CPE Article: Review of the Literature Regarding the Gut-brain Connection in Autism Spectrum Disorders and Associated Special Diet Therapies

As our knowledge of nutrition science advances and the availability of food increases, the incidence of diseases caused by nutrient deficiencies of centuries past declines. However, the complexity of developmental disabilities leaves healthcare practitioners seeking new knowledge to prevent and treat these growing health concerns. In this land of plenty, the standard American diet (SAD) may be causally related to a child’s developmental disability. There is much in the literature that supports healing the body and using food as medicine. Literature has established the presence of gastrointestinal (GI) inflammation in many children diagnosed with autism spectrum disorders (ASD). This evidence persuasively suggests that GI inflammation may exacerbate ASD symptoms and, conversely, that dietary interventions can ameliorate GI inflammation in at least some children, improving overall outcomes. This article discusses the literature regarding the gut-brain connection and will review healing diets and nutritional intervention to benefit people with ASDs.

Gastrointestinal dysfunction and ASD

While autism is classified as a behaviorally-defined syndrome by the current edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), there is a growing body of evidence suggesting that ASD is much more than is covered by the DSM-IV-TR definition. Many researchers and practitioners currently consider ASD to be a systemic disorder that involves immune, neuroimmune, metabolic, genetic, and gastrointestinal dysfunction.

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That there is a link between gastrointestinal dysfunction and ASD is not a new concept. Leo Kanner, the psychiatrist and physician whose studies helped form the foundation of modern understandings and approaches to autism, described what seemed to be GI disturbances in many of the subjects profiled in his 1943 paper, “Autistic disturbances of affective contact.” Eating problems, infant vomiting, large tonsils, and poor nursing are some of the descriptions Kanner used when presenting his case histories. In a 1971 study, Goodwin and coauthors found that six of the 15 children they studied had bulky, odorous, or loose stools or intermittent diarrhea, and one had celiac disease. In 1999, endoscopic
examinations of 36 autistic children with intestinal symptoms showed that over two-thirds of the children had reflux esophagitis (69%) and/or chronic duodenal inflammation (67%), and a sizeable proportion (42%) had chronic gastritis.7

In 2006, Valicenti-McDermott evaluated ASD and family autoimmune disease and found that 70% of children with ASD had GI issues compared with 42% of children with a developmental disorder other than ASD.8 In a 2010 consensus report, Buie and a group of experts concluded that “gastrointestinal disorders and associated symptoms are commonly reported in individuals with ASD, but key issues such as the prevalence and best treatment of these conditions are incompletely understood.”9 These studies confirm that something more than behavior is going on in children with ASD—some form of gut dysfunction seems to be present. If this is the case, can healing the gut alleviate symptoms of ASD? Some of the research suggests that the answer is yes. The increasingly strong evidence of a gut-brain connection means that healing the gut will help heal the child.

The gut-brain connection and gluten

The potential impact of gluten ingestion on the gut, brain auto-antibodies, and behavior is one example of how the gut is connected to the brain. In the 1950s and 1960s, doctors found that neurological conditions improved in some psychosis and celiac disease patients when gluten was removed from their diets.9 Several decades later, in the early 1990s, Reichelt and Knivsberg found abnormal substances that resembled opioid peptides in the urine of autistic persons.10 These peptides were thought to originate from the incomplete breakdown of food, given that their levels exceeded what the central nervous system (CNS) could produce on its own. This work resulted in what is now known as the opioid excess theory.11 This theory states that the incomplete breakdown of gluten and casein produces two different peptides that are known to have opioid activity in the body, namely glueotemorphins (from gluten) and casomorphins (from casein).10 In persons with ASD, these peptides are able to escape the gut in the presence of intestinal permeability. The peptides are then able to cross the blood-brain barrier and cause neurological manifestations.12

In 2002, Knivsberg and colleagues demonstrated that children with both autism and urinary peptide abnormalities experienced improvements in social connectedness, willingness to learn, and ability to make transitions after one year on a gluten-free/casein-free diet.13 This was followed in 2009 by a thorough review by Reichelt and Knivsberg affirming both the possibility and probability of a gut-brain connection in autism. They concluded that diet affects behavior, and that behavior can be correlated to excreted compounds.13

One factor that the opioid excess theory fails to recognize, however, is that children with ASD may react to gluten and casein in metabolically different ways. According to a body of work by celiac researcher Dr. Alessio Fasano and his colleagues,14 there are two distinct categories of individuals who experience difficulty with gluten. The first category includes people with “gluten sensitivity,” who experience inflammation from gluten even though they do not initially have visible intestinal damage. Persons with celiac disease (CD), on the other hand, have an autoimmune reaction to gluten that damages the intestines. The difference between these two conditions stems from how the immune system responds to gluten. Where gluten sensitivity is present, the innate immune system responds to gluten ingestion by fighting the gluten directly. This creates inflammation both inside and outside of the digestive system. In those who are gluten sensitive, gluten has been demonstrated to weaken the tight junctions that serve a barrier function in the gut.14 Moreover, Fasano and colleagues have shown that zonulin is a protein that increases intestinal permeability by opening tight cellular junctions and that gluten in certain individuals stimulates zonulin production.15 In the case of celiac disease, both the innate immune system and the adaptive immune system are involved. However, persons with CD and individuals with gluten sensitivity can experience near-identical symptoms, including diarrhea, bloating, abdominal pain, joint pain, depression, brain fog, and migraines.14

In studying gut permeability and mucosal immune gene expression in individuals with CD and gluten sensitivity, Fasano and colleagues reported that only 57% of those identified as gluten sensitive carried DQ2 or DQ8 genes, the genes that are tested for when determining gluten metabolism disorders. This finding indicates that those two genes are less involved in gluten sensitivity than they are in celiac disease. On blood tests, just under half (48%) of those diagnosed as gluten sensitive had positive antigliadin antibodies (AGA-IgA) or AGA-IgG blood tests, showing that they were making antibodies to the gluten in their diet.14 AGA-IgA and AGA-IgG are antibodies that the body produces in response to gluten. A little more than half of the gluten sensitive group carried CD genes, while the rest did not, indicating that the genes are not necessary for the body to produce the AGA antibodies. The study also found that none of the participants labeled as gluten sensitive produced ttG-IgA (tissue transglutaminase antibody) or EMA-IgA (endomysial antibody), which are antibodies very specific to celiac disease that indicate when the body is attacking its own tissue in an autoimmune reaction.14

The important take-home message of Fasano’s work is the observation that even persons who don’t have celiac disease can still have a negative reaction to gluten. As the authors conclude, “In itself, the absence of autoantibodies [the autoimmune antibodies produced in CD but not in gluten sensitivity] and intestinal lesions does not rule out the intrinsic toxicity of gluten, whose intake, even in non-CD individuals, has been associated with damage to other tissues, organs and systems besides the intestine.”14 In addition, it does not appear surprising that research over the past several decades has demonstrated that gluten elimination has improved schizophrenia symptoms in some patients.16

When considering the digestive effects of gluten in those who are gluten sensitive, it is helpful to understand the term
“oral tolerance.” Oral tolerance refers to the body’s ability to differentiate between pathogens that enter the body through the gastrointestinal tract and elicit an appropriate immune response versus the diverse group of dietary proteins and compounds that should not normally trigger an immune response. Oral tolerance to dietary antigens is maintained by three different mechanisms: anergy (a state of immune unresponsiveness), cell deletion, and immune suppression. However, in the presence of a stressor and infection, oral tolerance can break down, allowing gut-associated lymphoid tissue (GALT) to react to the antigens. This, in turn, causes proinflammatory compounds to build up, prompts opening of the tight junctions between the small intestinal cells, allowing antigens to enter into circulation, and triggers subsequent production of IgA, IgG, IgM, and IgE antibodies. Some of the antibodies created in response to this inflammatory cascade get released into the bloodstream and cross the blood-brain barrier, where they can affect brain chemistry and behavior.

