Leppert, RDN, LD; Healthy Aging DPG Delegate

References

Author Opportunities
The Spectrum’s editorial board is searching for authors to write articles on the following topics:

1. Issues of nutrient supplementation
2. Protein and aging
3. Nutrients and cognition
4. Nutrition status as a risk factor for falls among older adults
5. Malnutrition and older adults

If you are interested in becoming an author, or if you would like to suggest a possible author, please submit your name and contact information to Robin Dahm, RDN, LDN.

Renewed Your Membership Yet?
We hope you have enjoyed the Healthy Aging DPG’s continuing-education opportunities, newsletter, and other member services this past year. When you renew your Academy membership, please remember to renew your membership with the Healthy Aging DPG at the same time.

You can renew your Academy and DPG membership online.

To renew by phone, call (800) 877–1600 ext. 5000, Monday through Friday, 8:00 AM–5:00 PM Central time to reach the Member Services Center.
Legislative Update
Dietitians Must Advocate for Our Services if We Are to Succeed

What Is Advocacy?
According to Wikipedia, advocacy is “a political process by an individual or group which aims to influence public-policy and resource allocation decisions within political, economic, and social systems and institutions.” Individual people as well as organizations can choose from a wide range of activities. Examples include media campaigns and public speaking, the commissioning and publishing of research or polls, the filing of amicus briefs, and lobbying.

Lobbying plays a significant role in modern politics. This form of advocacy is often carried out by lobbying groups and political action committees (PACs), whose leaders directly approach target legislators about specific issues. The Academy’s PAC—ANDPAC—is your voice on Capitol Hill. ANDPAC provides funding for Academy members to meet with their elected officials in their communities. ANDPAC also supports members of Congress and candidates who champion nutrition issues.

Additionally, ANDPAC helps the Academy enhance and develop strategic relationships with elected officials. With the help of ANDPAC, the Academy strengthens its partnership with key committee members whose decisions affect food, nutrition, health, and our profession.

Advocacy groups in the U.S. and Canada are using social media to facilitate civic engagement and collective action. Another definition for advocacy is the building of support for an idea or issue, with the aim of influencing an important change in current policy—which is pretty much what we dietetics practitioners do on a regular basis. We want third-party payers to recognize us and pay for the services we perform today and in the future.

What Is Grassroots Activism?
Usually grassroots activism refers to political activity that begins within a community and is initiated by the general population or membership, as opposed to political activity started and carried forth by a formal political organization. Many people initially get involved in grassroots activism because they see something they want to change or improve, such as their schools, environments, or communities. Grassroots activists can fight for virtually any cause. My original foray into grassroots activism dealt with recycling. I had decided to embrace recycling years before my community seemed interested in a recycling program. My family and friends wrote letters, made phone calls, and eventually established a city-wide recycling program. Seeing the positive results of my actions turned me into a career activist.

Becoming an Advocate
What are the best ways to become an advocate for the dietetics profession?

- Learn as much as you can about the legislative process. This may require dusting off old civics 101 course books from college, or a visit to the library.

We must show leaders that we are cost-effective, can save governmental entities money, and can improve the health of our communities.

