The Administration on Aging reports that 12.9% of the U.S. population is over the age of 65, but by 2030, almost 20% of the population will be older than 65.\(^1\) Included in these statistics are those aged 90 or above, considered “the oldest of the old” and the fastest growing portion of the population.\(^2\) A majority of older Americans live at home. Ensuring this population has the highest quality of life during their later years is an important public health initiative.\(^3\) Primary care physicians and community health care providers are in a position to identify and manage the health of the elderly to ensure the best quality of care.\(^4\)

Both depressive symptoms and reduced nutrient intake promote a lower quality of life but can be monitored by primary care physicians. Life satisfaction is a predictor of longevity and psychiatric morbidity. Adults who are dissatisfied with life are over 41 times more likely to have depressive symptoms than those who are satisfied with life.\(^5\) While the number of adults >65 years of age tend to be more satisfied with life compared to those 18-64 years of age, it is probable that those who are dissatisfied are at greater risk for depressive symptoms.\(^5\) Depression is a strong risk factor for suicide and has been associated with diseases such as stroke, cardiac disease, and cancer.\(^6\) Even minor depression has been associated with increased use of health services, excess disability, poor health outcomes, and higher mortality.\(^7\) Older adults may not report depression to their physicians because they do not recognize the symptoms\(^8\) or are hesitant to describe feelings of depression or anxiety for cultural reasons.\(^8\) Older adults should be regularly screened and interventions initiated if depression presents.
The nutrition status of older adults should also be monitored. As we age, our ability to absorb certain nutrients decreases, as does our caloric need. Ensuring older adults have access to, and are able to consume, a nutrient dense diet can help ensure a high quality of life. For older adults, the management of chronic diseases may take priority over prevention or identification of new conditions such as depression or changes in nutrition status; however, both impact quality of life in older adults.

**Depression in Older Adults**

The prevalence of late-life depression is around 11% in adults older than 60 years as compared to about 19% in those younger than 60 years.\(^8\) Depression in the older population may present itself with different symptoms than younger adults and usually has different causes. Depressive symptoms in older adults are associated with gender (females exhibit higher rates), somatic illness (physical pain in many parts of the body without an identified physical cause), cognitive (anxiety, insomnia) and functional (muscular and joint aches) impairment, and lack of social support (widowhood, low emotional support).\(^7\) Risk factors such as deteriorating health, cognitive decline, diminishing social network, inadequate coping strategies, and stressful life events are especially important to identify in the elderly.\(^10\)

Some common symptoms are worry, psychomotor delay, loss of concentration, feelings of hopelessness, fatigue linked to poor appetite, weight loss, and sleep disturbances.\(^9\) Agitation and memory loss can be mistaken for dementia rather than recognized as depression. Further, depression can be difficult to assess in older adults due to medication side effects and underlying medical conditions which cause many of the same symptoms.\(^7,8\)

Primary care physicians and community health providers should be trained to recognize depression and how it manifests in the older population.\(^8\) Health professionals should be knowledgeable about the increased risk of depression with the presence of risk factors such as loss of a spouse, change in living arrangements, or any change in health, mobility, or independence.\(^3\) Individual coping styles and social support can significantly influence risk for depression.\(^9\) The Patient Health Questionnaire-9,\(^9\) Geriatric Depression Scale,\(^13\) Geriatric Anxiety Inventory,\(^13\) Cornell Scale for Depression in Dementia,\(^14\) and The Neuropsychiatric Inventory\(^15\) are all validated instruments that can be used in the older population to identify depressive symptoms. Due to medication use and health issues, treatment of depression needs to be individualized. Fear of adverse outcomes may cause health care providers to hesitate treating older adults, but the benefits of treatment outweigh the safety and efficacy concerns of current treatments for depression.\(^7\) Both medications and counseling can be part of the prescription for depression at any age. Identifying depression in older adults requires assessing several variables including behavioral, psychosocial, and biological factors. Many of the symptoms for depression are similar to those of dementia, frailty, and age-related failure to thrive. Depression should not be incorrectly labeled as simply “age-appropriate mental changes” and go uninvestigated.

Cardiovascular disease and mortality are well documented results of untreated depression later in life.\(^4,6,16-18\) Data from the Prevention of Suicide in Primary Care Elderly: Collaborative Trial (PROSPECT) indicate depressive symptoms lasting for over a year are associated with a significantly increased risk of mortality five years later.\(^4\) Older adults newly diagnosed with depression are at high risk for mortality, and those with increasing depression over time have a 70% increase in mortality compared to those with stable depression.\(^4\) However, the relationship between depression and mortality may be confounded, and those who are older but in poor health may report more depressive symptoms due to quality of life issues. Higher mortality rates may be a result of chronic conditions and not necessarily depression.\(^6\) Monitoring and treating symptoms of depression in the elderly may ensure a higher quality of life despite increasing disability and chronic disease and may decrease their risk of mortality.

