Atherosclerosis, Functional Foods, and Nutritional Genomics

Micheline Vargas, DrPH, RCEP
Nutrilite Health Institute
Research Scientist: Nutrition Investigation

Introduction
The leading cause of mortality in both men and women in the United States is cardiovascular disease (CVD) due to atherosclerosis. Atherosclerosis involves chronic inflammation and a progressive build-up of lipids and fibrous elements in the arterial walls. It begins with the formation of “fatty streaks”. Fatty streaks can be found in the aorta by 10 years of age, in the coronary arteries by age 20, and in the cerebral vasculature by the age of 40. Early intervention is imperative. Preventive interventions focused on managing cholesterol, blood pressure, and weight, have been found to favorably alter atherosclerotic progression. Unfortunately, less than 50% of the cardiovascular events are prevented in the treatment groups of the most successful clinical trials. In fact, most myocardial infarctions (MI) occur in individuals with normal cholesterol levels. Greater focus on contributing factors (i.e., inflammation) involved in the atherosclerotic disease process may be helpful in preventing cardiovascular events. Biological data now demonstrate that most MIs occur after atherosclerotic plaque rupture and thrombosis (clot) formation. Inflammation can threaten plaque stability and increase its propensity to rupture and in turn cause thromboses that trigger a cardiovascular event. Approximately two-thirds to three-quarters of all fatal coronary thromboses are due to rupture of the fibrous cap. Autopsies show that rupture is more likely to occur in plaques with a soft lipid core and a thin inflamed fibrous cap. Therefore, the contributing factors that lead to the lipid core and inflamed cap need to be addressed in an intervention. Nutrition therapy can play an integral role in the prevention of atherosclerosis and should aim to reduce contributing factors such as low density lipoprotein cholesterol (LDL-C) deposition, LDL-C oxidation, and chronic inflammation. Nutrition plays a key role in reducing risk of CVD in populations. Individuals, however, differ significantly in the degree to which beneficial changes occur. This individual response is likely due to differences in genetic makeup, known also as genotype. Only recently have medical researchers begun to understand how variations in genes affect an individual’s health. Personalized nutrition, or “nutritional genomics”, uses an individual’s unique genetic makeup to make recommendations that will potentially reduce risk for diseases and/or more effectively manage diseases such as atherosclerosis.

This article will review the importance of nutrition in reducing risk for atherosclerosis. Specifically it will: 1) review the atherosclerotic process, 2) review heart healthy guidelines, 3) discuss how functional foods may modulate atherosclerosis and CVD risk, and 4) briefly touch on the role of nutritional genomics, as it relates to the atherosclerotic disease process and CVD.

Review of the Atherosclerotic Disease Process
Chronic inflammation of the arterial wall is a well-established theory in the atherosclerotic disease process. Advances in basic and experimental science have established that inflammation is involved in mediating all stages of this disease from initiation through progression and, ultimately, to atherosclerotic plaque rupture. These findings not only enhance one’s understanding of atherosclerosis, but also aid in more appropriate targeting of therapy. Preventive therapies (i.e., dietary) that reduce chronic inflammation also appear to reduce the risk of CVD.

The atherosclerotic disease process will be described in the steps and figures below as it is the basis for dietary treatment approaches. Injury to the arterial wall, which may be due to one or more risk factor(s) (i.e., hypertension, smoking, etc.), triggers an inflammatory cascade. Once injured, the endothelium (layer of cells that line the inside of the artery) will express adhesion molecules such as: selectins (E, P, L); vascular cellular adhesion molecule -1 (VCAM-1), intracellular adhesion molecule-1 (ICAM-1), and integrins. Adhesion molecules facilitate monocyte continued on page 23
Welcome to Fall and the anticipation of the annual Food & Nutrition Conference & Expo in Denver, CO. I look forward to seeing many of you there. It promises to be an exciting time with many excellent presentations and numerous offerings by YOUR Dietitians in Integrative and Functional Medicine Dietetic Practice Group (DIFM DPG). There will be much to share with members at the DPG Showcase and Product Market Place. I will be at both booths during FNCE and I hope that you will stop and let me know your thoughts on the first electronic newsletter offering from summer. I also hope that many of you will offer to assist with the newsletter, either as author, resource reviewer, or in any other capacity that might be available – newsletter or DPG related.

As you have seen by the new masthead for the newsletter and information contained in several pieces herein, our name has changed to reflect more of what our practice group has evolved into – Dietitians in Integrative and Functional Medicine. This is a name more fitting to the broad expanse of nutrition related practices that our members are interested and involved in. I hope that all of you will welcome the new name and our continued direction towards incorporating nutrition care in integrative and functional medicine.

As always, I welcome your comments regarding the newsletter or offers to author or assist at peaknut@cascadeaccess.com or in person at FNCE in Denver, CO in October. Hope to hear from you soon!

--

Editor’s Notes:
Sarah Harding Laidlaw, MS, RD, MPA, CDE

---

Dietitians in Integrative and Functional Medicine Award Winners

Excellence in Service

Rick Hall, MS, RD, is a founding member of NCC and has been a part of dietetic practice group since its initial planning stages during the inaugural year. He has served NCC and its members through the development and maintenance of its website and he served three years on the executive committee during his stint as the DPG chair.

Rick has been appointed to many working groups with NCC and with the American Dietetic Association. He is currently one of the foundational members of the ADA’s Council for Future Practice – a role he was appointed to by the House of Delegates and is currently working with a subgroup of the Council for Future Practice on a career guide for dietitians and dietetic technicians in every type of practice.

Rick holds a master’s degree in human nutrition and is on faculty in the nutrition program at Arizona State University. He is completing his PhD from the child nutrition academy at Iowa State University.

Excellence in Practice

L. Kathleen Mahan, RD, MS, CDE has been a co-author of Krause’s Food and Nutrition and Therapy for over a quarter of a century. The most recent 12th edition of this classic text was published in 2008. When she is not working on a revision of the text she can be found in her office Nutrition by Design, Inc., (www.nutritiondesign.com) counseling patients both young and old on how to meet their nutritional needs or change their diets to maintain health and prevent or manage disease.

Kathleen specializes in working with children, an interest which grew out of her previous work with the Pediatric Pulmonary Center, a program of Children’s Hospital and Medical Center and the Department of Pediatrics, University of Washington School of Medicine in Seattle, Washington. She is also a member of the newly formed Nutrition Advisory Board of the Institute of Functional Medicine, which has the purpose of integrating clinical nutrition into a functional medicine approach to health care.

The views expressed in this newsletter are those of the authors and do not necessarily reflect the policies and/or official positions of the American Dietetic Association.

We invite you to submit articles, news and comments. Contact us for author guidelines.

Send change-of-address notification to the American Dietetic Association, 120 South Riverside Plaza, Ste. 2000, Chicago, IL 60606-6995.

Copyright © 2009 Dietitians in Integrative and Functional Medicine, a Dietetic Practice Group of the American Dietetic Association. All material appearing in this newsletter is covered by copyright law and may be photocopied or otherwise reproduced for noncommercial scientific or educational purposes only, provided the source is acknowledged. For all other purposes, the written consent of the editor is required.

Annual Subscription Rates (payable in U.S. funds):
Individuals ineligible for ADA membership ................................................................. $40/year
ADA membership ...................................................................................................... $30/year
Student Members ...................................................................................................... $15/year

For international orders, add $5 shipping and handling for the printed issue available in the fall. Make checks payable to DIFM DPG/I18 and mail to the Treasurer. See back cover for address. ISSN 1524-5209

Page 21
Fall 2009 Volume 12, Issue 2
www.integrativeRD.com
Chair’s Corner:
Kathie Swift, MS, RD, LDN

“The primary and most beautiful of nature’s qualities is motion”
Marquis de Sade

As fall embraces us in its changing landscape, nature reminds us of the power of change. It is with great excitement that we welcome a new era of motion as we transition our practice group from a worthy name that served us well, Nutrition in Complementary Care, to a new name that remains grounded in a solid foundation of holistic health care and reflects our clear identity in the national and world communities of integrative and functional medicine: Dietitians in Integrative and Functional Medicine!

I would like to share with you a brief recap of the history and evolution of this change. After serious deliberation and debate about our Strategic Plan at the Executive Committee Spring Leadership Retreat, coupled with consideration of our desire to advance our members as credible and trusted practitioners in integrative and functional medicine, we proposed to you, our members, some suggested name changes. We tallied your votes and submitted the top choice, Dietitians in Integrative and Functional Medicine, along with our Vision and Mission proposal to the ADA Board of Directors (BOD) for approval. The BOD approved our name, vision, and mission as follows:

**Name:** Dietitians in Integrative and Functional Medicine

**Vision:** Optimize health and healing through integrative medical nutrition practices.

**Mission:** Empower members to be leaders in evidence-based practice including personalized genomics, holistic healthcare, and functional nutrition therapies.

Creating this vision of practice requires each of us to think outside traditional roles, challenge ourselves to learn and embrace progress in science, technology, and diagnostics, and apply these in practice. Our new name, vision, and mission must effectively communicate the scope of our practice within the ADA, the healthcare community, and the patients and consumers who seek our expertise. As I write this column, I want to assure you that behind the scenes there is a dedicated task force of committed individuals working on Standards of Practice and Standards of Professional Performance for our members, to ensure your rightful position as an expert practitioner in the integrative healthcare community. Your Executive Committee is also committed to establishing further strategic networks and alliances to provide members with continuing educational opportunities and resources to expand our knowledge and professional practice in integrative, holistic, and functional medicine.

Many of you may also be aware that there is a growing contingency of individuals who do not have the RD credential but are interested in practicing as integrative nutrition counselors or holistic health counselors. A number of non-accredited online courses, certifications and weekend programs are available to meet this mounting demand. It is our hope that by establishing Dietitians in Integrative and Functional Medicine, we will strengthen our brand to be the respected, trusted, evidence-based practice group in the emerging field of integrative nutrition and functional medicine.

The seeds of change now planted can bring abundance, growth, and transformation. Dietitians in Integrative and Functional Medicine signifies a rebirth of our practice group. Let’s move forward in curious anticipation of the opportunities and possibilities. I welcome your participation in this movement!

Live the day!

Kathie

---

“SNiP” Update – Celiac Disease or Gluten Intolerance?