Becoming an advocate in the political process is sometimes referred to as active citizenship. As active citizens, average people achieve their goals for community change by influencing political decision-makers: Citizens choose their priorities, create a plan, and actively work to take action and make their voices heard. The dietetics community is always in need of people—such as you—to become active citizens who can help advocate for our continually changing profession. We may not have been at the table when health professionals were being reimbursed under Medicare in the 1960s, but we are there today. If we want to be reimbursed for our services, we must convince our elected officials that we are cost-effective and can improve the health of our citizens.
Legislative Update
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- Identify your representatives in your local and state legislatures, and look into what issues are most important to them. Everyone should know their elected officials’ names and how to contact them. Some officials, if not most, prefer email communications, especially if they work at the national level.
- Register to vote, if you have not already done so—and exercise this important right by actually voting.
- Share any pertinent research and findings, as well as your professional experiences, with your community leaders and legislators. This is an area where dietetics practitioners have not excelled. We need to show leaders how cost-effective we are, how we can save governmental entities money—and perhaps most importantly, improve the health of our communities.
- Write letters, send emails, or make phone calls to elected officials. Encourage others to do the same. Our Grassroots Manager system is one of the best I have ever used. This user-friendly system is simple to use. The advocacy emails we receive from the Academy connect us to the Grassroots Manager, and to the professionally prepared letters pre-addressed to your specific legislators. Clicking the buttons to personalize and submit these letters takes about 2 minutes. When you receive these emails, it’s important that you take the time to visit the Grassroots Manager to support the cause.
- Attend local political meetings that are open to the public. Some ways you can find out about these meetings: Read your local paper, become involved with community groups, and sign up for a legislator’s email list. Be sure to announce that you are a credentialed dietetics practitioner, even if the issue being discussed is not directly related. This helps them remember you in the future when they may need to get your advice or input on another issue.
- Consider running for an elected position with the Academy, or even for a local, state, or national office. Several dietitians are currently serving as school-board members, mayors of small towns, and federal and state legislators.
- Stay current on political news, and participate in forums and discussions with others. This cannot be underemphasized. Stay abreast of what is happening in your local, state, national, and even international communities.
- Write a letter to the editors of the newspapers or magazines that you read. These are called op-eds (opinion editorials) and can be written on any subject matter. Perhaps during National Nutrition Month, you could write an op-ed on a relevant topic affecting your community, such as obesity or school lunch programs.
- Recruit others to work with you to build a coalition working toward common goals, such as:
  - Professional health associations
  - Patient-advocacy groups
  - Social-service organizations
  - Neighborhood groups
  - Local businesses
  - Consumer-advocacy groups.

The Academy’s Legislative and Public Policy Committee is doing all these things on your behalf at the national level. We can use your support at the state level as well as the national level. Each state dietetics association has members working on state and national issues. State issues are varied and frequently change. Each state has three volunteer positions: public policy coordinators, state policy coordinators, and state regulatory specialists. Also, DPGs such as the Healthy Aging DPG have public policy advocates serving on the board of directors and sharing policy information with members.
- Ask questions of electoral candidates:
  - What do they plan to do about problems such as obesity or diabetes?
  - How will they allocate funding to address the problem?
  - How will they help lessen health problems?

Finding Your Advocacy Niche: Recommended Readings
Anyone can become an active citizen who promotes the importance of good nutrition and the value of dietetics practitioners. You can become involved at a level that balances nicely with your personal and professional obligations. The following sources, which provided information for this article, are good starting points for learning more about advocacy:

- **American Public Health Association: Advocacy & Policy.** (Accessed April 11, 2012.)
- **California State University, Fullerton. What is Advocacy?** (Accessed April 11, 2012.)
- **Patient Advocate Foundation: Solving Insurance and Healthcare Access Problems.** (Accessed April 11, 2012.)
disparities between population groups?
- Know your facts:
  - Study the cause that you are supporting.
  - Stay informed about new research, statistics, and so on.
- Always be professional and honest with legislators and other people in positions of influence. Send them thank-you cards after you visit with them.
- Keep informational handouts or brochures with you, because you never know when you will meet someone who could help to further your cause.

In the past year, have you contacted an elected official about anything related to our profession? If not, now is the time to get active. It can be as simple as responding to a grassroots advocacy request or calling your representative.

—Dianne Polly, JD, RDN, LDN; Policy and Advocacy Leader; Member, Legislative and Public Policy Committee

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- Members contribute to and benefit from ANDPAC
- Productive Congressional relationships get results

To learn more about the Academy’s Political Action Committee or make a donation, visit [www.eatright.org/ANDPAC](http://www.eatright.org/ANDPAC).

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**Healthy Aging DPG Member Benefits**

The Healthy Aging DPG achieves success by supporting the success of its members.

Renewing your HA DPG membership when you renew your Academy membership will ensure your uninterrupted access to:

- Continuing-education credits through webinars as well as articles in The Spectrum.
- Professional development grants to further your education and credentialing.
- Networking and leadership opportunities.
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HA website: www.hadpg.org

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