The accumulated evidence indicates that both gluten sensitivity and celiac disease can also exist even in the absence of verified enteropathy and can affect many organs. Studies have identified gluten-related immunological pathogenesis in the joints, bones, heart, thyroid, cerebellum, and in neuronal synapsin I, a protein responsible for synaptogenesis (the formation of synapses) and neurotransmitter release. Gluten ataxia has also been found to be 30 times higher in patients with celiac disease than in the general population. Ultimately, the production of autoantibodies in response to gluten may result in neuroimmune dysregulation and autoimmunity.

**Gut, brain, and body**

In 1999, the journal Gut published an article on neurogastroenterology, described as “a new and advancing subspecialty of clinical gastroenterology and digestive science.” Neurogastroenterologists examine the interactions of the central nervous system (CNS), including the brain, with the gastrointestinal tract. Alongside a focus on the neural and endocrine influences on the GI tract, this emerging discipline considers the enteric nervous system (ENS), which is embedded in the lining of the GI tract and is sometimes regarded as the “second brain.” The ENS contains far fewer neurons than the brain but many more than the spinal cord.

Traditionally, the primary focus of the field of gastroenterology was to describe the genesis of functional gastrointestinal disease. However, the inflammatory cascade that is ignited in the GI tract by offending substances that trigger an enteric reaction has body-wide implications. Moreover, enteric glial cells and mast cells communicate with the CNS. The enteric glia control gastrointestinal functions and certain neurotransmitter precursors and thus may serve as a link between the nervous and immune systems of the gut. They synthesize cytokines and appear to be involved in the etiopathogenesis of various pathological processes in the gut, particularly those with neuroinflammatory or neurodegenerative components. In 2005, Pardo and colleagues demonstrated the presence of neuroglial and innate neuroimmune system activation in the brain tissue and cerebrospinal fluid of individuals with autism, findings that support the view that neuroimmune abnormalities occur in the brain of autistic patients and may contribute to the diversity of the autistic phenotypes.

The ENS performs a triage role with the flow of information that begins with immune detection and signal transfers from the host of dietary antigens, toxins, bacteria, viruses, and yeast with which it interfaces on a daily basis. This is the basis for the neuroimmunophysiologic communication that exists as enteric neurons are activated. The GI tract, when immunologically challenged, can release various cytokines that can lead to an increase in corticotropin-releasing hormone (CRH), which is involved in the stress response. This, in turn, can affect the CNS, the hypothalamic-pituitary-adrenal (HPA) axis, and the peripheral nervous system. Translocation of bacteria or lipopolysaccharides into a damaged gastrointestinal lining can also alter the HPA axis. This complex system of stressors, antigens, cytokines, and cortisol forms a multifaceted communication network together with the neurological and neuroendocrine systems, all originating in the gut.

**The role of gut flora**

The human body is colonized by multiple species of bacteria from mouth to anus. Many are protected within biofilms—groups of microbes encased within a self-produced matrix of proteins and polysaccharides. Factors affecting microbial colonization include type of birth (i.e. vaginal vs. cesarean), diet, environment, health/disease status, medications, anatomy, host defenses, sex, and age. The health of the gut and the host is a function of their microbiota, the microorganisms that typically inhabit the gut. The enteric immune system is colonized by populations of immune and inflammatory cells that are constantly changing in response to luminal conditions and during pathophysiologic states. Disruptions in gut flora can be responsible for a host of diseases as a result of overgrowth of pathogenic bacteria.

Recognition of the role of gut flora imbalances in the development of disease has led to the examination of flora in individuals with specific diseases, including autism. A 2002 study that examined the GI flora of children with late-onset autism found that ASD children harbored more Clostridium species bacteria than control children. When fed a diet of sugar and refined carbohydrates, Clostridia produce propionic acid (PPA), a short chain fatty acid. PPA is also a food preservative found in bread products. Considering the effects of Clostridium species overgrowth, a 2008 study demonstrated how PPA produced from Clostridia resulted in negative social behaviors in rat models. Specifically, intraventricular infusions of PPA produced reversible repetitive dystonic behaviors, hyperactivity, turning behavior, retropulsion, caudate spiking, and the progressive development of limbic kindled seizures, all of which suggest that this compound has CNS effects. Moreover, this group of researchers noted that
PPA produces brain and behavioral abnormalities similar to symptoms observed in human autism. In more recent research, these authors reported that immunohistochemical analysis of brain tissue from PPA rats revealed an innate neuroinflammatory response as a result of the exposure to PPA. This demonstrates a direct influence of a gut compound on behavior.

The studies focusing on the proliferation of pathogenic bacteria and the organic acids they produce provide a persuasive framework for beginning to understand the link between the gut flora and behavior as well as cognition. There are several other examples of the relationship between the gut flora and cognition, in particular, including:

- Evidence of a verbal IQ decrement in both inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS) patients when measured against healthy controls as well as the patients’ own pre-disease IQ scores, with a particularly pronounced verbal IQ deficit in the IBD patients.
- Presence of psychiatric disorders (especially major depression and anxiety) in up to 94% of IBS patients (and frequent overlap of IBS with fibromyalgia and chronic fatigue syndrome [CFS]), with evidence that cognitive-behavioral therapy is effective in IBS sufferers.
- Relief of neurocognitive symptoms, such as short-term memory loss and ability to concentrate, in patients with CFS following re-establishment of gut flora through a probiotic combination containing Lactobacillus acidophilus (L. acidophilus), Bifidobacterium infantis (B. infantis), and Bifidobacterium longum (B. longum).

**Inflammatory disease and the gut**

As the previous examples suggest, the immune responses that arise when the gut flora are disturbed are increasingly likely explanations for the high incidence in industrialized countries of inflammatory disease, including autism. Changes in the gut flora have been shown to influence insulin resistance, metabolic disease, obesity, and the cardiovascular sequelae of obesity. Perturbations in the gut microbiota can result in a lack of immunoregulation or mucosal tolerance, thereby facilitating the overgrowth of pathogenic microbes and the production of inflammation, particularly in genetically susceptible individuals. Mucosal tolerance is essential to health. When mucosal surfaces such as the GI tract are in a state of balance, they are nonreactive to antigens (whether “self” or “non-self”), and there is no inflammation. This balance involves a complex process of anergy of reactive T cells and induction of regulatory T cells. When there is a loss of mucosal tolerance, the ensuing breakdown in innate immune system function initiates inflammation. Although inflammation is an essential immune response to an injury or pathogen, ongoing inflammation can contribute to the pathogenesis of a disease condition. The effector T cells of the adaptive immune system potentiate inflammation. Because the gut flora shape intestinal immune responses during both health and disease, the bacterial communities in the gut are intimately linked to the proper functioning of the immune system.

It has been noted that over 700 randomized, controlled human studies have been conducted on probiotics, yielding strong clinical support for their use in both the prevention and treatment of gastrointestinal disorders and metabolic syndrome. Dietary factors can shape the gut environment for the proliferation of both beneficial and pathogenic bacteria. For example, fermented foods can provide both prebiotics, non-digestible food ingredients that stimulate the growth and activity of bacteria, and probiotics. Animal products provide nutrients such as essential fatty acids and vitamins A and D, which support innate immunity and are required for the balance of T regulatory and T helper cells. Sugars and refined flour products, on the other hand, feed pathogenic bacteria. Although probiotics are now regarded as mainstream, the intricacy of these dietary relationships means that just taking a probiotic and “calling it a day” is insufficient for the maintenance of intestinal health.

**Other dietary influences on behavior**

In addition to the potential contributions of gluten and gut flora disturbances to gut dysbiosis, there are other dietary factors that can negatively influence inflammatory status. A reaction to monosodium glutamate (MSG) demonstrates a very definite and immediate connection between the gut and the brain. Glutamates, including MSG, are excitotoxins that over stimulate neurons. Individuals with autism have been found to have increased serum glutamate levels. Studies have also found a significant increase in reports of headache and subjectively reported pericranial muscle tenderness after oral administration of MSG.