**Nutrition in Older Adults**

For older adults, factors such as changes in physical and cognitive status, management of multiple medical conditions, and changes in social and family environments are all barriers to optimal food and
nutrient intake. Several age-related changes in older adults including decreases in taste sensation, secretion of digestive enzymes, salivation, ability to detect thirst, motor ability, renal function, hepatic function, chewing ability, smell, sight, and early satiety can lead to inadequate nutrient intake. Even if intake is sufficient, absorption of vitamins and minerals diminishes with age while chronic disease complications and the use of medication exacerbates malabsorption. The need for fewer calories as we age makes the intake of nutritionally dense foods very important. Fruits and vegetables are a good source of vitamins, minerals, fiber, and antioxidants but may be the hardest for the elderly to obtain. Transportation costs and decreased mobility can complicate travel, inhibiting the consumption of fresh foods. Adequate protein intake is important to lessen the risk of age related muscle loss; preservation of muscle mass is important to maintain bone mineral density and to decrease bone fracture risks. However, high protein foods, other than nuts and legumes, are more expensive, spoil quickly, and can be difficult to prepare. A healthy diet can decrease a person’s risk of coronary artery disease, and the intake of adequate calories, vitamins, and minerals aids in the control of many chronic diseases.

In addition to advising the elderly on taking their medications, physicians can also assess the level of food insecurity on patients’ nutrition status. The Mini Nutritional Assessment has been used in clinic and community settings as a quick and accurate way to assess nutrient intake in the older population. Dietary restrictions recommended to control chronic disease may overwhelm older patients. They may unnecessarily avoid many healthy foods which can lead to nutrient deficiencies, so a less restrictive diet, when possible, may outweigh health risks.

Nutrition and Depression
Older adults reporting inadequate intake are four times more likely to be depressed. Studies also suggest a link between coronary artery disease, inflammation, and the development of depression. The development of frailty and reductions in muscle skeletal strength may be a result of oxidative stress and inflammation. Research indicates a relationship between nutrition and systemic inflammation. Over the past two decades, research on specific nutrients and depression has grown. Vitamin D, folate, magnesium, zinc, and unsaturated fatty acids research, while inconclusive, has received the most attention. There are no current best practices when it comes to individual nutrient supplementation for depression. Folate and magnesium are consumed in inadequate amounts in older adults: fewer than 50% meet the Estimated Average Requirement (EAR) for folate and magnesium from food sources alone or with the addition of supplements. A majority of older adults consume the EAR for zinc, and nearly all older adults who regularly take a vitamin and mineral supplement meet the EAR for zinc. Vitamin and mineral supplementation can increase the intake of many nutrients, but research indicates only half of older adults use a supplement daily. A diet high in fruits and vegetables, whole grains, and fish would provide the nutrients thought to be low in older adults and may aid in the control of depressive symptoms. Research is now turning to whether dietary patterns play a role in depression.

Vitamin D
The discovery of vitamin D receptors in the central nervous system led to research on its role in depression. Older adults are at risk for vitamin D deficiency because they produce only 25% of the cutaneous vitamin D produced by young adults and may have less exposure to solar radiation with which to synthesize vitamin D due to geographical location and/or increased time spent indoors. In addition, the few foods that naturally contain vitamin D (salmon, mackerel, cod liver oil) are not consumed in adequate amounts. Several studies found higher rates of vitamin D deficiency in older adults with psychiatric disorders, both in the inpatient and outpatient setting. The few randomized control trials (RCTs) studying the effect of Vitamin D on depression found low vitamin D in people with symptoms of depression, but supplementation with vitamin D to decrease depressive symptoms has had mixed results. Vitamin D plays a significant role in bone health: a low intake can lead to issues with mobility which in turn can lead to frailty and depression later in life.
Data supports the use of vitamin D supplementation to decrease mortality in elderly women, but a recent meta-analysis questions the use of vitamin D supplementation to help prevent falls. The Institute of Medicine recommends supplementation of vitamin D in older adults, and assays should be obtained to assess compliance with supplementation regimens. Older adults may decrease their risk of disability with early vitamin D supplementation. A long-term outcome may be a decrease in depression later in life secondary to sustained mobility.

**Folate**

Evidence of a relationship between folate intake and depressive symptoms is mixed, and the exact mechanism is not known. One theory claims vitamin B deficiencies can lead to increased homocysteine concentrations, which have been associated with depression. Skarupski and colleagues did not find a relationship between folate intake and depression in the Chicago Health and Aging Project that looked specifically at depression in the elderly. Jacka and colleagues found a weak association (p=0.06) in women while Nguyen et al found no association in women. However, folate deficiencies have been associated with depression in several other studies, specifically in older adults. Folate intake in the United States is usually adequate due to fortification of the grain supply, so the relatively low risk of folate insufficiency may explain some of the differences in outcomes. Research has shown the older population is at higher risk for low folate intake due to an overall decreased caloric need and decreased intake of fortified foods, but a link with depression is not certain.

**Magnesium**

Systemic inflammation is a prominent feature of depression, and magnesium has strong anti-inflammatory effects. National data indicates the majority of the population has magnesium intake below the Recommended Daily Allowance. Magnesium supplementation has been linked to improvement in symptoms of major depression, premenstrual symptoms, postpartum depression and chronic fatigue syndrome. Low magnesium status has been associated with increased depressive symptoms in several different age groups and ethnic populations. Issues in study design have led to inconclusive results and skepticism of magnesium’s role in depression. Serum magnesium levels were used to indicate magnesium status in some studies, but its reliability is questionable. Clinical trials have suffered from limited sample sizes and the use of the supplement magnesium oxide which is poorly absorbed. Cross-sectional studies have reported an inverse relationship between magnesium intake and standardized depression scores. One longitudinal study did not find an inverse relationship, although it was underpowered to detect a significant reduction in depression. With varying outcomes and limited sample sizes, consensus on the relationship between magnesium intake and depression has not been reached. Magnesium and folate are found in many of the same foods; therefore, it is important to decipher whether depressive symptoms are a result of inadequacy of one of these nutrients but not the other.