Colleen Fogarty Draper, MS, RD, LDN
Nutritional Genomics Director, Dietitians in Integrative and Function Medicine DPG

It is a commonly held misconception that we wake up one day and have a chronic disease. The reality is that the body goes through a period of progressive dysfunction, which if not rectified, ultimately results in a serious problem. An example of this would be celiac disease, an inherited, lifelong intolerance to gluten that is diagnosable only after a progressive continuum of gluten intolerance. Diagnosis involves serologic antibody screening and a small bowel biopsy to evaluate crypt hyperplasia and villous atrophy. Unfortunately, these diagnostic tests for celiac disease may represent the extreme state of progressive gluten intolerance and may not be reliable indicators that an individual’s immune system has started launching an autoimmune response to the presence of gluten. Therefore, some individuals with varying symptoms of gluten intolerance have negative antibody and small biopsy test results. Others try a gluten-free diet and feel better before testing for celiac disease.

Once a gluten-free diet is initiated, the presence of detectable serum antibodies and signs of intestinal villous atrophy are eliminated. Therefore, the opportunity for a celiac disease diagnosis is also eliminated. Additionally, since celiac disease and gluten sensitivity are inherited, questions often arise about other family members in terms of their health issues and susceptibilities.

One solution to these dilemmas is a predictive genetic test for celiac/gluten genetic susceptibility. HLA DQ2 and HLA DQ8 are genetic markers for celiac disease present in 40% of the general population and 97% of celiac sufferers. Approximately 1% of the general population has been diagnosed with celiac disease, which leaves another 39% of the population that is susceptible, but not predetermined to develop the disease. Based on the dysfunction to chronic disease continuum, there is a subset of this 39% that has already developed gluten intolerance, which if goes untreated may ultimately result in celiac disease.

Communications Department
Source: Nutrilite Health Institute

Figure 1: Recruitment of Blood Monocytes
Source: Nutrilite Health Institute Communications Department

Monocyte, now in the subendothelial space, can directly influence the endothelium by secreting growth factors, chemotactic substances, and cytokines (signaling molecules involved in cellular communication).

Once in the subendothelial space, monocytes differentiate into macrophages. Activated macrophages express cytokines such as tumor necrosis factor alpha (TNF-α) and interleukin-1 Beta (IL-1β). These inflammatory cytokines further stimulate endothelial cells to express adhesion molecules (i.e., VCAM-1, ICAM-1) as well as additional proinflammatory cytokines. An inflammatory cycle is created.

LDL-C infiltrates the extracellular matrix of the subendothelial space via passive diffusion and the action of specific receptors. Elevated serum concentrations of LDL-C, along with proinflammatory cytokines, enhance this process. The trapped LDL-C becomes exposed to reactive oxygen species (ROS) and undergoes oxidation.

Oxidation of LDL-C is a major physiological mechanism behind the pathophysiology of atherosclerosis. The oxidized LDL-C (ox-LDL-C) is a powerful inducer of inflammatory molecules. It can initiate and promote proinflammatory responses within the artery wall. The ox-LDL-C can induce chemoattractants such as IL-8 and TNF-α. These chemoattractants will recruit more monocytes to the arterial wall which will be bound to the artery wall by adhesion molecules. The ox-LDL-C will stimulate the differentiation of monocytes into macrophages by inducing macrophage colony-stimulating factor (M-CSF).

Macrophages express scavenger receptors, which gives them the ability to “scavenge” or ingest the ox-LDL-C. The scavenger receptors are up-regulated by proinflammatory cytokines. The uptake of ox-LDL-C by the macrophages results in “foam cells,” a hallmark of atherosclerosis. The foam cells die and form the soft lipid core of the atherogenic plaque.

Figure 2: Modified LDL-C Stimulates Chemoattractants from Endothelial Cells
Source: Nutrilite Health Institute Communications Department

Figure 3: Monocytes Differentiate into Macrophages
Source: Nutrilite Health Institute Communications Department

Cytokines released from foam cells and macrophages stimulate smooth muscle cells to migrate to the intima. The intima is the innermost layer of the artery wall. The fibrous cap that covers the soft lipid core is created by the smooth muscle cells and extracellular matrix secretion. Cell proliferation is directly stimulated by cytokines and growth factors from macrophages, interferon-gamma (IFN-γ) from T-cells, elevated homocysteine, and increased angiotensin II (a vasoconstrictor).

The vessel is further compromised by alterations in vasoactive substances. An imbalance between endothelial-derived vasodilating (i.e., nitric oxide) and vasoconstricting substances (i.e., endothelin-1, angiotensin) impairs regulation of vascular tone. Normally, nitric oxide (NO) inhibits leukocyte adhesion, helps maintain non-proliferative vascular smooth muscle, and limits platelet aggregation. As production or availability of NO is diminished, its ability to protect against vascular injury, inflammation, and thrombosis is diminished.

As the process continues, macrophages and foam cells release fibrogenic mediators (i.e., peptide growth factors). These mediators can promote smooth muscle cell (SMC) replication and contribute to proliferation and production of dense extracellular matrix, creating a fibrous cap. IL-8, which is present in macrophage dense areas of the atheroma, can also induce proliferation and migration of SMC.

The vascular smooth muscle cells (VSMC) that accumulate in the intima play a key role in the development of the arterial lesion. These cells synthesize collagen that stabilizes the fibrous cap. However, as the lesion progresses VSMC apoptosis occurs, contributing to plaque vulnerability.

As the atherosclerotic disease process continues, the plaque becomes more unstable. Foam cells and macrophages produce metalloproteinases that contribute to matrix degradation. As the proteolytic enzymes degrade the collagen in the fibrous cap, it becomes thin, weak, and susceptible to rupture. T-lymphocytes are also involved in the
Atherosclerosis, Functional Foods, and Nutritional Genomics

degradation of the fibrous cap. They produce IFN-γ, which can halt the synthesis of collagen by the SMC, thereby limiting the renewal of collagen and increasing susceptibility of the fibrous cap to rupture.5,12

Once the plaque has been disrupted excessive apoptosis of the VSMCs can increase thrombogenicity.5,16 The VSMCs produce active thrombin, which activates platelet adherence.12 Macrophages produce tissue factor, which is a major procoagulant and can trigger thrombosis. Thrombus formation can lead to vessel occlusion and trigger a cardiovascular event (i.e., MI).5

Inflammation and Adipose Tissue

Adipose tissue plays an important role in the atherosclerotic disease process. Although it will not be discussed in detail, it has been briefly addressed because of its contributing role in the inflammatory and atherosclerotic disease processes.

Maintaining a healthy body weight, specifically maintaining a healthy body composition, is important in the prevention and treatment of atherosclerosis. Obesity has long been considered a risk factor for CVD, due in part, to adipocyte secretion of cytokines that induce a proinflammatory state.

It is now recognized that adipose tissue functions in part as an endocrine organ.14 It secretes many immunomodulatory factors and sends inflammatory signals.15 Elevated concentrations of TNF-α and IL-6 have been found in obese subjects.16 This proinflammatory state may contribute to the atherosclerotic disease process. Dietary interventions that aid in body fat reduction may reduce proinflammatory cytokines and the inflammatory response. This may in turn reduce atherosclerotic disease risk.

General Nutrition Recommendations

Basic heart healthy dietary practices should be encouraged. The National Cholesterol Education Program (NCEP) has developed dietary guidelines (Table 1) for individuals with elevated cholesterol, those at risk for cardiovascular disease, or those with known cardiovascular disease. It should be noted that these guidelines are undergoing a revision and should be available in 2010. The goal of the current guidelines is to decrease total cholesterol (TC) and LDL-C levels, while maintaining or increasing high density lipoprotein cholesterol (HDL-C) level. Desirable/optimal levels of TC, LDL-C, and HDL-C can be found in Table 2. The following basic principles should be adhered to:1

- Eat a variety of fruits, vegetables, and whole grain or high fiber foods.
- Minimize the intake of salt and sugary foods and beverages.
- Dairy products should be fat-free or low-fat.
- Legumes, lean meats, and poultry without the skin are good protein choices. Soy protein may be used to replace some animal protein.
- Fatty fish (i.e., salmon, tuna, mackerel, sardines) should be consumed at least twice per week.
- Saturated fat found in butter, cheese, and animal fat should be limited.
- Trans fat, in processed snacks and sweets should make up less than 1% of total calories.
- The majority of dietary fat should come from monounsaturated and polyunsaturated fats such as nuts, seeds, fish, and vegetable oils.
- Most people should limit cholesterol intake to less than 300 mg per day.
- If the LDL-C level is over 100 mg/dL or the individual has heart disease, cholesterol intake should be less than 200 milligrams a day and the individual should follow the “Therapeutic Lifestyle Changes (TLC)” diet created by the NCEP (Table 1).
- Maintain a healthy body weight and body composition.
- The use of functional foods and the support of nutritional genomics can further strengthen the basic dietary intervention.

The Role of Nutrition and Functional Foods

Evidence suggests that dietary factors play an important role in the prevention and treatment of atherosclerosis. Nutritional therapies should target traditional cardiovascular disease risk factors (i.e., elevated cholesterol, hypertension, and obesity). This article will, however, focus on four key components in the atherosclerotic disease process: 1) LDL-C deposition, 2) oxidation of LDL-C, 3) inflammation, and 4) thrombosis. Functional foods appear to provide protection in each of these areas and can help tailor a diet to address the special needs of an individual.

What are Functional Foods?

Although there is not a legal definition of a functional food, the Institute of Medicine’s Food and Nutrition Board has defined functional food as “any food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains.”19,20 Generally speaking, functional foods have a positive impact on one’s health. These foods might, for example, aid in the prevention or treatment

Table 1: TLC Diet

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated Fat*</td>
<td>Less than 7% total calories</td>
</tr>
<tr>
<td>Polyunsaturated Fat</td>
<td>Up to 10% of total calories</td>
</tr>
<tr>
<td>Monounsaturated Fat</td>
<td>Up to 20% of total calories</td>
</tr>
<tr>
<td>Total Fat</td>
<td>25-35% of total calories</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>50-60% of total calories</td>
</tr>
<tr>
<td>Fiber</td>
<td>20-30 grams per day</td>
</tr>
<tr>
<td>Protein</td>
<td>Approximately 15% of total calories</td>
</tr>
<tr>
<td>Cholesterol*</td>
<td>Less than 200 mg per day</td>
</tr>
<tr>
<td>Plant Stanols/Sterols**</td>
<td>2 grams per day</td>
</tr>
<tr>
<td>Increased viscous (soluble) fiber**</td>
<td>10–25 grams per day</td>
</tr>
<tr>
<td>Total calories (energy)</td>
<td>Prevent weight gain - balance energy intake and expenditure</td>
</tr>
</tbody>
</table>

*LDL-raise nutrient **Therapeutic options for LDL-lowering Source: American Heart Association

Figure 5: Release of Fibrogenic Mediators and Plaque Rupture with Thrombosis

Source: Nutrilite Health Institute Communications Department
of a specific disease such as atherosclerosis. The health benefits or desirable physiological effects attributed to functional foods may be due to their biologically active components. Table 3 highlights functional foods or food components that are thought to have cardiovascular benefits. Selected functional foods and supplements will be discussed for their roles in reducing LDL-C deposition, LDL-C oxidation, inflammation, and/or thrombus formation (Table 4).