The increase in omega-6 consumption over the past century can be considered another very large and uncontrolled dietary experiment that may be contributing to the increased societal burdens of aggression, depression, and cardiovascular mortality. Compensating for the omega-6 to omega-3 imbalance in our diet has yielded favorable results in some studies, such as a small pilot study suggesting that supplementation with high-dose EPA/DHA concentrates may improve behavior in children with attention-deficit/hyperactivity disorder (ADHD). In the study, significant improvements were seen in inattention, hyperactivity, oppositional/defiant behavior, and conduct disorder.

One year after a study reported on food additives and hyperactive behavior in a community sample of 3-year-old and 8- and 9-year-old children, the European Union banned the use of some artificial colors in foodstuffs. In May 2009, the American Academy of Environmental Medicine issued a position paper calling for a moratorium on genetically modified (GM) foods, stating that “Several animal studies indicate serious health risks associated with GM food,” including infertility, immune problems, accelerated aging, insulin regulation, and changes in major organs and the gastrointestinal system. The specificity of the association between GM foods and particular...
disease processes is also supported by animal studies showing significant immune dysregulation, including upregulation of the cytokines associated with asthma, allergy, and inflammation.\textsuperscript{49,50} GM foods have been shown to cause translocation of gut flora DNA, thereby altering immune response.\textsuperscript{51} Eliminating common food allergens has also been shown to benefit children’s behavior. Many of these common food allergens, corn, soy, and wheat, happen to be the most commonly genetically modified foods. Milk, another common food allergen when commercially produced, comes from cows being fed a diet of GM corn and soy. In a recent study, 64% of children diagnosed with ADHD were actually experiencing a hypersensitivity to food.\textsuperscript{52} The study showed that a strictly supervised and restricted elimination diet can be a valuable instrument to assess whether ADHD is induced by food.

### Dietary Interventions for Autism

Dietary therapies do not help everyone with autism. However, data collected from more than 27,000 parents who have completed questionnaires from the Autism Research Institute (ARI) indicate that, on average, more than half (56%) of those implementing dietary therapy report improvement.\textsuperscript{53} Often, implementing a special diet involves selecting a greater variety of foods than a child previously has been exposed to. These foods are generally whole foods that are minimally processed and primarily home-prepared. Given the scientific evidence linking overall health and chronic disease prevention to dietary intake, embracing more healthful dietary habits and minimizing processed food consumption is almost always in the best interest of a child’s growth, development, and many health-related conditions. A solid foundational diet is always a good idea.

### Going Clean: Organic Foods and the Feingold Diet

“Going clean” is often a first step in dietary interventions for autism. Autistic individuals frequently are unable to detoxify food additives or pesticides in the way that others do, leading to a toxic build-up or adverse reactions. In such cases, minimally processed foods with short ingredient lists and whole foods are better alternatives to highly processed foods. When possible, eating organic foods is even better. A 2001 study conducted by the University of Washington showed that eating organically grown foods reduced pesticide exposure in children.\textsuperscript{54} In this study, the researchers found that the levels of organophosphorous metabolites, a product of pesticide metabolism, detected in urine were higher in the children who consumed mostly conventional juice and produce.\textsuperscript{54}

The Environmental Working Group (EWG) provides a good go-to list of the fruits and vegetables that one should eat organically, if at all possible, and a list of the produce that is lower in pesticides and therefore may not have to be organic. EWG has expanded the Dirty

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<tr>
<th>Dirty Dozen Plus™</th>
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<td>1. Apples</td>
<td>10. Cucumbers</td>
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<td>2. Celery</td>
<td>11. Blueberries - domestic</td>
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<td>3. Sweet bell peppers</td>
<td>12. Potatoes</td>
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<td>4. Peaches</td>
<td>+ Green beans</td>
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<td>5. Strawberries</td>
<td>+ Kale/Greens</td>
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<td>6. Nectarines - imported</td>
<td>(May contain pesticide residues of special concern)</td>
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<td>7. Grapes</td>
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<td>8. Spinach</td>
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<td>9. Lettuce</td>
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<td>2. Sweet Corn</td>
<td>11. Cantaloupe - domestic</td>
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<td>3. Pineapples</td>
<td>12. Sweet potatoes</td>
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<td>5. Cabbage</td>
<td>14. Watermelon</td>
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<td>6. Sweet peas</td>
<td>15. Mushrooms</td>
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<td>7. Asparagus</td>
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<td>8. Mangoes</td>
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<td>9. Eggplant</td>
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*This list has been revised from the original article to reflect the changes made by the EWG.*
Phenols and Salicylates

Another reason to eat as cleanly as possible is to avoid genetically modified foods. The World Health Organization defines genetically modified organisms (GMOs) as organisms in which the genetic material (i.e., DNA) has been altered in a way that does not occur naturally. Companies use genetic modification of seeds to create plants that are resistant to agricultural chemicals; some even produce their own pesticides.

Foods containing GMO ingredients entered the market in the 1990s. Although it has not yet been possible to fully ascertain their health effects on humans, the American Academy of Environmental Medicine has noted that GMO foods were not properly tested for safety of human consumption before being released into the marketplace. Moreover, animal studies have documented adverse health effects from eating GMO foods. Animals fed GM foods display significant immune dysregulation (including upregulation of cytokines associated with asthma, allergy, and inflammation) and intestinal damage, including proliferative cell growth and disruption of the intestinal immune system. Although this does not definitively mean that the same effects will be seen in humans, the possibility of harm exists, especially in those who have a vulnerable GI tract. Because the GI tract of many autistic individuals is in need of healing, it may be worth avoiding GMO foods. However, labeling of foods containing GMOs is not currently required in the US. Since genetic engineering is a prohibited practice according to organic standards, buying organic is currently the best assurance we have that foods do not contain GMOs.

A third strategy in going clean involves avoiding foods high in phenols and salicylates, compounds that triggered learning and behavioral problems in people who are sensitive to them. Dr. Ben Feingold pioneered the research discovering how phenols and salicylates may affect behavior and provided a strategy for avoiding them which became known as the Feingold diet. Phenols are found naturally in most foods at varying levels. They are also found in manmade items such as flavorings, preservatives, cosmetics, and pharmaceuticals. Salicylates are a type of phenolic compound made by plants to protect themselves from insects or disease. Although almost everything edible contains some phenolic compounds, in sensitive individuals some phenols are more detrimental than others. The most problematic are petroleum-based additives, which include colorings, flavorings, and three preservatives called BHT, BHA, and TBHQ. Research has shown that these additives can cause hyperactive behaviors in some people.

Phenols are broken down in the body by the enzyme phenol sulfotransferase (PST). PST speeds up the detoxification of phenols by attaching a sulfate group to these compounds. This process, called sulfation, converts the phenols into a compound from which the body can rid itself. When the PST enzyme is insufficient, however, the body cannot fully detoxify dietary phenolic compounds, which then accumulate in the body. Accumulation of phenolic compounds may lead to adverse behavioral symptoms such as hyperactivity, aggression, and irritability. Because the PST enzyme is lacking in some autistic individuals, eliminating phenolic compounds from the diet may prove beneficial.

Gluten-Free/Casein-Free Diet

The opioid excess theory, described earlier in this article, postulates that the incomplete breakdown of gluten and casein may create peptides that escape the gut and cause neurological problems in autistic individuals. Gluten is a protein found in wheat, rye, barley, and oats, and casein is the protein found in milk and milk products. Although oats do not naturally contain gluten they are often cross-contaminated with wheat, unless specifically labeled as gluten-free oats. A gluten-free/casein-free (GF/CF) diet can help to resolve this problem and possibly reduce symptoms. The GF/CF diet is a commonly trialed diet for autism, and for many practitioners and parents it is the recommended therapeutic diet with which to start.

In a GF/CF diet all gluten- and casein-containing foods are completely removed from the diet. Practitioners generally recommend removing casein first for a period of two weeks. This involves removing milk and milk products including cheese, cream, ice cream, and casein-containing processed foods. Non-dairy substitutions or supplements can be used to replace the calcium and vitamin D commonly found in milk products. Possible substitutions include soy milk or enriched rice and nut milks. Soy, however, is a high-allergen food that should sometimes be avoided. Soy is also viewed as a controversial protein, given its potential influence on the endocrine system and possible impact on thyroid and estrogen activity.