**Zinc**

Zinc is found in highest concentration in the brain, and zinc deprivation leads to alteration in behavior, learning, and mental function. It also has a lipid protective effect and is a constituent of fatty acid metabolizing enzymes. Zinc’s role as an anti-inflammatory and neuroprotective agent led to studies involving depression. Studies in animals have been promising, but human studies have presented mixed outcomes. Zinc’s role in depression is questioned due to varying issues with the design of past studies. (RCTs) have suffered from high dropout rates and the use of serum zinc as a marker for zinc status, which is known to be unreliable. Many cross-sectional studies also relied on serum zinc levels and were done outside of the U.S. Maserejian et al found an association in women in Boston, but not men. The U.S. tends to have a lower rate of zinc deficiency, and these results point to the need for further investigation of the U.S. population. Studies on zinc supplementation and depression in the elderly are lacking; however, zinc deficiency may only be of concern in older adults who do not take a vitamin and mineral supplement.

**Polyunsaturated Fatty Acids**

The role of fatty acids in depression is complex. Fatty acids are major structural components of the brain and therefore, may have a protective effect.
against depression. The fatty acid composition of membranes in the brain declines with age, but supplementation with essential fatty acids, such as omega-3 and omega-6 polyunsaturated fatty acids (PUFAs), can improve membrane fluidity. Numerous studies have shown diets with reduced levels of omega-3 are associated with major depressive symptoms, and RCTs have reported treatment with omega-3 fatty acids improves depression. A recent meta-analysis established that depression is related to a diet low in omega-3 fatty acids. Omega-3 concentrations affect neuroplasticity, cell survival, and gene expression. A deficiency in omega-3 PUFAs prevents the regeneration of membranes and accelerates cerebral aging, which can contribute to the development of depression. Omega-3 deficient diets are associated with an increase in depression scores on standard behavioral tests and are also associated with a reduction in expression of brain-derived neurotrophic factor (BDNF), a neurotrophin that plays a role in cell survival. Benefits have been seen with a range of doses between 1 and 9 grams daily.

Fatty acids also have an important role in inflammation. PUFAs influence the production of proinflammatory cytokines, which seem to be elevated in depressed patients. The competition between omega-3 and omega-6 for metabolic enzymes can inhibit the production of proinflammatory eicosanoids. Another link to inflammation is seen in omega-3’s relationship with cardiac disease. A study by Parker and colleagues showed that among patients with acute coronary syndrome, those with clinical depression had lower levels of omega-3. Cardioprotective effects have repeatedly been seen in high mono and polyunsaturated diets while high intakes of trans-fatty acids have a detrimental effect on depression. Many researchers argue there is a lack of association between the types and ratios of poly and mono unsaturated fats in the diet, and a diet generally high in mono and poly unsaturated fats in the diet, and a diet generally high in mono and poly unsaturated fats and low in saturated and trans-fats is associated with lower depressive symptoms. The health benefits of unsaturated fatty acids go beyond a possible role in depression and have been found to be beneficial in the management of many chronic diseases. Although foods containing unsaturated fats can have a shorter shelf life and are generally more expensive, they can add calories for those with early satiety. Older adults should be encouraged to consume foods containing unsaturated fats.

**Mediterranean Diet**

The Mediterranean diet pattern (MDP) is believed to decrease the metabolic, inflammatory, and vascular processes that contribute to the risk of developing depressive symptoms. The MDP provides a high level of the nutrients identified as having an impact on depression. This diet pattern includes high levels of magnesium and folate from vegetables and legumes, PUFAs from fish, monounsaturated fatty acids (MUFAs) from olive oil, and antioxidants from vegetables and red wine. Overall, the pattern promotes increased consumption of high fiber foods and unsaturated fatty acids. Lower mortality from cancer and cardiovascular disease as well as overall lower mortality has been associated with the MDP. Luciana et al recently replicated work showing the MDP protects against C-reactive protein-inflammation, and the effect is seen not only in those living in Mediterranean regions but also older adults following the MDP in other parts of the world. People inhabiting Greece and the Greek islands, where most people follow the MDP, have a lower rate of depression and mental disorders with the “oldest of the old” living on the island of Ikaria having the lowest rate. Ikaria has been the subject of many recent articles due to its unusually high numbers of people living to the age of 100 years, pointing to an overall increased survival rate from following the MDP. The MDP promotes the intake of fruits and vegetables, which are an important component of a healthy diet due to their high content of vitamins, minerals, fiber, and antioxidants. Epidemiological evidence suggests that regular consumption of fruits and vegetables in the recommended amounts is associated with lower risk for chronic diseases and is associated with lower mortality. The most recent recommendation for those > 70 years of age is a combined amount of nine servings (4.5 cups) for males and seven servings (3.5 cups) for females. On average, Americans aged 70 years or older consume only two-thirds of their recommended
servings of fruits and vegetables with only 25% reporting > 5 servings per day. Some studies have shown a high intake of fruits and vegetables inhibits the development of depression via the antioxidant neuroprotective and neurogenerative roles. Depression has been associated with low plasma levels of vitamin C which may reflect poor nutritional status and inadequate antioxidant status. The InCHIANTI study (aging in the Chianti area) concluded that a higher adherence to the MDP was associated with a higher intake of many antioxidants such as beta carotene and vitamins C and E; the intake of these nutrients may partly explain why the MDP has a protective role. Even a modest increase in fruit and vegetable intake can have a marked effect on health in older adults. Just one additional serving of fruits and vegetables has been associated with an approximately 10% increase in the odds of a person reporting health, including mental health, as good or better.