**Beyond the TLC: Functional Foods with Cardiovascular Benefits**

**Oats.** Oatmeal and oat bran have been widely studied for their cholesterol lowering capabilities. Statistically significant reductions in TC and LDL-C have been seen in hypercholesterolemic patients. Based upon a meta-analysis of 20 trials, the intake of 3 grams of soluble fiber (from oats) per day resulted in a 5-6 mg/dL reduction of plasma cholesterol in hypercholesterolemic subjects.2 This small reduction in plasma total cholesterol has been suggested to be clinically significant and likely to reduce risk for coronary heart disease by 27%.2 A health claim has been approved by the U.S. Food and Drug Administration (FDA) stating that soluble fiber from oat bran may reduce the risk of heart disease when added to a diet that is low in saturated fat and cholesterol. Beta glucan, a soluble fiber found in oat and barley products, is credited for the lipid lowering effects.

**Soy Protein.** Hypercholesterolemic patients that fortify their diets with soy protein are able to significantly lower TC and LDL-C.1 Evidence exists for the role of soy protein in reducing blood cholesterol.24 In fact, the FDA has approved a health claim based on scientific evidence for soy protein and reduced risk of cardiovascular disease. The claims reads, “25 grams of soy protein a day, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease.” It should be noted that the FDA is re-evaluating this claim due to recent mixed evidence.

**Stanols and Sterols.** In 2001 the American Heart Association (AHA) released a science advisory for healthcare professionals. This advisory discussed the possible health benefits of plant stanols and sterols in conjunction with a low fat diet. The FDA has approved a health claim stating that diets low in saturated fat and cholesterol that include plant sterol and stanol esters may decrease the risk of heart disease through the direct link of blood TC and LDL-C. Plant sterols and stanols reduce LDL-C by interfering with cholesterol absorption.25 Consumption of plant stanols and sterols has been reported to reduce LDL-C concentrations by 5–20%.24,25 A recent meta-analysis showed an association between plant sterol and stanol intake and a significant reduction in LDL-C (-12 mg/dL). This study found a positive dose response relationship between LDL-C reduction and plant sterols and stanols intake up to 2.5 gram per day. Doses higher than 2.5 grams per day showed little additional benefit.25 This dose is similar to 2 gram per day dose recommended by the AHA.15

**Psyllium.** Psyllium is an excellent source of soluble, viscous fiber. Psyllium has been found to decrease serum TC and LDL-C. It has consistently been shown to normalize or decrease blood lipid concentrations in patients with hypercholesterolemia and/or type 2 diabetes. The FDA has approved a health claim that consuming soluble fiber from foods such as psyllium seed husk (PSH) in conjunction with a diet low in saturated fat and cholesterol may decrease the risk of heart disease. To carry this claim a food must provide at least 1.7 grams of soluble fiber from PSH per serving.27

**Garlic.** Over the last several decades, scientific research has been examining the health benefits of garlic. Early clinical trials demonstrated very promising results. Recently, several of the early trials have been criticized for poor design, and lack of adequate controls. More rigorous clinical trials examining garlic’s efficacy have failed to reproduce the same magnitude of effects reported in some of the early studies. However, when the entire body of research is considered, the benefits of supplemental garlic powder are apparent, albeit of less impact than previously thought. Garlic does appear to exert beneficial effects on cardiovascular health.28

Many clinical trials and several meta-analyses have reported significant reductions (2%-25%) in TC levels with garlic use.29-36 Garlic, however, has a number of protective effects independent of cholesterol related concentration changes, such as reduced triglycerides, blood pressure, decreased platelet aggregation, improved blood flow, decreased fibrinogen, and reduced atherosclerotic plaque volume.31,37 Animal studies have demonstrated that purified allicin, an important bioactive compound in garlic, can reduce atherosclerotic plaque without lowering LDL-C concentration.38 Other bioactive compounds, such as ajene, allixin, erubosides, S-allyl cysteine, and N-acetyl S-allyl cysteine, exist in garlic. Many of these compounds have antiplatelet effects, antithrombotic effects, and affect the expression of endothelial adhesion molecules elevated during endothelial injury. In vitro studies have demonstrated that several isolated garlic compounds reduce the oxidation of LDL-C.39

A dose ranging from 600 mg to 1,200 mg per day is often seen in clinical trials. This amount corresponds to approximately one to two cloves of garlic per day. Garlic powder is, however, typically used in clinical trials and the dosage is based upon the biomarker, allicin. It is recommended that the garlic powder be standardized to 1.3% allicin for observable health benefits.40 In most studies garlic powder was taken in multiple doses throughout the day rather than as a single dose. This may enhance absorption.

**Coenzyme Q10.** Coenzyme Q10 (CoQ10), commonly known as ubiquinone, is a vital cofactor in the electron-transport chain. Therefore, CoQ10 plays an important role in the energy metabolism of food as well as cellular energy production.41,42 Tissues with high energy needs or high metabolic activity, such as the heart, contain high levels of CoQ10.43 It is therefore not surprising that the therapeutic effects of CoQ10 have been studied in patients with cardiovascular disease. It has been reported that individuals with cardiovascular disease have abnormal concentrations of CoQ10.44

<table>
<thead>
<tr>
<th>Total Cholesterol</th>
<th>LDL Cholesterol</th>
<th>HDL Cholesterol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desirable = &lt; 200</td>
<td>Optimal = &lt; 100</td>
<td>High (good) = ≥ 60</td>
</tr>
<tr>
<td>Borderline high = 200-239</td>
<td>Above Optimal = 100-129</td>
<td>Low (poor) = &lt; 40</td>
</tr>
<tr>
<td>High = ≥ 240</td>
<td>High = 160-189</td>
<td>Very high = ≥ 190</td>
</tr>
</tbody>
</table>

Source: US Department of Health and Human Services18

Table 2: Cholesterol Classification (mg/dL)
Preliminary research demonstrated an association between tissue levels of CoQ\textsubscript{10} and congestive heart failure (CHF). Some studies found improvements in ejection fraction, stroke volume, cardiac index, and exercise tolerance. Unfortunately, not all studies have shown improvements. This may be attributed to poor study design in early research. Additional evidence from in-vitro, animal, and human studies, however, does suggest CoQ\textsubscript{10} supplementation improves cardiovascular health.

Benefits of CoQ\textsubscript{10} may be attributed, at least in part, to its antioxidant capabilities. In its reduced form, CoQ\textsubscript{10} (ubiquinol), acts as an antioxidant protecting biological membranes from free radicals. CoQ\textsubscript{10} is effective in protecting against oxygen-generated damage to cellular membranes and lipid transport molecules (lipoproteins).

Preliminary evidence suggests that supplemental CoQ\textsubscript{10} may also mitigate statin (HMG-CoA reductase inhibitors) induced myotoxicity. Blood CoQ\textsubscript{10} concentrations are reduced by statin therapy. Statins inhibit cholesterol synthesis by inhibiting HMG-CoA reductase and the mevalonate pathway. CoQ\textsubscript{10} is synthesized from mevalonate and tyrosine. It is one of several end products of the mevalonate pathway. Hence, the inhibition of the mevalonate pathway by statins will reduce CoQ\textsubscript{10} synthesis. This reduction in CoQ\textsubscript{10} may contribute to myotoxicity via reduced mitochondrial metabolism. CoQ\textsubscript{10} supplementation has been found to increase CoQ\textsubscript{10} concentrations and may lessen the muscle damaging effects of statins. Routine use in all patients taking statins is, however, not recommended due to a lack of clinical documentation.

Normal plasma levels typically fall between 0.7-1.0 µg/mL. A 30-60 mg per day dose appears to maintain this level. Plasma levels typically need to reach a level between 2-3 µg/mL to stimulate a clinical effect. A 100-200 mg per day dose appears to be required to reach a clinically effective plasma level. It may take several weeks to reach a value greater than 2.5 µg/mL.

Omega 3 Fatty Acids. Unsaturated fatty acids are receiving increasing attention as potential anti-inflammatory and anti-atherogenic agents. Omega-3 polyunsaturated fatty acids (PUFA) in particular appear to possess the most potent immunomodulatory activities. Among the omega-3 PUFA,

---

**Table 3. Functional Foods with Cardiovascular Benefits**

<table>
<thead>
<tr>
<th>Functional Food/Component Food/Dietary Sources</th>
<th>Dietary Fiber</th>
<th>Fatty Acids</th>
<th>Plant Stanols &amp; Sterols</th>
<th>Soy</th>
<th>Phytoestrogens</th>
<th>Sulfides/Thiols</th>
<th>Flavonoids</th>
<th>Isothiocyanates</th>
<th>Minerals</th>
<th>Phenolic Acids</th>
<th>Vitamins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples, beans, citrus fruit, peas, psyllium seed husk</td>
<td>Soluble fiber</td>
<td>MUFA</td>
<td>Avocado, canola oil, olive oil, tree nuts</td>
<td>Soy protein</td>
<td>Lignans</td>
<td>Allyl methyl trisulfide, diallyl sulfide</td>
<td>Anthocyanins</td>
<td>Broccoli, cauliflower, cabbage, kale, horseradish</td>
<td>Dietary Fiber</td>
<td>Caffeic acid, ferulic acid</td>
<td>Vitamin C</td>
</tr>
<tr>
<td>Brown rice, cereal grains, oatmeal, whole wheat bread</td>
<td>Whole grains</td>
<td>PUFA (ALA)</td>
<td>Flaxseed, walnuts</td>
<td>Free stanols/sterols</td>
<td>Flaxseed, some vegetables, rye</td>
<td>Sulfides/Thiols</td>
<td>Flavanols (i.e., catechins, epigallocatechin)</td>
<td>Citrus foods</td>
<td>Flavonoids</td>
<td>Acerola cherry, citrus fruit, kiwi, strawberries</td>
<td></td>
</tr>
<tr>
<td>Barley, oatmeal, oat bran, rye, mushrooms</td>
<td>Beta glucan</td>
<td>PUFA (EPA &amp; DHA)</td>
<td>Calamari, mackerel, salmon, tuna</td>
<td>Stanol/sterol esters</td>
<td>Soy</td>
<td>Allyl methyl trisulfide, diallyl sulfide</td>
<td>Flavanones (i.e., naringenin, hesperetin)</td>
<td>Apples, broccoli, onions, tea</td>
<td>Isothiocyanates</td>
<td>Phenolic Acids</td>
<td>Sweet red/green pepper</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flavanols (i.e., kaempferol, quercetin)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ALA - a-linolenic acid; DHA - docosahexaenoic acid; EPA - eicosapentaenoic acid; MUFA - monounsaturated fatty acids; PUFA - polyunsaturated fatty acids</td>
</tr>
</tbody>
</table>