Two weeks after removing casein, gluten should also be removed. This involves eliminating common items such as bread, pasta, cereals, and bagels as well as less easily recognized gluten containing items such as soy sauce and many play doughs. Reading ingredient labels is a must to successfully adhere to a GF/CF diet because many commercially available foods contain casein and/or gluten.

Several studies suggest that a GF/CF diet may be beneficial for autism. A 2002 study by Knivsberg and colleagues found statistically significant improvements in multiple symptoms of autism when children were placed on a GF/CF elimination diet. A subsequent study by Elder and colleagues used the Childhood Autism Rating Scale (CARS) to measure improvements in symptoms of autism resulting from a GF/CF diet. Although the CARS measures showed no statistically significant results, anecdotal reports indicated that some of the children experienced improvements in hyperactivity, tantrums, and language.

In addition, ARI keeps track of parent ratings on the behavioral effectiveness of biomedical interventions for autism. According to ARI ratings gathered from 3,593 parents, almost seven out of ten parents (69%) indicated that a GF/CF diet improved symptoms of autism in their child.
Although a GF/CF diet may be a worthwhile intervention, there are some drawbacks. First, because gluten and casein are found in a wide variety of foods, it may be difficult to achieve full compliance in the beginning. However, it becomes easier to strictly adhere to the diet over time. Second, although eliminating these two problematic proteins from the diet is beneficial, it may not be enough to heal the gut. Other healing interventions and supplements may need to be used in tandem with the GF/CF diet to achieve the best possible outcome. Finally, removing gluten- and casein-containing foods may cause some households to default to a diet high in sugar and refined carbohydrates. It is important to prevent this from happening since these foods can feed pathogenic gut microbes that can interfere with healing.

Many individuals will need to adhere to the GF/CF diet for a period of time before results are fully realized. Although improvements from casein removal often can be seen after a few days, gluten is much more stubborn. It may take weeks to months for a gluten-mediated autoimmune response to cease. In addition, if and when a plateau is reached, it may be necessary to consider removing other offending proteins such as soy and corn or switching to another of the healing diets reviewed below.

**Specific Carbohydrate Diet™**

The Specific Carbohydrate Diet™ (SCD™) was initially developed by pediatrician Dr. Sydney Valentine Haas and later promoted by Elaine Gottschall as a treatment for ulcerative colitis, Crohn’s disease, celiac disease, other forms of inflammatory bowel disease (IBD), and irritable bowel syndrome (IBS). Because many individuals with autism are known to suffer from gastrointestinal problems, this diet has also become popular in the autism community. According to the ARI’s parent ratings of behavioral effects of biomedical interventions, almost three-fourths (71%) of 537 parents indicated that the SCD™ made their child better. The premise of the SCD™ for autism is that ridding the intestines of harmful yeast and bacteria offers the possibility of improving gastrointestinally induced neurological symptoms while healing the gut. As discussed earlier, the proliferation of harmful microorganisms in the gut can injure the intestines, cause dysbiosis, and produce toxic byproducts and mucus. This can lead to or exacerbate some symptoms of autism. The SCD™ seeks to kill off these microorganisms by removing their food source, the complex carbohydrates that, if not properly digested and absorbed, tend to linger in the gut. Once these problematic microorganisms are removed, the GI tract can heal, thereby reversing malabsorption, improving digestion, eliminating harmful microbial byproducts, and reducing mucus. The SCD™ involves eating select carbohydrates. Monosaccharides, including certain fruits, honey, vegetables, and, eventually, homemade yogurt are allowed because the body quickly absorbs them before bacteria and yeast can feed on them. The SCD™ diet also allows meat, eggs, some cheeses, nuts, nut flours, and lentils.

One of the drawbacks of this diet for autism is that families often move on to SCD™ after already being on the GF/CF diet. Many parents are reluctant to introduce cheese or yogurt into their child’s diet. Although including these dairy foods makes the diet more varied, if casein is found to be an offending substance, the SCD™ can be followed without casein-containing foods. Other limitations include the need for strict adherence, the diet’s inability in some cases to fully eliminate excess mucus and inflammation, and the likely need for recolonization with beneficial bacteria since the SCD™ calls for supplementation with just one probiotic species, Lactobacillus acidophilus.

**Body Ecology Diet**

The Body Ecology Diet (BED), pioneered by Donna Gates, also focuses on healing the gut and rebuilding healthy intestinal flora. BED combats yeast (specifically Candida) overgrowth in the gut by eliminating yeast-nurturing foods. At the same time, it seeks to improve the intestinal flora by encouraging beneficial bacterial growth in the gut. The diet fuels this intestinal flora overhaul through the ingestion of traditional fermented foods, which are rich in probiotics, and by creating a slightly alkaline pH that allows beneficial bacteria to thrive. BED employs food-combining principles to facilitate digestion and absorption. This method involves eating fruit alone, eating proteins with non-starchy and/or ocean vegetables, and eating grains and starchy vegetables with non-starchy vegetables and/or ocean vegetables. A general 80/20 rule is important on this diet, with the recommendation that 80% of foods be land or ocean vegetables and 20% be protein, approved grains, or starchy vegetables. The 80/20 rule also applies to the quantity of food consumed, with a recommendation to eat until you are 80% full. Dairy products, with the exception of raw butter, are not typically encouraged on this diet.

Despite its healing capabilities, BED can be challenging because it involves adherence to principles such as food combining and elimination of ubiquitous yeast-proliferating foods such as sugar. In addition, BED calls for preparation methods such as soaking and sprouting alkalizing grains such as millet, quinoa, and amaranth, which can be time-consuming.

**Gut and Psychology Syndrome Diet**

The Gut and Psychology Syndrome (GAPS) diet, created by Dr. Natasha Campbell-McBride, is another diet that recognizes the gut-brain connection and seeks to improve neurological conditions such as autism by healing the gut. The GAPS diet is based on the SCD™, except that it initially excludes all dairy products and explicitly advocates a therapeutic-strength probiotic supplement.

The GAPS diet recognizes that both the casein and lactose in dairy products can be a main source of allergies and intolerances. The diet therefore recommends avoiding dairy products until the gut is healed enough to handle them, at which point a specific protocol is available for their gradual reintroduction. The inclusion of a wide variety of probiotic strains is also suggested to help recolonize the gut with non-pathogenic microorganisms.
Unprocessed and whole foods are the staples of the GAPS diet and include eggs, meat, fish, cooked and raw vegetables, nuts, garlic, and olive oil. As with BED, fruits are eaten on their own so as not to overly tax digestion. Fermented foods and homemade fish and meat stocks are important dietary components, as they improve digestion over time.60

Weston A. Price Diet
This diet is based on the work and findings of Weston A. Price, a dentist and nutrition pioneer who conducted extensive fieldwork on traditional diets in the 1920s and 1930s. Price’s work was further developed and used by Sally Fallon Morell in her cookbook titled Nourishing Traditions.61 The Price-inspired diet, in which nutrient-dense whole foods are a must, focuses on abandoning modern ways of eating and getting back on track with traditional foods and food preparation methods. Fermented foods, which are rich in probiotics, are a notable staple because they aid digestion and facilitate assimilation of nutrients. Other staples include raw milk; animal fats; homemade meat, fish, and bone broths; and soaked grains, nuts, and beans. The diet recognizes that traditional food preparation techniques such as soaking and fermenting increase digestibility, break down inflammatory chemicals in foods, and promote gastrointestinal health. Moreover, animal fats are not avoided in the diet. Fallon Morell explains how animal fats are necessary to slow digestion, provide energy, serve as carriers of fat-soluble vitamins, and enhance mineral absorption. In addition, animal fats are necessary for brain development and overall health.61

Low Oxalate Diet
Another specialized diet is the low oxalate diet (LOD), adapted for the autism community by Susan Owens, MAIS, from her work as a member of the Autism Research Institute think tank. Articles on enteric hyperoxaluria demonstrated that the level of gut inflammation in autism described by gastroenterologists would lead to excess absorption of oxalate, as had been found with other inflammatory bowel conditions. Oxalates are naturally found in many plants and fruits and in virtually all nuts and seeds. We depend upon our microbial population in the gut and the presence of Oxalobacter formigenes, an oxalate-degrading anaerobic bacterium, to metabolize the oxalate we get from food before it reaches the colon.62 In certain individuals, problems in kidney regulation cause oxalate to form into stones. In addition, for some individuals, one of the consequential issues is likely to be mitochondrial dysfunction and the impairment of specific enzymes that have been characterized as being inhibited by oxalate.63

Families that succeed on LOD may have already had good results on other diets but saw that over time those diets left unresolved problems or caused some new problems that were not tolerable. Therefore, LOD may provide a value-added benefit. There may be families who notice through diet analysis that their child’s diet, irrespective of whether they are following any other type of special diet, is very high in oxalates; LOD may be considered as a first choice in diet therapy (S. Owens, written communication, March 2013).