A defining characteristic of the MDP is the high intake of MUFAs, mostly in the form of olive oil and fish. MUFAs, found in olive oil and red wine, are thought to have a beneficial role in managing depressive symptoms because they improve postprandial endothelial function and the binding of serotonin to receptors. Populations with a high consumption of fish, one of the best sources of omega-3 fats, tend to have a lower frequency of depression. The relationship between fish and depression is seen in studies of people older than 65, showing a 66% lower likelihood of having depression with the consumption of 300 grams (~10.5 ounces) of fish weekly. Some studies have shown that the MDP is more protective than a heart healthy diet of increased fruits and vegetables and low consumption of meat and alcohol and is just as easy to follow. Perhaps the protective effect comes from the cumulative effect of nutrients from the different foods as opposed to isolated nutrients. Decreasing depressive symptoms through better diet and exercise can reduce disability, improve self-image, and help control other chronic diseases as well as total body weight.

While the individual foods of the MDP each provide a beneficial protective effect from depression, the overall diet pattern may be more important than any one nutrient or food component. Synergistic effects of the nutrients together may lead to lower rates of depression. It is also possible that individuals following the MDP live healthier lifestyles in general, and the MDP is just one component of a lifestyle that leads to lower depression rates.

Conclusion
The number of people aged 65 years or older increased 21% from 2000 to 2010, a 15.1% faster rate than people younger than 45 years. This shift in age demographics is leading to a greater number of older adults looking for ways to control chronic diseases and maintain physical activity and independence. Depression in the elderly leads to an increased risk of mortality but is a treatable illness and should not be considered a normal effect of aging. People who are not receiving adequate nutrition are more prone to depression. The Mediterranean diet pattern and regular physical activity along with moderate alcohol consumption and not smoking are associated with decreased depressive symptoms later in life. Certain nutrients such as vitamin D, folate, magnesium, zinc, and unsaturated fats contain protective properties and may prove to be therapeutic treatments to depression, but not all studies are conclusive.
healthier. Healthy participants with sub-clinical depression may change their food intake as their mood disorder changes. A poor diet may be the result of depressive symptoms, or it may be that depressive symptoms result from a poor diet. Prospective designs in which the food is provided to volunteers and compliance is checked using validated clinical measures could help move research in this area.

Researching associations between depression and individual nutrients instead of overall dietary intake may lead to inaccurate assessment of these relationships, since diets are not consumed as individual foods or nutrients. Patients with depressive symptoms exhibit a wide range of behavioral, physical, and sociodemographic factors that play a role in their overall mental health. Nutrition may play a role in mental health early on in life, and thus changing the diet of the elderly may not lead to significant long-term changes in depressive symptoms. Most important, however, is increasing awareness of the need for nutrition and depression screening in the elderly. Preventing decline in mental and nutrition status can greatly improve overall quality and longevity of life of the elderly.

References


I hope your summer was enjoyable and your leisure time, whether spent at the beach, in the mountains, or traveling to new places, provided renewal and relaxation. As we move into the fall, I encourage you to make the Research DPG a part of your professional 'place'.

There are a number of areas and activities being worked on by the RDPG Executive Committee this year for you. Let me highlight a few to pique your interest. One of the major goals this year is to enhance our communication with you. You are seeing that through monthly eblasts, emails through our electronic mail list (EML), and, of course, The Digest. If you are not on the EML, go to the RDPG website at www.researchdpg.org, login to the Members Only section, and scroll down past Announcements to learn how to sign up. Speaking of the RDPG website, I hope you are visiting the site frequently to view progress in keeping it current and relevant. To our student members, email communication from our two student reps is providing expanded outreach. We will be highlighting all 2014 RDPG award winners including student poster awardees, a first for RDPG, at our Membership Breakfast Meeting and other RDPG planned events at FNCE that include:

- **Research DPG Pre-conference Workshop -- “National Dietary Data: Building Blocks to Expand Your Research Portfolio”**
  - **When:** Saturday, October 18, 11 am – 3 pm
  - **Where:** Omni at CNN Center, International E Room

  Learn about dietary intake data collection, survey databases, and research products that augment analysis from What We Eat in America (WWEIA), NHANES in a hands-on workshop (bring your laptop) that will provide attendees with a variety of resources that they can use in their nutrition practice. Attendance is free to Research DPG members and $25.00 for non-members. If not a member, join the Research DPG to receive the member rate. Registration required. Please go to www.eatright.org/dpgevents to register.