*Adapted from International Food Information Council Foundation Functional Foods Component Chart.*21
Atherosclerosis, Functional Foods, and Nutritional Genomics

Table 4. Functional Foods Involved in Reducing LDL-C Deposition, LDL-C Oxidation, Inflammation, and Thrombosis

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Food or Food Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve Cholesterol Concentration</td>
<td>Oats, soy, psyllium, flaxseed</td>
</tr>
<tr>
<td>Reduce LDL Oxidation</td>
<td>Garlic, CoQ10, antioxidants (i.e. vitamin C, E), rosehips, green tea</td>
</tr>
<tr>
<td>Improve Antioxidant</td>
<td>CoQ10, vitamin C, vitamin E, Beta-carotene, selenium, grapes, rosehips, blueberries, blackberries</td>
</tr>
<tr>
<td>Defense/Neutralize Free Radicals</td>
<td>Omega-3 fatty acids, grapes, blackberry, blueberry</td>
</tr>
<tr>
<td>Reduce Inflammation</td>
<td>Garlic, onion, flaxseed</td>
</tr>
<tr>
<td>Reduce Thrombosis</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Recommendations for fish and omega-3 fatty acid intake

<table>
<thead>
<tr>
<th>Population</th>
<th>AHA Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients without documented CVD</td>
<td>Eat a variety of fatty fish at least 2 days per week.</td>
</tr>
<tr>
<td>Patients with documented CVD</td>
<td>Consume approximately 1 g of EPA + DHA per day</td>
</tr>
<tr>
<td>Patients who need to lower triglycerides</td>
<td>Consume approximately 2-4 g of EPA + DHA per day</td>
</tr>
</tbody>
</table>

†Consult physician prior to supplementing

<table>
<thead>
<tr>
<th>Population</th>
<th>AHA Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients without documented CVD</td>
<td>Eat a variety of fatty fish at least 2 days per week.</td>
</tr>
<tr>
<td>Patients with documented CVD</td>
<td>Consume approximately 1 g of EPA + DHA per day</td>
</tr>
<tr>
<td>Patients who need to lower triglycerides</td>
<td>Consume approximately 2-4 g of EPA + DHA per day</td>
</tr>
</tbody>
</table>

†Provided in capsules under a physician’s care

The long-chain PUFA from fish oil, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) appear to be more biologically potent that α-linolenic acid (ALA).

Effects brought about by omega-3 PUFA may be due to their ability to modulate the amount and types of eicosanoids made, but they also elicit eicosanoid-independent mechanisms. Omega-3 PUFA appear to reduce endothelial expression of inflammatory markers such as, VCAM-1, ICAM-1, E-selectin, IL-1β, IL-6, IL-8, and TNF-α. Based on these anti-inflammatory effects, supplementation with omega-3 fatty acids theoretically has an antiatherogenic and plaque stabilizing effect.

Numerous studies have found supplementation to reduce cardiovascular disease risk. Population studies globally have shown protective relationships between omega-3 fatty acids and CVD. Results from large-scale epidemiological studies and clinical trials suggest fish consumption or fish oil supplementation lead to reduced incidence of coronary heart disease, reduced risk of sudden cardiac death, and reduced all-cause mortality and coronary mortality. Based on existing evidence the FDA permitted a qualified health claim for foods and dietary supplements containing EPA and DHA and the reduced risk of coronary heart disease.

The amount of omega-3 fatty acids that should be consumed depends on an individual’s health status. The American Heart Association makes fish and omega-3 fatty acid recommendations based on the population. These recommendations can be found in the following Table 5. Antioxidants. Antioxidants are thought to inhibit atherogenesis and improve vascular function. They improve biologic activity of endothelial derived NO and help to dispose of reactive oxygen species (ROS). In-vitro studies have found a-tocopherol to directly inhibit atherogenic mechanisms including monocyte release of ROS, monocyte-endothelial cell adhesion, IL-1 and TNF-α cytokine release, LDL oxidation, platelet adhesion, and smooth muscle cell proliferation. Consumption of both vitamin E and vitamin C appears to provide greater antioxidant benefit than ingestion of either vitamin alone. The antioxidant selenium has an inverse relationship with both atherosclerosis and cardiovascular mortality. Selenium is a cofactor for glutathione peroxidase, a critical enzyme involved in catalyzing the reduction of endothelial cell membrane oxidants (i.e., lipid hydroperoxides) to less reactive alcohols. Grapes (wine, juice, skins, seeds, resveratrol). Red grape skins and red wine contain many polyphenolic compounds, including proanthocyanidins, trans-resveratrol, and flavonoids such as kaempferol, catechins, and quercetin. These act as antioxidants. Resveratrol, in addition to its antioxidant effects, has anti-inflammatory properties, can cause blood vessel dilation, and can inhibit platelet aggregation. Resveratrol has been shown to reduce inflammation in animal studies, in part, by reducing IL-1b, TNF-α, and PGE2. Grapeseed extract has been found useful in ways similar to other grape products. Grape seeds have a high content of catechins and pro-anthocyanidins; both are members of the flavonoid family and function as powerful antioxidants. The ability of grape seed extract to scavenge free radicals is reportedly better than that observed with vitamins C, E, and beta-carotene. Grape seed extract has also been shown to relax the endothelium via release of nitric oxide. Pro-anthocyanidins, found in grape seed extract, scavenge free radicals and prevent peroxidation of lipid membranes. Pro-anthocyanidins may help protect the integrity of vascular structures and they may reduce atherogenic factors such as blood pressure, cholesterol levels and the aggregation of clotting factors (platelets) in the blood.

Rosehips, Blueberries, and Blackberries. Rosehips, blueberries, and blackberries have a number of heart healthy benefits. Rose hips are high in vitamin C, have high phenolic content, and scavenge free radicals (i.e. superoxide). Rose hips extract may also support cardiovascular health by limiting lipid oxidation and reducing the chemotaxis of leukocytes. In an animal model, blackberry extract reduced ICAM-1 expression. This may be one mechanism by which blackberry extract reduces the inflammatory process. In vitro studies further show that blackberry extract scavenges peroxy-nitrite free radicals to protect against endothelial dysfunction and reduces C-reactive protein (CRP). Blueberry extract contains anthocyanins and hydroxycinnamic acid, which impact the inflammatory response in vitro. Anthocyanins appear to inhibit the expression of IL-8, MCP-1, and ICAM-1, while hydroxycinnamic acids inhibit the expression of IL-8 and ICAM-1.

One botanical formulation discussed in the nutritional genomics section of this article found a botanical formulation containing rosehips extract (1200 mg/d), grape extract (40 mg/d), blackberry powder (165 mg/d), and blueberry powder (330 mg/d) effectively targeted mediators involved in the atherosclerotic disease process.

Nutritional Genomics

What is Nutritional Genomics? The wealth of information generated by the Human Genome Project combined with recent advances in molecular biology have fos-
Atherosclerosis, Functional Foods, and Nutritional Genomics

tered the emergence of nutritional genomics. Nutritional genomics is a new discipline in the field of nutrition science. This new discipline is paving the way for personalized nutrition as more associations between dietary components and gene variants are identified. It is anticipated that nutritional genomics will play a major role in disease prevention. Research in this area will lead to greater use of existing foods, food components, and novel foods in the prevention and treatment of atherosclerosis and other chronic disorders.

There is a two-way interaction between genes and components in food. A person’s genetic makeup determines how well they can use various food components to support health. The study of how individual genotypes determine a person’s response to food components is called nutrigenetics. Conversely, nutrients and other food components influence gene expression and the production of the proteins encoded in the genes. Essential nutrients (i.e. macronutrients, micronutrients), other bioactive substances (i.e. phytochemicals), and metabolites from food components (i.e. eicosanoids), and xenobiotics are all dietary components that can influence gene expression. Genes are exposed to nutrients in foods throughout life. Hence, diet is a critical environmental factor that influences gene expression. Bottom line, gene expression plays a major role in our very existence. Nutrients affect gene expression and formation of proteins that serve as hormones, enzymes, oxygen transporters, and building blocks for cells. Hence, the amount and the form of nutrients present during gene expression can alter protein synthesis and thereby affect health. The study of how food components influence gene expression is called nutrigenomics.

Nutritional Genomics, Inflammation, and CVD

Dietary recommendations, such as those set forth by the NCEP, have been found effective in populations. Individuals, however, respond differently to the treatment. This may be due to genetic variations within the population. Recent scientific evidence indicates that some CVD, including MI, is due to inherited gene variations. Genetic susceptibility may lead to more severe or earlier CVD. Some of these variants are susceptible to dietary intervention. Nutritional genomics, sometimes called “personalized nutrition”, uses an individual’s unique genetic makeup to make recommendations. Some individuals have a genetic predisposition for over-expression of inflammation. Genetic susceptibility to overexpression of the IL1 genes, for example, may lead to more severe or earlier CVD. IL1 plays a key role in regulating and coordinating inflammation. In an inflammatory response the IL1 gene is one of the first to be activated. It activates other proinflammatory cells, proteins and other molecules. It is responsible for activating other cytokines and chemical messengers that will maintain the inflammatory response. Small differences in the activation of the IL1 gene can have a significant effect on how powerfully the inflammatory system responds. Evidence now shows that people that test positive for the IL1 risk pattern also have elevated CRP levels and individuals with elevated CRP levels are at increased risk for CVD. This knowledge can help the nutrition or healthcare provider develop a personalized nutrition plan.

What’s Out There Now?

Scientists are discovering new ways to uncover diet-gene interactions at the molecular level. One company, for example, has created a genetic test that analyzes two IL1 genes that lead to over-expression of inflammation and risk for CVD. Testing positive for these genes does not mean that the individual will develop cardiovascular disease, but it does let them know they are at greater risk. Nutritional interventions, including nutritional genomics supplements, designed to target these genes and reduce inflammation may improve cardiovascular health.

Scientists are discovering gene-disease associations at a steady pace, investigating the molecular mechanisms, and identifying the influence of gene variants on disease susceptibility. The goal here is to identify gene variants that are strongly associated with risk for particular diseases so that disease susceptibility can be detected early in life and appropriate action taken to minimize risk. Additionally, gene-diet associations are being detected that link gene variants and diet and lifestyle approaches that provide guidance for decreasing disease susceptibility.