In a September 2011 article published in the European Journal of Paediatric Neurology, children with ASD demonstrated three-fold greater plasma oxalate levels and two and a half times greater urinary oxalate concentrations compared with matched controls without autism.64 Although further research is needed to fully explore the implications of this finding, the data are compelling in light of the recommendation to lower dietary oxalates in children with ASD who exhibit certain behaviors and physical symptoms and limitations. While the ability to measure oxalate exists via testing, making objective implementation of the diet possible, there are still families who will consider trying it based on subjective clinical symptoms.

According to Owens (written communication, March 2013), with LOD it is recommended that oxalate be limited to 40-60 mg a day (assuming 2000 calories daily intake). If one starts with an average American diet, then this amounts to decreasing the oxalate by about half; however, people on SCD or GF/CF may be consuming much more oxalate than that which is seen in a standard American diet because of the reliance on high oxalate foods as substitutes for grains in these diets. Owens urges caution and advises moving very slowly in reducing oxalate in children who were on a high oxalate diet. Stored oxalate, as it is released, can reach much higher levels than it had when it was first consumed. Owens states that these large releases can be dangerous and are proportional to how long and to what extent someone was absorbing excess oxalate in the past.

Low Glutamate Diet
Avoiding glutamate-containing foods may be another therapeutic dietary strategy for autism. Glutamate, among other things, is a major excitatory neurotransmitter in the brain, required for optimal brain functioning. Although a necessity, too much glutamate can be toxic. Sources of glutamate include animal protein, peas, mushrooms, tomatoes, and aged cheese as well as in synthetic flavor enhancers such as monosodium glutamate (MSG). If an individual has gut permeability issues, as is seen in many people with autism, the glutamates from foods can escape the gut and cross the blood-brain barrier, resulting in an overload of glutamate in the brain. This may lead to some of the neurological symptoms seen in autism.64 In this case, avoiding or reducing these foods may improve symptoms.
<table>
<thead>
<tr>
<th>Name/type of diet</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organics/Feingold diet</td>
<td>- Eating whole, minimally processed, and clean foods promotes health and longevity</td>
<td>- More expensive</td>
</tr>
<tr>
<td></td>
<td>- Eliminating phenols typically not too restrictive (unless fruit and fruit juices are dietary staples)</td>
<td>- Additional time for food preparation and cooking</td>
</tr>
<tr>
<td>Gluten-free/casein-free (GF/CF) diet</td>
<td>- Worth trying to bring about improvements in symptoms of autism</td>
<td>- Compliance and adherence difficult at first</td>
</tr>
<tr>
<td></td>
<td>- Due to the diet’s popularity, many gluten-free and casein-free foods easily available</td>
<td>- Important not to default to foods high in refined sugar.</td>
</tr>
<tr>
<td></td>
<td>- Eliminating phenols typically not too restrictive (unless fruit and fruit juices are dietary staples)</td>
<td>- Gluten-free and casein-free processed foods typically more expensive than traditional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>processed foods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- May need to supplement calcium and vitamin D</td>
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<tr>
<td></td>
<td></td>
<td>- Additional interventions may be needed to maximize healing if the GF/CF diet is not working or a plateau has been reached</td>
</tr>
<tr>
<td>Specific Carbohydrate Diet™ (SCD™)</td>
<td>- Effective diet that has proved helpful in many cases</td>
<td>- Restrictive, especially if attempted without dairy</td>
</tr>
<tr>
<td></td>
<td>- Good at improving gut flora</td>
<td>- Because nuts are used in place of grains, can be problematic for those with nut allergies or sensitivities, or who have difficulty processing the oxalates in nuts</td>
</tr>
<tr>
<td>Body Ecology Diet (BED)</td>
<td>- Good at ridding the body of yeast and improving the gut flora</td>
<td>- Time-consuming</td>
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<tr>
<td></td>
<td></td>
<td>- Restrictive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Have to keep track of food types and combinations</td>
</tr>
<tr>
<td>Gut and Psychology Syndrome (GAPS) diet</td>
<td>- Good healing diet that removes offending food items and improves gut flora</td>
<td>- Time-consuming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Restrictive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- May need to supplement calcium and vitamin D</td>
</tr>
<tr>
<td>Weston A. Price diet</td>
<td>- All-around healthy diet</td>
<td>- Time-consuming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Raw milk not widely available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Some concern in the medical community for raw milk use, especially with the medically frail</td>
</tr>
<tr>
<td>Low oxalate diet</td>
<td>- Elimination of oxalates may result in improvements for children who have problems processing oxalates</td>
<td>- Many foods contain oxalates, making compliance difficult</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- May be difficult for those on diets that rely on high-oxalate foods (potatoes for GF/CF or nuts for SCD™)</td>
</tr>
<tr>
<td>Low histamine diet</td>
<td>- Beneficial if foods high in histamines are a child’s major offender</td>
<td>- Can be challenging to implement because avoidances conflict with the principles of many other diets</td>
</tr>
<tr>
<td>Low glutamate diet</td>
<td>- Initially reducing high-glutamate foods for children who are highly excitable and who consume mostly animal protein may bring improvements during the gut healing process</td>
<td>- Animal protein is a foundational food in many of the other diets; its elimination or minimization creates a need for creative meal planning to assure that all protein and nutrient needs are being met</td>
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<tr>
<td></td>
<td>- After improving the integrity of the GI tract and reducing its permeability, the need to reduce high-glutamate foods may be less of an issue</td>
<td></td>
</tr>
<tr>
<td>Modified Atkins diet</td>
<td>- Appears to be highly effective for seizure control</td>
<td>- Very challenging to implement and maintain due to intensely restrictive carbohydrate intake</td>
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<td></td>
<td>- Improvements seen rapidly if the diet works for a child’s type of seizure</td>
<td>- Nutritional supplementation needed to assure adequate intake of micronutrients</td>
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<td></td>
<td></td>
<td>- Must be maintained for two years for best efficacy</td>
</tr>
<tr>
<td>Fermentable, oligo-, di-, and monosaccharides, and polyols (FODMAP)</td>
<td>- Can quickly reduce GI distress if FODMAP foods are the most offending factors</td>
<td>- Restricts certain fruits, vegetables, legumes, and dairy products</td>
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</tbody>
</table>
However, glutamine is synthesized from glutamate, and glutamine is essential for the maintenance of the gastrointestinal barrier and for the production of glutathione, a potent antioxidant. The risks of limiting dietary glutamate therefore need to be weighed against the benefits.

**Modified Atkins Diet**

Many children with autism are also diagnosed with seizure disorders. Ketogenic diets have been used to treat pediatric epilepsy since the 1920s and have been extensively studied in patients at the Johns Hopkins Children’s Center (JHCC) over the past decade. Although the ketogenic diet’s mechanism for controlling seizures is still unknown, it has proven to be especially helpful for children with intractable epilepsy that isn’t well controlled by medications or surgery.  