- **Research DPG Member Breakfast**
  - **When:** Monday, October 20, 7 – 8:30 am
  - **Where:** Omni at CNN Center, Dogwood Room

  Enjoy breakfast, learn about new activities of the DPG and 2014 RDPG award winners, and catch up with acquaintances and connect with new colleagues.

- **Research DPG Showcase, Level 3 Foyer, Booth 10, Georgia World Congress Center**
  - **When:** Monday, October 20, 9:30 am – 12:30 pm
  - **Where:** Georgia World Congress Center, Level 3 Foyer, Booth 10

  Stop by to meet Research DPG Executive Committee Members and learn about ways to become involved in the Research DPG.

Register and learn more about FNCE at www.eatright.org/fnce.

Our Executive Committee is committed to continuing activities and collaborations that enhance the relevance and visibility of the Research DPG and, more important, benefit the members. I welcome suggestions of potential ways we can serve you better.
The 2014-2015 year is off to a great start! The RDPG has several projects underway. Hectic schedules make it difficult to stay up-to-date and informed. Luckily, the RDPG has several avenues such as the RDPG website to let you know what is happening.

The Website committee, headed by Liz Parker, has been busy updating the website. Check it out! The URL is http://www.researchdp.org/. This is a great place to find current information. Our long term goal is to make the email blasts shorter and utilize the website to provide the detailed information about things that are happening. If you have not been to the website, you will find lots of Research Practice Group information available. For example, the current version of The Digest plus many earlier versions are available in the “Members Area.” To enter, click the words “Sign In” on the green tab in the top right corner of the home page. Then type your Academy member number in the box labelled “Username” and your Academy password in the box labelled “Password.” More changes are planned - so stay tuned and keep visiting the website. If you have ideas or suggestions on what should or should not be included on the website, send me an email at lbyterley@msn.com. I’ll be glad to pass along your comments and suggestions.

The Digest contains lots of RDPG-related information. We have a new editor for The Digest, Ginger Quick. She is always looking for articles and tidbits of useful information related to research to include in the Digest. The main article is peer-reviewed so this is a great way to get a peer-reviewed publication. Student articles are also encouraged. The Digest is published four times a year (i.e., January, April, July and October). Often the main article is available for continuing education (CPE) credit, which is great way to get CPE credit.

Come meet new colleagues or renew old acquaintances by joining us at this year’s FNCE in Atlanta. Several fun events are planned. On Saturday, we will host a pre-conference workshop titled: “National Dietary Data: Building Blocks to Expand Your Research Portfolio”. On Monday the RDPG has two events, the member breakfast and the member showcase. At the breakfast, our student award winners will be introduced. This award is sponsored by DuPont Nutrition and Health. All these events are free to RDPG members. I look forward to seeing you in Atlanta!

Finally, don’t forget about the electronic mailing list and LinkedIn. These are two other avenues to stay connected with other RDPG members.

Notes from the Secretary’s Desk…

Lauri O. Byerley, PhD, RDN, LDN
Ms. Betty E. Darnell, MS, RD, LD, FAND is the Director of Nutrition Research, at the Clinical Research Unit (CRU), a Clinical and Translational Science Awards (CTSA) center at the University of Alabama at Birmingham. As director of the Bionutrition Research Unit of the CRU, she supervises staff of the metabolic kitchen, works with investigators who utilize the research unit, and works with research participants who consume research diets. The Bionutrition Research Unit supports numerous research protocols encompassing volunteers of all age groups and many different diagnoses, as well as normal control volunteers for research studies. Read below to learn about Ms. Darnell’s exciting career in nutrition research that spans nearly four decades.

Ms. Darnell, please tell us about your background. How did you get to where you are now?

I completed a Master of Science degree in nutrition and accepted my first job as a research dietitian at the new National Institutes of Health (NIH)-funded General Clinical Research Center (GCRC) at the University of Kentucky. After leaving that first job to be closer to my family, I accepted a position teaching nutrition at the University of Alabama in Tuscaloosa for seven years. While I was on maternity leave with my second child, University of Alabama Birmingham (UAB) called; they had learned of my background in research and had been without a research dietitian for almost a year. The director wanted to start a major nutrition research protocol, so at first I took the job part-time but then became a full-time researcher and have stayed on at UAB since 1977. During my time here I have seen the ending of the GCRC program at NIH and the beginnings of the CTSA program.

Could you please summarize your current research for us?

Our team at CTSA has been conducting obesity research for the last 30 years. When one NIH-funded study is finished, we have been successful in building on that study and obtaining continued funding. Our research has evolved over the years, and we now have several protocols that focus on insulin sensitivity, obesity, diabetes, and body composition. I have personally performed several thousand anthropometric assessments over the years for these studies, some on the same participants yearly for multiple years.

In other studies, we are comparing a standard diet to a controlled carbohydrate diet in order to test the efficacy of a reduced carbohydrate diet in improving metabolic outcomes and achieving weight loss in an overweight pediatric population. We have also begun a series of protocols with advanced glycation end products (AGEs); AGEs in foods are known to contribute to increased oxidation and inflammation, which are linked to the recent epidemics of diabetes and cardiovascular disease. Finally, we are also looking at phosphate additives and the relation to inflammation in renal disease.