Numerous genes, gene variants, disease, and diet/lifestyle approach associations have been detected to date. Since inflammation is a major predisposing factor in the development of cardiovascular disease, the IL1 gene family is being studied in an attempt to identify gene variants that increase the risk of developing cardiovascular disease and diet and lifestyle approaches that target these gene variants, thereby decreasing this risk. Nutritional genomics is also facilitating research and development of novel nutraceuticals and functional foods that target mediators involved in the atherosclerotic disease process. One study demonstrated that a botanical formulation containing rosehips extract (1200 mg/d), grape extract (40 mg/d), blackberry powder (165 mg/d), and blueberry powder (330 mg/d) could influence expression of the IL1B gene. The mixture significantly decreased IL1B gene expression and CRP levels in healthy individuals with gene variants associated with over expression of the IL1 cytokine. These results suggest that dietary approaches can influence gene expression and thereby, decrease the magnitude of inflammation and risk of developing CVD.

Evolving and powerful genomic technologies are shaping the field of nutritional genomics. As this research advances and the mystery behind gene–diet interactions unfolds, strategies for more personalized and more effective nutrition therapies will be developed. A few novel products have already hit the market place. As the science behind nutritional genomics evolves, we can expect new strategies for preventing and treating atherosclerosis.

Take Home Message

Prevention and treatment of atherosclerosis is accomplished by interventions that attempt to reduce LDL-C, oxidation of LDL-C, inflammation, and thrombogenesis. Functional foods appear to provide protection in each of these areas and can help tailor a diet to address the special needs of an individual. The emerging field of nutritional genomics can further help a dietitian determine a patient’s individual needs based on his or her unique genetic makeup. This knowledge will allow for a more personalized and effective nutrition plan.

Dr. Micheline Vargas is a Research Scientist in the Supplement Product Development Department at the Nutrilite Health Institute. Her research emphasizes the development of botanical products with functional properties designed to maintain health and wellbeing. She also develops sports nutrition products and provides nutritional advice to collegiate and professional sports teams. Contact Micheline at micheline.vargas@accessbusinessgroup.com or 714-562-5447.

References

Atherosclerosis, Functional Foods, and Nutritional Genomics

7 Vaeche T, et al. Increased expression of interleukin-1 in coro-

10 Libby P, Ridker PM, Maseri A. Inflammation and atherosclero-
16 Ghanim H, Aljada A, Hofmeyer D, et al. Circulating Mono-
tissue cytokines in metabolic disorders linked to obesity. Molec Cell Cardiol. 2002;10:1065-1073.
21 Lau BH. Suppression of LDL oxidation by garlic compounds is a possible mechanism of cardiovascular health benefit. J Nutr. 2006;136:765S-768S.
23 Mayes, P. The respiratory chain and oxidative phosphoryla-
27 Soja AM, Mortensen SA. Treatment of congestive heart fail-

28 Forsslich P, Knopf J and Sell M. Pror compressed intake of garlic and QH10 in chronic heart failure, angina, and hypertension. Pharmaco-
29 Chopra RK, Goldsmid R, Sinatra ST, et al. Relative bioavail-

33 Endres S, Grorhan B, Kelley VE, et al. The effect of dietary supplementation with n-3 polyunsaturated fatty acids on the synthesis of interleukin-1 and the necrosis factor alpha by mono-
34 Meydani S, Endres S, Woods MM et al. Oral (n-3) fatty acid supplementation suppresses cytokine production and lym-

35 Koenig BA, Birns G,蕁kusik J, et al. Dietary intake of ma-

36 Brown A, Hu FB. Dietary modulation of endothelial func-
37 Albert CM, Hennekens CH, O’Donnell CJ, et al. Fish consump-
38 Bendich, Deckelbaum. Preventive nutrition. The comprehen-
41 Reaven PG, Khouw A, Beltz WE, et al. Effect of dietary anti-
42 Mosca L, Rubenfire M, Mandel C, et al. Antioxidant nutrient supplementation reduces the susceptibility of low density lipo-
46 Bombardelli E and Morazzoni P. The flavonoids: New per-
Atherosclerosis, Functional Foods, and Nutritional Genomics

80 Fitzpatrick DR, Bingle B, Maggi DA, et al. Vasodilating procyani-
83 Maffei-Faccio R, Carini M, Aldini G, et al. Free radicals scav-
84 Liviero L, Puglisi PP, Morazzoni P, et al. Antimutagenic activ-
86 Chang W, Huang F. Inhibition of platelet aggregation and ara-chidonate metabolism in platelets by proanthocyanidins. Prostaglan-
dins Leukotrienes and Essential Fatty Acids. 1989;38:181-188.
90 Rossnegel K and Willich SN. Value of complementary medi-
93 Serraino I. Protective effects of cyanidin-3-O-glucoside from blackberry extract against peroxynitrite-induced endothelial dysfunction and vascular failure. Life Science. 2003;73:1097-1114.
100 Duff GW. Influence of genetics on disease susceptibility and progression. Nutr Rev. 2007;65:577-581.
101 Duff GW. Evidence for genetic variation as a factor in maint-
102 Ridker PM. Inflammatory biomarkers and risks of myocard-

Resources Review

Laboratory Evaluations for Integrative and Functional Medicine, 2nd edition


Hard cover: $200.00. ISBN 0—9673949-4-5.

Laboratory Evaluations for Integrative and Functional Medicine, 2nd edition is a pioneering accomplishment. This is the second edition of the first textbook published on the application of and interpretation of lab assessments in functional medicine. This edition is more comprehensive, reflecting the most current peer-reviewed literature, substantiating the basis of these cutting-edge tests. Just as Krause’s Food & Nutrition Therapy & Modern Nutrition in Health & Disease are the cornerstone textbooks for every dietetics student, Laboratory Evaluations for Integrative and Functional Medicine should be in the tool box of every functional dietitian.

The text follows the tenets of functional medicine and examines imbalances underlying ill health. As such, functional lab exams identify nutrients, toxicants, and other factors underlying disease. A proclamation on the first page of this text supports the need for this reference manual in every dietitian’s library: “Nutrition may be the single most influential component of health maintenance, since diet is a determining factor in many diseases, including obesity, cancer, diabetes, hypertension, heart disease, stroke, cirrhosis of the liver, childhood developmental and behavioral disorders, and celiac disease.” Functional medicine is about nutrition. Functional medicine testing is about examining the biochemical status of individuals to apply the principles of functional dietetics.

With twelve chapters, three appendices, 80 plus case studies, more than 175 graphic illustrations, in excess of 3,800 citations, and 662 pages, Laboratory Evaluations for Integrative and Functional Medicine is exhaustive. The initial chapter discusses the value of functional testing, issues surrounding and methods of assessment, reliability of testing, reference intervals, quality assurance, and laboratory licensing and certification. For any clinician unfamiliar with laboratory analyses or for those needing a refresher, this chapter provides an excellent overview. In addition, a keyword searchable CD-ROM is included with this reference.

The bulk of the book, of course, describes the categories of functional laboratory evaluations, which are devoted to one chapter each. These include vitamins, nutrients and toxic elements, amino acids, fatty acids, organic acids, gastrointestinal function, toxicants and detoxification, oxidative stress, and hormones. Each chapter begins with a table summarizing the salient information about that particular test category. The vitamins chapter, for example, neatly provides a list of the biochemical markers for deficiency for each vitamin, along with the adult repletion range. The organic acids chapter correlates organic acids with metabolic pathways and potential interventions. The last chapters, though perhaps those to read first, include overviews of nutritional genomics and pattern analysis, featuring detailed case studies.

Together with conventional nutrition assessment techniques, dietitians can use the labs outlined in Laboratory Evaluations for Integrative and Functional Medicine to practice nutrition in a functional, as well as integrative manner, getting to the root of the problem. This book can certainly represent your sole reference about functional testing.

Reviewed by Laura W. Lagano, MS, RD, CDN. Contact Laura at 917-829-0250 or laura. lagano@verizon.net
Mary Alice Gettings, MS,RD,LDN,CDE
Immediate Past Chair
The 2008 – 2009 Nutrition in Complementary Care Dietetic Practice Group (NCC DPG) Executive Committee (EC) worked diligently to enhance member benefits and knowledge in the area of integrative and functional nutrition/medicine as reflected in the list of accomplishments below.

Strategic Plan Developed
A three to five year strategic plan was developed and revised during the 2009 spring leadership retreat. Thank you to Nutrilite Health Institute for their support of this retreat.

Two Networking Relationships Established
A networking relationship with the Center for Mind Body Medicine (CMBM) was finalized. Our previous network, Institute for Functional Medicine (IFM), and CMBM provided significant discounts on professional development workshops to NCC DPG members – Food as Medicine (CMBM) and Applying Functional Medicine in Clinical Practice (IFM). Close to 500 members attended each of three webinars developed by IFM, with NCC DPG input, at no cost. Topics included popular supplements, nutritional genomics, and the RD in Functional Medicine. Each webinar provided 1 CPEU. IFM also provided a discount on text books. The International Omega-3 Learning and Education Consortium for Health & Medicine (IFM) was approved. Revisions were made and proposal was recently completed application was submitted to ADA. Professional Practice category was initiated. At a yearly rate of $15, student members will receive member benefits. Thanks to the following 2008-2009 NCC DPG Sponsors:
- Gold ($15,000) Nutrilite Health Institute
- Silver ($10,000): Lipton Institute for Tea and Pharmavite
- Bronze ($1,000): Biosan and Sciona

Awards
L. Kathleen Mahan, MS,RD,CDE received the Excellence in Practice Award and Rick Hall, MS,RD was awarded with the Excellence in Service Award
Two Professional Development Awards (to defray the cost of an educational program) were awarded to Elizabeth Quintana, EdD, LD, RD, CDE (active member) and Cory Talbott (student member).

Pre-Food & Nutrition Conference & Expo (FNCE) 2008
The first NCC DPG Pre-FNCE conference entitled Gut Health: The Inner Tube of Life was held on the Saturday, October 25 before the opening session of FNCE. This was attended by more than 100 nutrition professionals and provided 5 CPEUs. The pre-conference was taped and more than 200 CD's have been sold (CPEUs are available). Thanks to Biosan and Sciona for their support of the pre-FNCE conference.

FNCE
Close to 1000 people attended the NCC DPG 2008 FNCE Priority Session addressing drug and nutrient interaction. Members enjoyed an evening of networking and visiting during the NCC DPG Reception and the always popular Member Breakfast. A program on Vitamin C was conducted and one free CPEU was offered. Thanks to Ester-C, Lipton Institute for Tea, and Pharmavite for their support of these events.