Limitations of the traditional ketogenic diet include its generally unpalatable nature, the need for strict adherence to a specific protein: fat ratio, and fluid restrictions. The late Dr. Robert Atkins then created the Atkins diet, a ketogenic diet designed to treat conditions including obesity, gut disorders, diabetes, and seizures. Dr. Atkins’ diet involved an induction phase of no more than 20 grams of carbohydrates daily, followed by gradual increases while still supporting clinical objectives. Dr. Eric Kossoff of JHCC followed with a modified version of the original Atkins diet featuring some distinct differences. The modified Atkins diet, for example, is decidedly high in fat and restricts carbohydrates indefinitely, rather than during an initial induction period only. In the modified diet, there is no weighing, measuring, fluid restriction, or restriction of calories. Although some individuals lose weight on the modified Atkins diet, weight loss isn’t the primary goal. Encouraging fat calories, especially in a growing child, helps to assure continued growth.

**FODMAPS**

The acronym FODMAPs (fermentable, oligo-, di-, and monosaccharides, and polyols) describes a group of fermentable short-chain carbohydrates. FODMAPs, as short-chain sugars, can be easily fermented and exert an osmotic effect, increasing fluid delivery into the large bowel and resulting in gas, pain, and osmotic diarrhea. Individuals with visceral hypersensitivity or gut motility disorders appear to be particularly distressed by the side effects these carbohydrates cause. In such individuals, the colonic microflora feast on the malabsorbed sugars and create gas, which contributes to abdominal bloating. Growing evidence reveals the beneficial role of minimizing FODMAPs in those with functional gut disorders (FGDs) such as IBS. The diet reduces FODMAP intake and categorizes foods based on their primary carbohydrate source. Reducing global intake of FODMAPs to manage functional gut symptoms may provide symptom relief for about 75% of patients with FGDs.

**Take Home Message**

When diet and microbiota are in concert with the body, the enteric nervous system does not get stimulated into an inflammatory state. It stands to reason, then, that body-wide inflammation, such as that which occurs in the brain and central nervous system of children with autism, may be improved through diet. Research appears to demonstrate that the way to build a better brain is through the gut. It may be as simple as changing one side of the equation (diet) to affect the other side of the equation (symptoms). In the same way that what a mother consumes during gestation is known to influence her baby’s neurological development, it appears that everything the baby consumes after birth has to be regarded as important, with the utmost respect given to the gut, in particular. As fragile as the gut is, it is also the most difficult system to repair. The gut is the interface for the health of the entire body, and healing the GI tract can have effects on all body systems. The various therapeutic diets recommended for healing the integrity of the GI tract and reducing gut permeability and its associated sequelae (see summary of pros and cons in Table 2) may offer noninvasive options for reducing the risk of or treating various complexities of ASD. A thorough assessment and an individualized diet plan, conducted and monitored by a professional experienced in integrative and functional nutrition, are the first steps in the healing process.

**References:**


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Published by the New England Journal of Medicine\(^1\), findings from the landmark Spanish PREDIMED (PREvención con Dleta MEDiterranea) trial, report that a Mediterranean diet including nuts, primarily walnuts, reduced the risk of cardiovascular diseases (myocardial infarction, stroke or cardiovascular death) by 30% and specifically reduced the risk of stroke by 49% when compared to a reference diet consisting of advice on a low-fat diet (American Heart Association guidelines). Please note, that study participants were over the age of 55, living in Spain and at high cardiovascular risk; whether the results can be generalized to persons at lower risk or to other settings requires further research.

According to lead researcher Dr. Ramon Estruch\(^2\), “The results of the PREDIMED trial are of utmost importance because they convincingly demonstrate that a high vegetable fat dietary pattern is beneficial for cardiovascular prevention.”

Co-investigator Dr. Emilio Ros believes that these findings build on previous research where he has found positive results in consuming walnuts, and thinks the unique nutrient profile of walnuts may be one of the key factors responsible for the health benefits of the Mediterranean diet.

“In addition to being the only nut containing significant amounts of alpha-linolenic acid – the plant-based omega-3 fatty acid – walnuts offer numerous antioxidants and additional nutrients that, I believe, work together synergistically to produce their cardiovascular protective effect\(^3\),” states Dr. Ros.

Click here for helpful Mediterranean diet tools for you and your clients.

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\(^3\) Please note: One ounce of walnuts provides 18g of total fat, 2.5g of monounsaturated fat, 13 g of polyunsaturated fat, including 2.5 grams of alpha linolenic acid - the plant based omega-3, 2g of fiber; 4g of protein, 3.68 mmol/28 g of antioxidants. (http://www.nal.usda.gov/fnic/foodcomp/cgi-bin/list_nut_edit.pl)
Questions – Review of the Literature Regarding the Gut-brain Connection in Autism Spectrum Disorders and Associated Special Diet Therapies

Choose the one best answer to each question.

1. The opioid excess theory postulates that _________.
   a. Children with autism may react to gluten and casein in metabolically different ways
   b. Incomplete digestion of gluten and casein results in the production of substances with opioid activity
   c. Opioids from foods cause neurological manifestations when consumed in greater quantities than what is produced by the central nervous system
   d. Oral tolerance to dietary antigens breaks down, leading to systemic inflammation

2. What condition must be present in order for gluteomorphins and casomorphins to cross the blood-brain barrier?
   a. Autism spectrum disorder
   b. Celiac disease
   c. Intestinal permeability
   d. Opioid excess

3. According to research by Knivsberg and colleagues, children with autism and urinary peptide abnormalities who maintained a gluten-free/casein-free diet for one year showed improvements in
   a. Social connectedness and willingness to learn
   b. Language development and ability to make transitions
   c. Aggressive behavior and hyperactivity
   d. Repetitive dystonic behavior and digestion

4. Which of the following did Fasano and colleagues find in persons with gluten sensitivity?
   a. Innate and adaptive immune system activation
   b. Increased zonulin production and tissue transglutaminase antibodies
   c. Endomysial antibodies and intestinal inflammation
   d. Anti-gliadin antibodies and DQ2 or DQ8 genes

5. Which of the following is an example of the gut-brain connection?
   a. Antigens in the gut can trigger a reaction by the gut-associated lymphoid tissue (GALT)
   b. Cytokines released by the GI tract can increase corticotropin-releasing hormone
   c. Gluten intake can stimulate zonulin production
   d. Gut flora imbalances can lead to the overgrowth of pathogenic bacteria

6. The gut microbiota may be influenced by which of the following factors?
   a. Enteric glial cells
   b. Zonulin
   c. Cesarean birth
   d. Propionic acid

7. Which of the following would best be used to determine whether food sensitivities were contributing to a child’s ADHD?
   a. IgE testing
   b. Elimination diet
   c. Urinary peptide testing
   d. Food diary

8. Based on data collected by the Autism Research Institute, approximately what fraction of parents report improvements after implementing dietary therapy for their children with ASD?
   a. 1/3
   b. 1/4
   c. 1/2
   d. 3/4

9. Fermented foods are an important component of all EXCEPT which of the following diets?
   a. Body Ecology Diet
   b. Weston A. Price Diet
   c. Feingold Diet
   d. Gut and Psychology Syndrome Diet

10. Fermented foods should be avoided on which of the following diets?
    a. Low Glutamate diet
    b. Low Oxalate diet
    c. Gluten-Free/Casein-Free diet
    d. Low Histamine diet

11. What is the main difference between the Atkins diet and the Modified Atkins diet?
    a. The omega-6:omega-3 fatty acid ratio
    b. The types of carbohydrates allowed
    c. The amount of protein allowed
    d. The duration of carbohydrate restriction

12. A 2002 study looking at the gut flora of children with autism found more of which species in children with ASD compared to control children?
    a. Lactobacillus acidophilus
    b. Bifidobacterium longum
    c. Clostridium
    d. Bifidobacterium infantis

13. Why are monosaccharides permitted on the Specific Carbohydrate Diet?
    a. They provide fuel for beneficial bacteria
    b. They are absorbed quickly before microbes can feed on them
    c. They reduce mucus and improve digestion
    d. They help kill off harmful microorganisms

14. A main component of the Feingold diet is
    a. Avoidance of phenols and salicylates
    b. Restriction of carbohydrates to induce ketosis
    c. Avoidance of glutamate-containing foods
    d. Soaking and fermenting foods to increase digestibility

15. One drawback of a gluten-free/casein-free diet is
    a. It cannot be combined with other dietary approaches
    b. It requires keeping track of food combinations
    c. It may lead to an increased intake of refined carbohydrates
    d. It requires time-consuming food preparation
Instructions for Completing the CPE Activity for Credit

1) Read the Continuing Professional Education article and answer the associated quiz questions. For each question, select the one best response. Compare your answers to the answer key on this page.