How did you become involved/interested in your current line of research?

My goal as director of nutrition research for the CRU is to facilitate the research of investigators throughout the university. The investigator who began the obesity studies came to me with a suggestion for a controlled feeding study using a commercial formula with sodium and potassium tablets added to achieve the desired composition. Since this was a weight loss study, I suggested we could use food instead of a purchased formula. That interaction began a long, successful working relationship that continues today. I have worked closely with many investigators and have served as co-investigator on several research protocols throughout the years. The CRU has been an ideal setting for many of these studies as we provide special diets for the participants on controlled feeding studies. Throughout the years, we have established a reputation for our willingness to help young investigators with their research and are continuing to begin new and exciting research protocols on our unit.

Ms. Darnell, what advice would you give to a young researcher for developing a successful line of research?

For the last several years, we have offered graduate nutrition traineeships on the GCRC and now CRU for both master’s and doctoral students in nutrition. These traineeships were funded by a series of cookbooks that I co-authored and were published by Oxmoor House: Cookbook for Diabetics and Their Families, All New Cookbook for Diabetics and Their Families, and Complete Cookbook for Diabetics and Their Families. The books were extremely successful, so we used the small royalty fee we got to fund the traineeship, along with many other items/activities/supplies on the CRU. We have funded a total of 29 master’s students and 6 PhD students in order for them to complete their graduate studies. We currently have one master’s student and one PhD student with us.

As a research mentor to the trainees, I saw many get excited about their area of research, and these students have completed their PhD degrees and post-
doctoral fellowships. So, it is important for a young investigator to seek out an area of research they can be passionate about. Then, they often find that area of interest which subsequently opens doors to other opportunities. Also, each of the students with whom I have worked developed excellent writing skills during their research experience and have been successful in publishing, which is crucial as a researcher.

**What are your career goals?**

Retirement years are approaching, so I would like to finish the current research protocols that we are now conducting. Since I have trained numerous dietitians who are now involved in research, some at CRUs and others who work with individual investigators, I would like to see one of the people I have trained step into my position when I retire.

**How has your affiliation with the Academy impacted your career progression?**

I have been associated with the Academy for many years and continue to believe it is an important organization for anyone in the nutrition/dietetics field. I applied and became a Fellow of the American Dietetic Association (FADA) and am now a FAND. I feel this fellowship has benefited me in my career as a researcher.

Ms. Darnell, if someone were to ask you to explain why research is important to the field of dietetics, what would you say?

I have been involved over the years with clinical research. Research is vital to the field of dietetics/nutrition. For example, clinical research is important in the study of the etiology of human obesity. Although epidemiology and basic studies may provide a strong indication of important mechanisms in the prevention of obesity, clinical studies also can provide strong evidence. Animal studies and basic science studies provide the foundation for clinical studies, as well as the models on which clinical studies are based. No single class of research can stand by itself. Rather, all three types of research—clinical, animal, and basic—are required before we can understand the etiology and treatment of obesity.

Clinical research is usually considered the “gold standard” of research and can influence a change in our practice and improve current treatments. Clinical nutrition studies give us the opportunity to create new diagnostics, therapeutics, and prevention strategies for the public. Through 38 years in my position at the CRU, I have been involved with research that is on the cutting-edge of some of the most exciting clinical discoveries today.
I have been busy becoming familiar with the Treasurer position, including the new online expense report system. The new fiscal year began on June 1st and if you have any ideas for the upcoming fiscal year, feel free to email me at EJReverri@gmail.com.

Membership continues to drive the income for the Research DPG. The reserve of 146% keeps the Research DPG in good financial standing. The most recent expenses include postage for training materials, website maintenance by DevBridge, The Digest Summer lead article, FNCE stipend for four executive committee members, and intercall conference fee.

Projected expenses will include several FNCE related expenses, including for the Research DPG Member Breakfast on Monday, October 20th from 7-8:30am in the Omni at the CNN Center in the Dogwood Room. Hope to see you there!

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| Reserve                      | July 2014 Reserve    | 41,383                   |
Calcium is a mineral essential for bone, muscle, and nerve function as well as hormonal and enzymatic activity. The Recommended Dietary Allowance (RDA) for calcium ranges from 1,000-2,000 mg per day for adults, dependent on age and gender or if pregnant/lactating. Within the American diet, dairy sources are the most significant contributors of calcium. However, calcium is also available in substantial amounts from non-dairy sources, such as leafy green vegetables and fortified foods.

The adult human body functions at a calcium balance of zero: all excess calcium is stored in the bone or excreted; inadequate calcium intake will decrease the excretory calcium losses and may be reabsorbed from bone in times of need. Retention and excretion are dependent on dietary intake. Calcium absorption occurs in the duodenum and the jejunum via active transport or through passive diffusion in the ileum and large intestine. Fractional absorption is determined by calculating the ratio between oral intake and venous calcium following consumption of the stable Ca$^{45}$ isotope-labeled food source. Cows milk has been shown to contain almost a third of the daily requirement for calcium of most healthy individuals (300 mg) and displays high fractional absorption (32.1%). Fractional absorption of calcium can be reduced by co-ingestion of other nutrients such as protein, phosphorus, fat, sodium, and vitamin D. Common constituents of plant products such as phytates, oxalates, and fiber have also been shown to reduce calcium absorption, supporting the hypothesis that calcium from leafy greens is less absorbed than calcium from milk.