Nutritional Genomics
A White Paper on the importance of Nutritional Genomics in the future of dietetics practice was submitted for review and consideration by the House of Delegate members prior to their fall meeting. A Nutritional Genomics Director was added to the NCC DPG EC. The Nutritional Genomics section of the website was updated with pertinent information for the dietician practitioner.

Communication
- A Web Manager was hired to enhance web site look and ease of use.
- A new eblast format was initiated to communicate more efficiently with members. All agree it easier to use and read, and is more pleasing to the eye.
- The quarterly newsletter continues to be first-rate with cutting-edge information and provided 2 CPEUs at no cost to members. A survey to assess conversion to electronic newsletters was conducted. Based on the results, three electronic and one print (fall) newsletter will be produced each year beginning in 2009-10.

Standards of Practice/Standards of Professional Practice
Completed application was submitted to ADA. Revisions were made and proposal was recently approved.

Student Members/Natural Standard Database
A student member category was initiated. At a yearly rate of $15, student members will receive all the benefits of active members, including access to the Natural Standard Database ($299 value). After a thorough review by the NCC DPG, the decision was made to change to the Natural Standard Database.

Sponsorship
New sponsorship levels were established and significant number of sponsors were recruited, which allowed us to provide a plethora of member benefits. Thanks to the following 2008-2009 NCC DPG Sponsors:
- Platinum ($20,000): Ester-C
- Gold ($15,000) Nutrilite Health Institute
- Silver ($10,000): Lipton Institute for Tea and Pharmavite
- Bronze ($1,000): Biosan and Sciona

Administrative
With the economic downturn, the EC managed to increase the reserves required by ADA through meticulous accounting. All position descriptions were updated, to reflect current responsibilities, as well as the Guiding Principles and other administrative documents.
As reflected in the above work, the NCC DPG EC worked around the clock to move our mission and vision forward and to enhance the reputation of the nutrition professional in the area of integrative and functional nutrition/medicine.

NCC Annual Budget Report for 2008-2009
Submitted by Kathy Moore, Treasurer

<table>
<thead>
<tr>
<th>Category</th>
<th>Revenues</th>
<th>Expense</th>
<th>Excess (Deficit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration</td>
<td>61,368</td>
<td>31,067</td>
<td>30,301</td>
</tr>
<tr>
<td>Newsletter</td>
<td>1220</td>
<td>30,293</td>
<td>-29,073</td>
</tr>
<tr>
<td>Website/EML</td>
<td>0</td>
<td>13,674</td>
<td>-13,674</td>
</tr>
<tr>
<td>FNCE</td>
<td>42,668</td>
<td>52,873</td>
<td>-10,205</td>
</tr>
<tr>
<td>Member Services</td>
<td>25,336</td>
<td>5,853</td>
<td>19,483</td>
</tr>
<tr>
<td>Totals</td>
<td>130,592</td>
<td>133,760</td>
<td>-3,168</td>
</tr>
<tr>
<td>Total Net Assets</td>
<td>95,430</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Most nutrition and healthcare professionals are familiar with standard laboratory tests such as cholesterol or albumin, though advances in medical science have brought tremendous growth in laboratory tests and clinical laboratories that go beyond the standard markers. There are many laboratories that provide testing for a variety of clinicians, including nutrition and healthcare professionals. Many of these specialty laboratories provide specific types of testing, such as nutritional testing used in integrative and functional medicine. In deciding on a laboratory, nutrition and healthcare professionals would be best served by looking at laboratories that specialize in nutritional analysis, offering tests of amino acids, fatty acids, vitamins, as well as digestion and absorption abilities and functional evaluations of nutrients and metabolic status.

Why do laboratory testing?
Laboratory testing is an essential assessment tool that can help nutrition and healthcare professionals identify suboptimal nutrient status that can adversely affect function as well as nutrient insufficiencies that may underlie many complex, chronic diseases.

Figure 1 reviews the many factors that influence nutrient status. While diet records can provide estimates of mean and median intakes, actual levels of nutrients can be altered due to many factors, including nutrient quality of food or supplements, digestion, absorption, disease states, age, medications, activity levels, genetics, biological differences, environment, or stress. Any of these can lead to suboptimal levels or insufficiencies even in the face of perceived adequate intake. Insufficiencies can result in changes in cellular function before clinical symptoms develop. As insufficiencies progress into later stages, physiologic function can be impaired, resulting in symptoms such as fatigue, indigestion, or a general complaint of not feeling your best. Finally, a diagnosed deficiency or pathology may eventually be expressed. Utilizing laboratory functional testing can help in identifying insufficiencies before they progress into a full deficiency.

It can seem overwhelming to decide which laboratories provide the best tests, and which tests will be the most useful. There are many things to consider such as: Is the laboratory certified by the right organizations? Can nutrition and healthcare professionals order laboratory tests? Are the tests reliable? Are you ordering the right test? How can you provide testing without a blood draw? What are the different types of specimens? What are some of the laboratories that provide nutritional testing?

Laboratory certification
The Centers for Medicare & Medicaid Services (CMS) strictly regulate all laboratory testing (except research) performed on humans, requiring certification through the Clinical Laboratory Improvement Amendments (CLIA). In total, CLIA covers approximately 200,000 laboratory entities. Many states have their own licensing agencies that monitor and inspect laboratories. Federal, state, and voluntary agencies require onsite inspections by their staff. Thus a quality laboratory should be licensed by CLIA, as well as by those states requiring individual licenses.

Clinicians who can order tests
Restrictions on who can order laboratory tests vary from each state, and there are not always clear definitions. Medical doctors (MD) and osteopathic physicians (DO) are allowed to order tests in all 50 states. The privileges of other practitioners such as nutrition and healthcare professionals, registered nurses (RN), or naturopathic physicians (ND) vary from state to state. The scope of practice for registered dietitians (RD) varies in states that require licensure as well. The American Dietetic Association’s (ADA) scope of practice standard four provides nutrition monitoring and supports nutrition evaluations, both of which include monitoring of laboratory values. If your state does not provide nutrition and healthcare professionals with the opportunity to order laboratory tests, there are two options.

First, if you are working with another provider such as an MD, who can order tests, they can sign an authorization form for you to order tests under their account. If you do not work with a provider who is allowed to order, most laboratories offer the ability to sign up with in-house physicians, for a fee. Once completed, you are free to order tests from their laboratory. Testing restrictions may be easing since currently more than 30 states allow patients to get lab tests performed directly from laboratories themselves, without a clinician.
These services, part of the phenomenon known as Direct Access Testing (DAT), require only that the consumer pay up-front, and be able to receive their test results directly. Most of these DAT laboratories are re-sellers of laboratory tests and often have significant up-front charges, though most do provide phlebotomy services. If a patient utilizes this option, it is important to make sure you know specifically what test they received, such as plasma or RBC, IgG total or IgG4?

Indicators of test reliability
There are four basic indicators used to determine the reliability of a clinical laboratory test: accuracy, precision, sensitivity and specificity. Accuracy and precision reflect how well the test method performs day to day in a laboratory. A test method is considered precise when the amount of random variation is small, ensuring the results are reliably reproduced time after time. The accuracy of a test refers to the closeness to the true value. Comparisons to “control specimens” are often used to assess accuracy. Due to differences between laboratories, however, test results may vary somewhat when repeat tests are performed by a different laboratory. Sensitivity tests the ability to correctly identify individuals who have a given condition, while specificity is the ability of a test to correctly exclude individuals who do not have a given disease or condition. The more sensitive a test, the fewer “false-negative” results, and the more specific a test, the fewer “false-positive” results it produces. There are also many non-analytical factors to consider that can affect the reliability of the results you receive. These include things such as patient preparations, sample collection, or how the test was transported. For example, in tests such as culture assessments, bacterial populations can change significantly in transport and can result in differing results.

Ordering the right test
There are many areas to consider when deciding on which test to order. A test may be accurate and precise, sensitive and specific, but what does it tell you clinically? Does it answer the question you are asking? A good first step is to see how much research has been done on an analyte in the literature. Starting with a database such as PubMed is helpful. A good example is food allergy testing. Our understanding of the mechanism of immune reactions to food has substantially increased over the past decade. There are several different types of tests referred to as food allergy tests. It is important to look at what these tests are specifically evaluating. Reactions to foods are classified into immunoglobulin E (IgE) mediated or true allergies, and non-IgE mediated, also referred to as delayed food reactions. Clinical manifestations of food reactions may be modulated by imbalances of TH helper cells (Th1/Th2), which may be the ultimate determinant governing the expression of IgE-mediated, non-IgE-mediated, or mixed forms of IgE/non-IgE mechanisms of food reactions.2-4 IgE-mediated responses are the less common but widely recognized atopic food sensitivities, such as an immediate reaction to peanuts or shellfish. There is less of an awareness of non-IgE mediated food reactions, and its clinical relevance is likely underestimated. Research is showing that solely relying on a true IgE allergic reaction will certainly miss diet changes that could be beneficial in conditions such as inflammatory bowel disease (IBD).5, 6 IgG is the marker that is most commonly assessed in evaluating non-IgE long-term or delayed food reactions.6 There are four types of IgG: 1, 2, 3, and 4. After reviewing the literature IgG4 appears to be the most specific, although some clinicians look at total IgG or IgG1 plus IgG4. Research has shown that adjusting the diet based on IgG4 food reactions offered the greatest clinical response.5 Besides immunoglobulin reactions, there are other tests that look at physiologic response to foods. The Mediator Release Test (MRT) claims to look at the change in size of white cells and platelets and plasma in whole blood. A bigger change represents a greater release of cytokines or a total immune response to a specific food. However, no studies were found on MRT on PubMed. A test that calculates all immune reactions will surely result in many false positives, since not all immunoglobulin reactions are significant. These are all things that should be reviewed prior to ordering a test. Nutrition and healthcare professionals should review the literature, as well as have discussions with clinicians who work with laboratory tests. Many laboratories offer educational materials and references from peer-reviewed journals.

Drawing blood
Once nutrition and healthcare professionals are set-up to order tests, a second concern is getting blood drawn. For those who work with a clinician who can do blood draws this aspect is easy, but for those who do not, arrangements must be made. Some nutrition and healthcare professionals find a phlebotomist or a nurse to draw blood for them, either at another laboratory or in private practice. However, this can be challenging. Therefore, many laboratories have worked to provide tests in specimens that do not require a blood draw, such as a finger stick, stool, or urine sample.

Testing that does not require a blood draw
Finger stick
Finger stick capillary whole blood or blood spot testing on dried filter paper is a well-established technique that has been used for more than 40 years. The filter paper is manufactured to give accurate and reproducible absorption of blood specimens as well as consistent chromatographic effects. The blood spot test generally requires bloodspots from a fasting patient to be collected on filter paper.7 The most common blood spot test is of course glucose, but there are also tests for HIV, amino acids, celiac and IgG food reactions. The ease of use makes it a great choice in several situations, including follow-up, for those unable to obtain a draw blood for their patients, or for patients who wish to complete their test at home.