2) Send your completed quiz and application for CPE credit by email, fax or mail to:
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4500 Keeney Street, Skokie, IL 60076
sbethp@gmail.com
fax: 312-569-6118

3) Complete the CPE Certificate online and retain it for your records. You will be notified only if your application for credit is not approved.
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Folic acid supplementation in early pregnancy linked to lowered risk of autism

Women who took folic acid supplements from four weeks before the start of pregnancy through the first eight weeks of pregnancy had a significantly lower risk of having a child diagnosed with autistic disorder, the most severe form of autism spectrum disorder. The study sample was based on the prospective Norwegian Mother and Child Cohort Study (MoBa) and included 85,176 children born between 2002 and 2008. By the study’s end on March 31, 2012, children ranged in age from 3.3 to 10.2 years and 270 children had been diagnosed with an autism spectrum disorder (0.32%). The children exposed to folic acid had a 39% lower risk of autistic disorder. Of children whose mothers took folic acid supplements during all or part of the 12-week exposure window, 0.10% (64/61,042) developed autistic disorder, compared to 0.21% (50/24,134) of children whose mothers did not take folic acid supplements. No association was found with Asperger syndrome or PDD-NOS (Pervasive Developmental Disorder, Not Otherwise Specified). No association was found between combined daily dietary and supplemental folic acid at gestational week 22 and risk of autistic disorder. The authors note that foods naturally containing folate and folic acid supplements were the only sources of the vitamin for the women in the study; there was no fortification at the time of participant recruitment.


Elevated toxic metals levels found in children with autism

In a case-control study, children with autism (n=55), compared to neurotypical children (n=44), were found to have significantly higher levels of lead in their red blood cells (41%), and urinary lead (74%), thallium (77%), tin (115%) and tungsten (44%). Children ranged in age from 7 to 14; the autism group included those diagnosed with autistic disorder (85%), Asperger’s syndrome (11%) and PDD/NOS (4%). In addition, levels of cadmium in whole blood and mercury in whole blood and in red blood cells were most closely associated with autism severity.


Early antibiotic exposure and food allergies in children

In a retrospective case-control study, researchers found that infants exposed to three or more courses of antibiotics before one year of age had a significantly greater risk of food allergies. Study results were presented on February 26th in an abstract at the American Academy of Allergy, Asthma & Immunology 2013 Annual Meeting, which took place at the end of February. While the study cannot determine causation, the researchers hypothesize that, “altering the normal gut flora in infants with early use of antibiotics might contribute to the increasing prevalence of childhood food allergy.”


Irritable bowel syndrome and diet

This review article details the role of diet in the development and management of irritable bowel syndrome (IBS). While the intake of calories and macronutrients is not different in patients with IBS versus those without IBS, patients with IBS consume a diet lower in calcium, magnesium, phosphorus, riboflavin and vitamin A. Food allergies and intolerances have not been found consistently in patients with IBS. It is often difficult to clinically differentiate between symptoms of IBS and celiac disease, and certain foods, such as durum wheat products, will exacerbate both conditions. Durum wheat is higher in fermentable oligo-, di- and monosaccharides and polyols (FODMAPs), which may increase IBS symptoms. An overview of the neuroendocrine system of the gut is provided, including the primary signal substances and their actions. Gut hormone abnormalities have been associated with IBS, which may explain the IBS symptoms of irregular motility.
and visceral hypersensitivity. IBS patients should be counseled to avoid foods rich in FODMAPs and increase foods supplemented with Lactobacillus and Bifidobacterium strains of probiotic bacteria. The restriction of FODMAP-containing foods should be tailored to the patient’s tolerance, and patients should evaluate the effect of diets higher and lower in protein, carbohydrate and fat on their IBS symptoms.


**International Society of Nutrigenetics/Nutrigenomics Introductory Workshop**

An introductory workshop was held during the 6th Congress of International Society of Nutrigenetics/Nutrigenomics (ISNN), which was held last November in São Paulo, Brazil. Abstracts from each of the workshop’s presentations are provided below. Topics include how diet can influence enzymes and proteins produced by our genes (gene expression), and how variations in DNA methylation can also influence gene expression (epigenetics/epigenomics). Genetic testing and gene expression microarray testing are also mentioned along with gene–gene interactions (epistasis), and gene-environment interactions. Specific online resources are provided relevant to terminology and synonyms for genes and gene variants. Education of dietitians and the role of dietitians in educating the public are also addressed. The next ISNN Congress will be held in tourist-friendly Quebec City, Canada on October 5-8, 2013. Save the date.

**2013 ISNN Abstracts:**

**Dietary modulation of gene expression: implications for health and disease**

Chandan Prasad, Professor & Chair, Department of Nutrition and Food Sciences, Texas Woman’s University Denton, TX 76204

“Let thy food be thy medicine and thy medicine be thy food.” — Hippocrates (460-377 B.C.) It was not until the early naturalistic era (circa 400 BC) that diet was recognized as an important element in disease prevention and treatment. This is reflected by a quote from Hippocrates, the great physician-philosopher, who lived during the early part of the era. Since then, we have made great progress in our understanding of nutrition and its role in disease as well as maintenance of good health. However, it was not until some 25 years ago that we could explain why some individuals who consume high fat diet, show no evidence of atherosclerotic disease like most others? The answer to this question lies in our inherent genetic differences that make us respond differently to different dietary components. The completion of the sequencing of the human genome in 2001 has not only provided tools but also ignited interest in our search for role genetics in handling of nutrients and vice versa. In the workshop, Dr. Prasad touched upon how different components of the food that we consume affect gene expression. Examples will come from modulation of gene expression by macronutrients (fats, carbohydrates and proteins), micronutrients (vitamins and minerals) and other food components (flavonoids and xenobiotics). Time permitting, he also touched upon how food components can also affect expression and function of essential proteins.

**Nutritional Epigenomics**

Thomas Ong, Faculty of Pharmaceutical Sciences, Food and Nutrition Research Center, University of São Paulo, Brazil

Epigenetics refers to heritable changes in gene expression that are not accompanied by alterations in DNA sequence. The main epigenetic processes are DNA methylation, histones post-translational modifications and microRNAs. They modulate gene expression by altering chromatin architecture. Increasing evidence shows that nutrients influence these epigenetic processes. One-carbon metabolism, in which folate and vitamin B12 are key components, provides the methyl groups for cytosine and histone methylation reactions. Several other food components including green tea catechins, garlic allyl-compounds, retinoids, fatty acids and selenium have been shown to modulate the activity of enzymes that integrate the epigenetic machinery, including DNA methyltransferases and histone deacetylasers and acetyltransferases. More recently, nutritional regulation of microRNAs has been reported. Dietary modulation of the epigenome expands the complexity of gene-nutrient interactions. At the molecular level, non-communicable diseases including not only cancer, but also obesity, diabetes, cardiovascular and neurodegenerative diseases display profound epigenetic deregulation. Inadequate nutritional modulation of DNA methylation, histone acetylation and methylation and microRNA expression during early life, in which the epigenome is especially plastic, could be associated with the developmental origin of health and disease (DOHaD). Thus a deeper understanding of the mechanisms whereby nutrients exert such influences will be fundamental for the definition of strategies for health promotion and disease prevention, that should consider a life course approach probably starting early in life.