Spinach was one of the first leafy green vegetables to be compared to milk for the study of calcium absorption. In an early study by McLaughlin, seven healthy women consumed a diet in which 79% of the calcium was provided from milk for the first seven days, and in the following six days, spinach provided 73% of dietary calcium. Lower absorption was found with the spinach diet (0.042 g) compared to milk (0.097 g), even though on average the spinach diet provided more oral calcium (0.509 g) than the milk diet (0.493 g). This was one of the first studies to conclude that calcium absorption was possible from non-dairy sources as the mere retention of calcium from spinach indicated partial absorption despite factors such as fiber and oxalate content. Heaney, Weaver, & Recker (1988) further investigated the absorption of calcium from spinach compared to milk through a randomized, crossover study with direct assessment measures of isotope-labeled food sources. The calcium load for both sources was 200 mg; the absorption of calcium from spinach compared to milk through a randomized, crossover study with direct assessment measures of isotope-labeled food sources. The calcium load for both sources was 200 mg; the absorption of calcium from spinach and milk averaged 0.051 and 0.276, respectively. The spinach test meal was determined to contain a 477.5 mg load of oxalate, which was presumed to negatively affect the calcium absorption. The relationship between oxalate content and calcium absorption was expanded further in a study by Heaney and Weaver (1989). Calcium oxalate and 2% milk were given as the calcium sources. The fractional absorption from milk was determined to be 0.358, compared to 0.100 from calcium oxalate. Despite providing the same amount of calcium load within test meals (200 mg), the fractional absorption in this study was shown to be greater than reported in the earlier study by Heaney, Weaver, & Recker (1988); more research in this area is needed to determine an explanation for this occurrence.

The impact of oxalate content in spinach was also hypothesized to impact calcium absorption in a study by Poneros-Schnieier and Erdman (1989), which compared the bioavailability of calcium in rats from sesame seeds, almond powder, whole wheat bread, spinach, and nonfat dry milk. As presumed, spinach was the food source found to have the least amount of absorbable calcium, followed by sesame seeds, almond powder, and whole wheat bread. However, the authors questioned the particular action of the chemical structure of spinach in relation to calcium absorption, as an earlier study found that chocolate, which also contains oxalate, did not impair calcium absorption in rats. It is reasonable to hypothesize that the fiber content of the spinach may have negatively impacted the calcium bioavailability of the food. However other studies have shown that low-oxalate, high-fiber vegetables do not exhibit this effect. Heaney and Weaver (1990) used similar methods from their earlier study (1988) by using isotope-labeled kale and milk to compare differences in absorption.
The aforementioned research was the foundation for the now-accepted conclusion that calcium absorption is inversely proportional to oxalate content in food, including vegetables; kale specifically has been found to provide a significant amount of absorbable calcium. This is notable as it can be a challenge to meet calcium needs from diet alone when meat and dairy are excluded, as is the case with ovo-vegetarians, vegans, and individuals with lactose intolerance or milk protein allergies. The research has also been hypothesized to hold external validity to include other leafy, green, low-oxalate vegetables; however, other dietary factors could impact calcium absorption such as total protein or total oxalate intake. Future research is now being focused on the cellular level of plant composition in relation to calcium content and absorbability.

Complete dietary composition should be taken into account in future studies. Non-dairy sources of calcium provide more fiber and less cholesterol and total fat than their counterparts; however, a serving of most milk products provides a complete source of most vitamins and minerals including riboflavin, zinc, vitamin B12, vitamin A, thiamin, phosporus, magnesium, potassium, and, of course, calcium. Dairy products are also less expensive than green leafy vegetables when cost per unit of estimated absorbable calcium is calculated. One cup of milk contains 300 mg of calcium and 96.3 mg are absorbed, which is greater than the calcium absorbed in a ½ cup serving of spinach (5.9 mg) and kale (30.1 mg). To absorb the amount of calcium equivalent to a cup of milk, an individual would need to consume 3.2 cups of kale or 16.3 cups of spinach. At this time, it is not appropriate to recommend leafy green vegetables as a superior calcium source to dairy for the aforementioned factors, as well as the lack of research.

It is important to consider alternative calcium sources to allow for optimal calcium intake in individuals with special diets or taste preferences. Given vegetable sources have a much less absorbable amount of calcium compared to dairy sources, it is recommended that those avoiding dairy products meet their calcium needs through supplementation. Absorption from calcium supplements is similar to that of milk - typically between 30%-40% (Table 1). Dietary intake of other foods in combination can decrease calcium absorption from calcium supplements, thus dairy products remain the preferred source for calcium due to the high absorbability with the least likelihood for inhibition by other factors.