An example of a nutritional blood spot test is a fatty acid blood spot, which gives a summary of the predominant fatty acids. It can include omega-3 fatty acids, such as ALA, EPA, and docosahexaenoic acid (DHA); omega-6 fatty acids, LA, GLA, DGLA and AA, as well as trans fats. Considerable research has been done correlating the level of omega-3 fatty acids in cardiac cells and cardiovascular disease risk.8, 9 Cardiac and Red Blood Cell (RBC) EPA+DHA levels have been found to be highly correlated (r=0.82, P <0.001), and respond similarly to omega-3 supplementation.10 The sum of EPA+DHA in RBC has been termed the omega-3 index and serves as a surrogate marker for cardiac omega-3 fatty acid levels.10 RBC EPA+DHA has also been found to have a strong correlation with finger stick or blood spot EPA+DHA (r= .74-.68). The finger stick significantly correlates with plasma EPA+DHA levels as well (r= .86-64).11 There is not a perfect correlation because whole blood is a combination of RBCs and plasma. Plasma is influenced more by recent dietary intake, and RBC represents metabolic function within the cell and longer dietary status. Fatty acid supplementation and assessments have also been used in monitoring maternal and infant DHA levels, attention deficit
Laboratory Testing for Nutrition and Healthcare Professionals

hyperactivity disorder (ADHD), depression, learning disabilities, multiple sclerosis, inflammatory bowel disease (IBD), and fibrocystic disease.12-17

Urine
Urine is another specimen type that is easy to collect in most patients. There are more than 100 different tests that can be done on urine. The most familiar are tests of inborn errors of metabolism, such as phenylketonuria (PKU), evaluating for iodine status, or drug testing. Additionally, urinary organic acids are frequently used by functional and integrative clinicians to reveal nutritional and metabolic status. Organic acids are metabolic intermediates produced in metabolic pathways. They are markers of oxidative damage and detoxification, neurotransmitter breakdown products, and intestinal microbial activity, and help to determine the functional needs of specific nutrients. Accumulation of specific organic acids in urine often signals a metabolic inhibition or block, which may be due to a nutrient deficiency, an inherited enzyme deficit, toxic build-up, or drug effect.17-19

A good example is urinary methylmalonic acid (MMA), which is an indicator of functional vitamin B12 status.20,21 The conversion of methylmalonyl-CoA to succinyl-CoA is vitamin B12 dependent. If vitamin B12 is not available in sufficient quantities, this conversion cannot take place, and MMA will build up in the blood and urine. There is a linear relationship between MMA concentration in serum and urine (r = 0.74).22, 23

Another valuable analyte assessed in urine is 8-hydroxy-2′-deoxyguanosine (8-OHdG) that has become a standard bio-marker for evaluating oxidative damage in research studies, and is utilized by clinicians in guiding treatments, which include increasing intakes of antioxidants through diets or supplements.24 8-OHdG is a metabolic by-product of oxidative damage by hydroxyl radicals to the guanine bases of DNA, which has the lowest oxidation potential of the four bases.25,26 Urinary assessment correlates with the rate of DNA damage and repair, and is a stable product not subject to further metabolism.26-28 Reduced 8-OHdG levels correlate to a reduction in oxidative damage. Research has shown that increased vegetable intake, as well as antioxidant supplementation, lower 8-OHdG levels.29, 30

Urine is also an accepted specimen to evaluate levels of toxic elements (heavy metals), estrogen metabolites, amino acids, and bone breakdown products. Urine testing is useful to monitor levels of toxic metals such as aluminum, arsenic, cadmium, lead, and mercury, and for mineral testing. Some elements can accumulate in tissues causing toxic effects. Ensuring a patient has adequate minerals such as magnesium, iron, or zinc can be helpful in decreasing the effect of toxic elements. Urinary concentrations of estrogen metabolites are related to risk of breast cancer in women, and can be clearly evaluated in urine.31-36 The risk of cancers in estrogen-sensitive tissues increases in proportion to the percentage of estrogen converted to 16α-hydroxyestrone, as opposed to 2-hydroxyestrone or the 2:16 ratio. Cancer risk has been found to be greater in 2:16 ratio values of less than 2.37 Dietary interventions of omega-3 fatty acids and cruciferous vegetables have been shown to significantly increase the ratio. The protein matrix of bone upon which the mineral structure is accumulated consists of type I collagen. Type I bone collagen contains unique cross-linked protein structures that give greater stability, including deoxypyridinoline (DPD). Active bone resorption breakdown results in increased DPD excretion. Ensuring adequate vitamin D, vitamin K, magnesium, and calcium can all help to decrease bone breakdown. Following DPD can help monitor treatments.39,40

Saliva
Many analytes are primarily measured in saliva, and include cortisol, dehydroepiandrostosterone (DHEA), antigliadin antibodies, drugs, and hormones. Monitoring cortisol and DHEA can help identify the ability of the adrenal cortex to react to stress. The test monitors circadian variation in cortisol and DHEA-S levels. An increased cortisol level, a decreased DHEA-S level, or a decrease in the DHEA-S/cortisol ratio is an indication of chronic physical or mental stress. There are many nutritional interventions that help to ameliorate stress-induced adrenal fatigue.

Stool
Gastrointestinal function is important for general health, and should be a cornerstone for nutrition and healthcare professionals. The intestinal tract contains significant amounts of bacteria - some beneficial, some neutral, and some harmful. Balancing beneficial microbial flora in the gut is a key factor in digestion, nutrient usage, and ridding the body of waste and pathogens. Poor digestion and malabsorption can lead to nutritional insufficiencies. Stool tests are easily collected by the patient, and newer DNA techniques only require a single sample as opposed to culture methods that require three samples. DNA assessment has greater efficiency, reliability, and reproducibility, along with an ability to provide both qualitative and quantitative data. Microbiota such as predominant bacteria, opportunistic organisms, parasites, pathogens, and yeast/fungi can all be evaluated from a stool sample, as well as dietary influences, intestinal inflammation, pancreatic functions, and impairments in digestion and absorption. In the last decade, DNA sequencing has played a pivotal role in the identification of intestinal microbiota composition.38-42 DNA techniques have sensitivity unparalleled in laboratory medicine, have created new opportunities for the clinical laboratory to have an effect on patient care, and have become the new “gold standards” for laboratory diagnoses of several infectious diseases.43

Nutritional laboratories
Nutrition and healthcare professionals should not see ordering tests as something other clinicians do, they should decide for each patient if there are specific laboratory tests that could benefit the nutrition evaluation of a patient. Though insurance reimbursement can vary significantly, many patients want to do what is necessary to make them better. RDs are specifically trained to understand the biochemical pathways and why the patient may have developed specific insufficiencies, which helps them create a nutritionally targeted plan for the patient. Nutrition and healthcare professionals should take the lead in functional and integrative nutrition. Many clinicians who are ordering nutrition related tests and providing nutrition services do not have any significant nutrition training, and there are organizations that provide nutrition credentials that require no science background. Below is a brief list of several major nutritional laboratories in the United States. There are other good laboratories that specialize in immune testing and toxin or hormone assessments, but the laboratories below specifically offer testing for comprehensive nutrition evaluations. As always, it pays to give attention to the details.

Resources
METAMETRIX LABORATORY: Nutritional, metabolic, gastrointestinal, and environmental
As part of full disclosure, please note that Elizabeth Redmond, PhD, MMSc, RD, LD is a clinical consultant at Metametrix Clinical Laboratory in Georgia. She speaks regularly on laboratory testing in functional and integrative medicine and is a co-author of the Laboratory Evaluations for Integrative and Functional Medicine (2008) textbook. Contact Dr. Redmond at eredmond@metametrix.com or 678-638-2954.

References

5. Bernardi D, Borghesan F, Faggian D, et al. Time for Integrative and Functional Medicine testing in functional and integrative medicine. beth Redmond, PhD, MMSc, RD, LD is a clinical
31. The Manual of Clinical Microbiology, 8th Edi
32. Page 35
33. Fall 2009 Volume 12, Issue 2 www.integrativeRD.com
2009 - 2010 LEADERSHIP CONTACT INFORMATION

EXECUTIVE COMMITTEE
Kathie Madonna Swift MS RD LDN
Chair 2009 - 2010 ▲
248 Mountain Drive
Pittsfield, MA 01201
Cell: 413-822-8660
Fax: 413-464-0108
sswiftdifm@aol.com

Mary Alice Gettings MS RD LDN CDE
Past Chair 2009 - 2010 ▲
205 Opal Drive
Cranberry Township, PA 16066
Office: 724-774-3003
Home: 724-766-7800
Fax: 724-774-0971
magettings@psu.edu

Deborah Ford MS RD CCN
Chair Elect 2009 - 2010
PO Box 8142
Vero Beach, FL 32063
2009 - 2010 Nominating Committee Chair
Joycelyn Peterson DrPH MPH RD
Alliance Director 2009 - 2011
PO Box 180279
Tallahassee, FL 32318-0279
Phone/Fax: 850-562-7012
ruthdebusk@comcast.net

Rita Kashi Batheja MS RD CDN
Chair 2009 - 2010
825 Van Buren Street
Baldwin Harbor, NY 11510
2009 – 2011 Nominating Committee Past Chair 2009 – 2010
Christine Doolittle MS RD CSSD
LDN CLT
Nominating Committee Chair Elect 2009 – 2010
730 Bridle Path Drive
Wexford, PA 15090-6815
Office: 724-272-6351
Fax: 866-627-7033
foreverfit@zoominternet.net

DEPUTY EXECUTIVE DIRECTOR
Sarah Harding Laidlaw MS RD MPA
Newsletter Editor 2009 – 2010
90 Panamoka Trail
Ridge, NY 11961
2009 - 2011 Reimbursement Chair
Dorothy Humm MBA RD CDN
Nominating Committee Past Chair 2009 – 2010
6558 4th Section Road, #159
Brockport, NY 14420-2477
Home: 585-637-2675
Office: 585-637-5430
dothumm@escapees.com

Past Chair 2009 - 2010
Sarah Laidlaw@mesaviewhospital.com
peaknut@cascadeaccess.com
Phone: 1-800-279-6880 x 4811
Email: djuskelis@eatright.org

Keith Moltzni MPH Candidate,
CPEU Article Chair 2009 - 2010
Katherine Stephens Bogard MS RD CDE
Chair 2009 – 2010
4808 Jewell Terrace
Palm Harbor, FL 34685
Office: 727-781-4326
Fax: 727-773-2124
sdeanrd@aol.com

Executive Assistant/Technical Advisor
Deborah Ford RD CCN
Chair Elect 2009 - 2010
1031 S. Shannon Street
Cranberry Township, PA 16066
2009 – 2010 Technical Advisor
Kathie Madonna Swift MS RD LDN
561-394-8490
Fax: 561-394-9846
2220 North Federal Highway
Boca Raton, FL 33431
Boca Wellness & Nutrition Services
News Letter
rschauer_rd@yahoo.com
Phone: 612-722-6080
Fax: 612-899-4811
Adelphi, MD 20783
3434 West Anthem Way
Anthem, AZ 85086-6006
Cell: 602-284-4607
Phone: 708-529-8463
Jayreg123@gmail.com

American Dietetic Association
Dietetic Intern
Sara Harding Laidlaw MS RD MPA
Newsletter Editor 2009 – 2010
90 Panamoka Trail
Ridge, NY 11961
2009 - 2011 Reimbursement Chair
Dorothy Humm MBA RD CDN
Nominating Committee Past Chair 2009 – 2010
6558 4th Section Road, #159
Brockport, NY 14420-2477
Home: 585-637-2675
Office: 585-637-5430
dothumm@escapees.com

Kathy Moore RD LD CCN
Treasurer 2008 – 2010 ▲
PO Box 487
Tijeras, NM 87059-0487
Phone: 505-286-2428
Fax: 1-877-862-8390
moo re nutritiondifm@q.com

Ann Sukany-Suls Med RD LD
Secretary 2009 – 2011 ▲
71 Powder Hill Drive
Bedford, NH 03110
Home: 603-471-6347
Cell: 603-493-7243
sulsdifm@gmail.com

Rita Kashi Batheja MS RD CDN
Member Services Chair 2008 - 2010
825 Van Buren Street
Baldwin Harbor, NY 11510
2009 – 2011 Reimbursement Chair
Christine Doolittle MS RD CSSD
LDN CLT
Nominating Committee Chair Elect 2009 – 2010
730 Bridle Path Drive
Wexford, PA 15090-6815
Office: 724-272-6351
Fax: 866-627-7033
foreverfit@zoominternet.net

Kathy Moore RD LD CCN
Treasurer 2008 – 2010 ▲
PO Box 487
Tijeras, NM 87059-0487
Phone: 505-286-2428
Fax: 1-877-862-8390
moo re nutritiondifm@q.com

Ann Sukany-Suls Med RD LD
Secretary 2009 – 2011 ▲
71 Powder Hill Drive
Bedford, NH 03110
Home: 603-471-6347
Cell: 603-493-7243
sulsdifm@gmail.com

Rita Kashi Batheja MS RD CDN
Member Services Chair 2008 - 2010
825 Van Buren Street
Baldwin Harbor, NY 11510
2009 – 2011 Reimbursement Chair
Christine Doolittle MS RD CSSD
LDN CLT
Nominating Committee Chair Elect 2009 – 2010
730 Bridle Path Drive
Wexford, PA 15090-6815
Office: 724-272-6351
Fax: 866-627-7033
foreverfit@zoominternet.net

PUBLIC POLICY CHAIR/REIMBURSEMENT CHAIR 2009 – 2011
Rita Kashi Batheja MS RD CDN
825 Van Buren Street
Baldwin Harbor, NY 11510
Home: 516-688-0605
Cell: 516-689-8822
krbat1@juno.com

TECHNICAL ADVISOR 2009 – 2010
Kathy Moore RD LD CCN
Treasurer 2008 – 2010 ▲
PO Box 487
Tijeras, NM 87059-0487
Phone: 505-286-2428
Fax: 1-877-862-8390
moorenutritiondifm@q.com

Ann Sukany-Suls Med RD LD
Secretary 2009 – 2011 ▲
71 Powder Hill Drive
Bedford, NH 03110
Home: 603-471-6347
Cell: 603-493-7243
sulsdifm@gmail.com

Rita Kashi Batheja MS RD CDN
Member Services Chair 2008 - 2010
825 Van Buren Street
Baldwin Harbor, NY 11510
2009 – 2011 Reimbursement Chair
Christine Doolittle MS RD CSSD
LDN CLT
Nominating Committee Chair Elect 2009 – 2010
730 Bridle Path Drive
Wexford, PA 15090-6815
Office: 724-272-6351
Fax: 866-627-7033
foreverfit@zoominternet.net

PUBLIC POLICY CHAIR/REIMBURSEMENT CHAIR 2009 – 2011
Rita Kashi Batheja MS RD CDN
825 Van Buren Street
Baldwin Harbor, NY 11510
Home: 516-688-0605
Cell: 516-689-8822
krbat1@juno.com

TECHNICAL ADVISOR 2009 – 2010
Ruth DeBusk PhD RD
DeBusk Communications, LC
PO Box 180279
Tallahassee, FL 32318-0279
Phone/Fax: 850-562-7012
ruthdebusk@comcast.net

EXECUTIVE ASSISTANT/EMl COORDINATOR 2009 – 2010
Katherine L. Bernard MS RD CDن
90 Panamoka Trail
Ridge, NY 11961
Phone: 1-800-279-6880
Fax: 1-877-862-8390
Kathyb4difm@optonline.com

NEWSLETTER
Sarah Harding Laidlaw MS RD MPA
Newsletter Editor 2009 – 2010
1045 Raptor Circle
Mesquite, NV 89027
Phone: 702-346-7968
Fax: 702-346-9031
peaknut@cascadeaccess.com
Sarah.Laidlaw@mesaviewhospital.com
CPE Objectives and Questions
Atherosclerosis, Functional Foods, and Nutritional Genomics

**Continuing Professional Education Article,**

**sponsored by Dietitians in Integrative and Functional Medicine, Fall 2009.**

This activity has been approved for 1 hour of self-study. Possible learning codes: 2010, 2040, 3100, 5160.
Expires September 30, 2011

After reading this CPE article, the nutrition professional (RD, DTR) will be able to:

1. Delineate the pathophysiology of the atherosclerotic disease process;
2. State the NCEP target TC, LDL-C, and HDL-C serum lipid levels;
3. Identify the NCEP general & TLC nutrition recommendations;
4. Define functional food;
5. Identify component(s)/constituent(s), and benefit of a specific functional foods;
6. Define nutritional genomics;
7. Identify an example of a genotype predisposed to CVD

**Questions:**

1. True/False: Hyperlipidemia is the sole cause of CVD and the predominant precipitating factor of a MI.

2. True/False: Nutritional genomics is an emerging field of nutrition whereby genetic disease susceptibility is modulated by specific individualized dietary interventions.

3. True/False: A functional food is a food or food ingredient that confers a health benefit beyond its traditional macro/micronutrient content.

4. Which of the following are examples of adhesion molecules:
   A. monocytes
   B. chemoattractants—MCP-1, IL-8, PAF, LT
   C. LDL-C and ROS
   D. Selectins (E, P, L), VCAM-1, ICAM-1, and integrins

5. Which is not a component of the TLC diet:
   A. PUFA/MUFA comprising the majority of dietary fat
   B. Omega 3 fatty acids from supplemental sources
   C. Fiber intake of >20g/day with > from soluble fiber
   D. Plant Stanols/sterols >2g/day

6. Which sequence best summarizes the atherosclerotic disease process:
   A. Insult to endothelium, macrophage activation, LDL oxidation, LDL-C entrapment, plaque instability & rupture
   B. Inflammatory cascade, insult to endothelium, cellular adhesion/migration, unstable plaque formation, plaque rupture
   C. Elevated LDL-C, LDL entrapment, LDL oxidation, foam cell formation, plaque formation, plaque rupture
   D. Genetic susceptibility/risk factor, Endothelial insult/injury, inflammatory cascade, LDL entrapment/oxidation, foam cell formation, formation & subsequent rupture of unstable plaque, CVD event.

7. An optimal level of LDL-C is:
   A. < 100 mg/dL
   B. < 200 mg/dL
   C. > 40 mg/dL
   D. ≥ 60 mg/dL

8. A polymorphism in which gene influences the strength and magnitude of the inflammatory cascade?
   A. MTHFR
   B. CRP
   C. IL1
   D. TNF-α

COPY I: COMPLETION VERIFICATION

Please obtain a separate Certificate of Completion Form for license verification and your own records. You should record each session on your Learning Activities Log (Step 4), and retain a completed form for your file in the event you are audited by CDR.

Certificate of Completion
American Dietetic Association/DIFM-DPG

Title of Program

Participant Name

RD/DTR ID Number

Date Completed

2.0 CPEUs Awarded CPE Level: II

CDR Accredited Provider # AM003
Sarah Harding Laidlaw, MS, RD, CDE

Retain original copy for your records
CDR Accredited Provider Signature

COPY II: LICENSE VERIFICATION

Please present a completed form to your Licensure Board upon request.

Certificate of Completion
American Dietetic Association/DIFM-DPG

Title of Program

Participant Name

RD/DTR ID Number

Date Completed

2.0 CPEUs Awarded CPE Level: II

CDR Accredited Provider # AM003
Sarah Harding Laidlaw, MS, RD, CDE

State Copy
CDR Accredited Provider Signature

Instructions to receive credit:

1) Read the article, “Atherosclerosis, Functional Foods, and Nutritional Genomics”

2) Answer the questions listed above. For each question, select one best response. Compare your answers to the answer key on page 37.

3) Mail, fax, or e-mail the application for CPE credit to Annie Griffin, RD, LD: Please make sure the article title is included with the application, request for CPE credit, name, address, telephone number, e-mail address, and ADA member registration number.

4) Once this information has been received, Kathy Bernard, DIFM Executive Assistant/EML Coordinator, will e-mail verification of completion for the CPE credit. Complete and retain the certificate on this page for your records along with the verification in case you are audited by CDR.
THANK YOU TO OUR SPONSORS
Without your generous contributions, many of the opportunities and member benefits would not be possible.

Platinum

Silver

Copper
Biosan Laboratories, Inc.

DIFM EDITORIAL STAFF

EDITOR
Sarah Harding Laidlaw, MS RD CDE

COPY EDITOR
Rebecca Schauer, RD

COMMUNICATIONS DIRECTOR
Paula Mendelsohn, MPH RD LD CCN

EDITORS
Christian Calaguas, MPH RD
Danielle Torisky, PhD RD

CPE EDITOR
Katherine Stephens-Bogard, MS RD CDE

Those of you who would like to contribute an article or have topics that you would like to see in future issues, please feel free to drop me an email or give me a call – peaknut@cascadeaccess.com or 702-346-7968 – or contact any one of the capable DIFM leaders listed on the back of the newsletter.