### Table 1. Fractional Absorption (%) of Calcium-Containing Foods and Supplements (Adapted from Weaver & Heany (1999) and Weaver & Plawecki (1994))

<table>
<thead>
<tr>
<th>Food</th>
<th>Serving Sizes (g)</th>
<th>Fractional Absorption (%)</th>
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</thead>
<tbody>
<tr>
<td>Spinach</td>
<td>90 g</td>
<td>5.1</td>
</tr>
<tr>
<td>Calcium oxalate</td>
<td>2-3 g</td>
<td>10.2</td>
</tr>
<tr>
<td>Calcium citrate</td>
<td>2-3 g</td>
<td>24.2</td>
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<tr>
<td>Calcium carbonate</td>
<td>2-3 g</td>
<td>29.6</td>
</tr>
<tr>
<td>Milk</td>
<td>240 g</td>
<td>32.1</td>
</tr>
<tr>
<td>Calcium malate</td>
<td>2-3 g</td>
<td>36.3</td>
</tr>
<tr>
<td>Kale</td>
<td>65 g</td>
<td>58.8</td>
</tr>
</tbody>
</table>

Load of the kale and milk test meals were 288 mg and 312 mg, respectively. Blood samples were taken five hours after the test load was ingested and resulted in a fractional absorption of calcium from kale of 0.409 and 0.321 from milk. The fractional absorption of calcium from kale reported in this study is significantly greater than that reported from milk and from the fractional absorption amounts reported in the aforementioned studies; however, the authors note that the mean fractional absorption from kale displayed a confidence interval that overlapped the fractional absorption range of calcium from milk. Hence, kale may not be a superior source of calcium in comparison to milk, but calcium absorption between the two sources is comparable. As reported by Heaney and Weaver (1990), the findings from this study can be applied to other leafy, green, low-oxalate vegetables within the Brassica oleracea class. This includes other varieties of kale, collards, broccoli, and cabbage which also have sources of calcium, but more research is needed to make this claim.

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Website Committee Report

Elizabeth Parker
Website Committee Chair, Research DPG 2014-2015

This year one of our initiatives of the RDPG is to enhance the website so that it will be a more valuable resource for you as a member. To begin this process, we appointed a Website Committee which I am chairing, and through coordination with our RDPG Chair, Alanna Moshfegh, and Website Committee members, Karin Pennington, Chris Taylor, and Janet Roseland, we are currently in the process of updating the website content. I encourage you to check our website regularly for information about RDPG announcements and events, including information about the upcoming events at FNCE 2014. You can visit our website here: http://www.researchdpg.org/

House of Delegates (HOD) Report

Mara Vitolins, DrPh, RD
Wake Forest School of Medicine

The Fall 2014 Backgrounder and Supporting Materials for the House of Delegates meeting have been posted on the eatright website (www.eatright.org/hod). The topic is "Business and Management Skill" and the information available on the website includes the meeting agenda, backgrounder, executive summary, fact sheet, and member feedback form.

Feedback needed!
The House of Delegates will discuss this Mega Issue Question: How can Academy members utilize, expand and sustain business and management skills to take advantage of current and emerging professional opportunities?

Think about this question - What is the value of business and management skills in your area of practice?
Please email your responses to Mara Vitolins at mvitolin@wakehealth.edu (Research DPG HOD Delegate) by no later than October 10, 2014.

See you in Atlanta!
Upcoming Conferences

October 11-14, 2014
American Academy of Pediatrics National Conference & Exhibition
(San Diego, CA)
Call for abstracts: Closed
Website: http://www.aapexperience.org/

October 18-21, 2014
Food & Nutrition Conference & Expo™
(Atlanta, GA)
Call for abstracts: Closed
Website: http://www.eatright.org/fnce/abstractsubmission/

November 2-7, 2014
Obesity Society Annual Scientific Meeting
(Boston, MA)
Call for abstracts: Closed
Website: http://www.obesityweek.com

December 4-6, 2014
ASN Advances and Controversies in Clinical Nutrition
(National Harbor, MD)
Call for abstracts: Closed
Website: http://www.nutrition.org/meetings/advances-and-controversies-in-clinical-nutrition-2014/

March 18-21, 2015
Society of Adolescent Medicine and Health Annual Meeting
(Los Angeles, CA)
Call for abstracts: TBD
Website: http://www.adolescenthealth.org/Meetings/Future-Meetings.aspx

March 18-20, 2015
International Conference on Eating Disorders
(London, UK)
Call for abstracts: Closed
Website: http://www.mahealthcarevents.co.uk/cgi-bin/go.pl/conferences/detail.html?conference_uid=408

April 16-19, 2015
Women’s Health 2015: The 23rd Annual Congress
(Washington, DC)
Call for abstracts: Open
Website: http://academyofwomenhealth.org/conference/

March 28-April 1, 2015
Experimental Biology
(San Diego, CA)
Call for abstracts: Open until November 6, 2014
Website: http://experimentalbiology.org/2015/Coming-Soon.aspx

June 3-6, 2015
Annual Meeting of the International Society of Behavioral Nutrition & Physical Activity
(Edinburgh, Scotland)
Call for abstracts: Opens- October 31, 2014
Closes- December 5, 2014
Late breaking from December 12 to March 27, 2015
Website: http://www.isbnpa2015.org/

Get Involved in Research that Matters

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

Join the DPBRN and be part of a network committed to improving patient and client outcomes.

You're invited to join the DPBRN!

Learn how by visiting www.eatright.org/members/dpbrn.

Dietetics Practice Based Research Network – Advancing dietetics through outcomes research.
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