**Nutrigenetics and implications for dietetics practice**

Colleen Draper, MS, RD, LDN; Academy of Nutrition and Dietetics, United States; Nestlé Institute of Health Sciences, Lausanne, Switzerland

Nutrigenetics is focused on the impact alterations in our genes have on our potential health trajectory, which is strongly influenced by food, nutrition, stress, and toxins. In order to understand an individual’s health trajectory of resilience and adaptability, we need to assess multiple components of the health equation. One essential component is genetic susceptibility. Although we know gene polymorphisms, such as single gene polymorphisms (SNPs) only contribute 1% to our knowledge of heritability, and the large number of variants (including approximately 2 million SNPs) identified through genome wide association studies on large numbers of people (as much as 250,000 in some studies) so far explain only 5-10% of heritability for common chronic health issues, such as dyslipidemia, obesity, and diabetes, this...
offers us a place to start. Ultimately, the outcomes of this equation need to be measured and monitored, through gene expression analyses (mRNA microarrays), proteomic and metabolomic analyses. For example, urinary metabolite testing is already used by early adopters in nutrition practice to conduct a functional nutrition assessment that identifies early phase markers of metabolic dysfunction that, if left unchecked, will eventually result in a loss of health plasticity and disease will ensue. Nutritional genetic susceptibility testing has been available commercially, although sporadically, for the last decade. It is important to know the limitations of this information. This includes: missing disease risk heritability, which has not been fully explained due to the need for a better understanding of epistasis (gene x gene interactions – including the newly recognized impact of copy number variants), impact of rare variants, epigenomics interactions, and environmental interactions not yet identified.

A new strategy to analyze gene-nutrient interaction
Jacqueline Pontes Monteiro1, et al, Department of Pediatrics, Faculty of Medicine. Faculty of Nutrition and Metabolism, University of Sao Paulo Ribeirao Preto, SP, Brazil, et al.

The challenges with analyzing gene-nutrient interactions include: genetic heterogeneity in humans: the complexity of environmental factors, with particular attention to dietary intake differences, the resulting diverse physiologies that produce the same apparent disease and, to provide reliable and predictable personalized dietary recommendations for specific health outcomes. Our novel experimental approach is (i) to use cross over intervention designs for nutrients with small effect sizes, (ii) use deep phenotyping and genotyping methods (iii) identify patterns with and between different data types using conventional and novel statistical methods, (iv) use dietary and lifestyle information to interpret results of group and level individual analyses, and (v) make recommendations for diet changes. This strategy was developed and tested in a 2-year intervention study of 61 children ages 6 through 14 (23 boys and 38 girls). Plasma levels of homocysteine (Hcy), SAM, SAH, pyridoxal, pyridoxine, thiamin, riboflavin, vitamin A, vitamin E and vitamin D were analyzed in samples taken before, at the end, and one month after a whole food intervention trial. Discovery methods identified two SAM/SAH clusters, one with a mean SAM/SAH of 1.81 (C1) and the other (C2) with a mean of 0.81 (p < 10^-4). Generalized Linear Mixed Effects analyses discovered patterns of 182 SNPs in 81 genes that differed significantly between C1 and C2. The average gene methylation differences were similar between C1 and C2. The SAM/SAH ratio in children with genotype A was sensitive to decreased nutrient intake values. SAM/SAH ratio was associated with nutritional status and may be a marker of poor nutrition in this population. Genetic patterns associated with response to the intervention were found and analyzed through a systems biology approach. Replicating and validating nutritional genomics studies on the individual level are a priority before personalized nutrition can be considered a valid approach to improving human health.

Nomenclature and databases in nutrigenetics
Ron L. Martin, MS; President, Nutrigenetics Unlimited, Inc., Fullerton, California, USA.

Nutrition is the most universal example of gene-environment interaction since its unavoidable impact begins even before birth and continues throughout life. Gene-environment interactions are profound because they affect our physical health, emotions, behaviors, and sense of well-being. Although automated tools for clinical decision support are constantly being pursued, it is unlikely that automation will ever completely replace the need for individualized attention from professionals. In order to effectively utilize the “evidence base” for either nutrition or medicine, one of the most basic needs is the ability to recognize within the literature the multiple synonyms for genes and gene variants used by different authors. Examples will be shown of common synonyms for genes and gene variants relevant to nutrition. For instance, a single nucleotide polymorphism (SNP) may sometimes be described by its nucleotide substitution (e.g., 677C-T for the MTHFR gene), or by its corresponding amino acid substitution (Ala222Val, or A222V), or by its reference SNP number (rs1801133). Resources for identifying synonyms for both genes and gene variants will be described, including the Human Gene Nomenclature database at www.genenames.org, or the OMIM database at www.ncbi.nlm.nih.gov/omim, or the MeSH Browser at www.nlm.nih.gov/mesh/MBrowser.html, or the SNP database at www.ncbi.nlm.nih.gov/snp. Besides assisting with nomenclature, the database at www.nutrigenetics.net can also help identify exactly which genes and gene variants have been studied in connection with any given topic, including nutrients, health conditions, pharmaceuticals, and other risk modifiers. Valuable tools are already available for studying gene-environment interactions including nutrition, and for translating that information into clinical practice, as listed above with others to be described. Practical use of tools like these requires both education and engagement with researchers, health professionals, and members of the public – including educators, students, journalists, and companies.

Teaching nutritional genomics to dietetics students
Chandan Prasad, Professor & Chair, Department of Nutrition and Food Sciences, Texas Woman’s University, Denton, TX 76204.

Nutritional genomics offers a great promise to personal health management based on understanding of relationship between diet, gene expression and health outcomes. While the ideal healthcare provider for delivery of nutrigenomic education to public will be the primary care physician (general internist, family medicine physician, or pediatrician), this is unlikely to come to fruition for many reasons. These include, a greater demand on physicians to see more patients in less time as well as lack of emphasis on training of physicians in the science of nutrition and nutrigenomics in the medical schools, or during residency training. With
The need for training dietitians in the science and practice of nutritional genomics. Our readiness to deliver nutrigenomics-based nutrition education has been slow due to complexity of gene-nutrient interaction and interplays between many disciplines such as genetics, nutrition, biostatistics, sociology, law and philosophy in the process. In his talk Dr. Prasad presented some key learning objectives that dietitians must master to be able to educate the public with not necessarily a nutrition advice based on gene profiling, but also limitations of this technology.

Permission to reprint above abstracts from Journal of Nutrigenetics and Nutrigenomics Vol. 5, No. 4-5, 2012. S. Karger AG, Medical and Scientific Publishers, Basel Switzerland.

Monique Richard is pursuing a Master of Science degree while completing a dietetic internship at East Tennessee State University in Johnson City, TN. Monique is a Student Representative for the Academy of Nutrition and Dietetics, the Student Committee Chair for DIFM, and serves as the Student Outreach Chair for the American Overseas Dietetic Association, an affiliate of the Academy. Monique has traveled to China, India, Israel, Italy, and Egypt participating in nutrition related education or research presentations. Contact Monique at mmr2v@mtmail.mtsu.edu.

The 2013 Public Policy Workshop, March 10th-12th
The Academy of Nutrition and Dietetics’ Public Policy Workshop took place in Washington D.C., the home of our nation’s legislative and governing branches. Legislation, congress, licensure, regulations, and policy related to food and nutrition were the focus of the three-day long workshop. Getting to the root of the issues, this year’s theme focused on “policy from the ground up.” Below is a brief overview of the activities, highlights of the sessions, and the issues brought to Capitol Hill.

We kicked off the workshop with the Academy President, Dr. Bergman, emphasizing the Academy’s Political Action Committee (ANDPAC) motto “If dietetics is your profession, then policy should be your passion.” Attendees enjoyed Meatless Monday and were briefed on the issues most pertinent to dietetics.

• Effective March 1, the consequences of sequestration will result in cuts to the National Institutes of Health; Food and Drug Administration; Centers for Disease Control and Prevention; Women, Infants, and Children; food safety; Head Start; Supplemental Nutrition Assistance Program (SNAP); SNAP-Ed; and senior programs, like Meals on Wheels.

• The Older Americans Act (OAA), which helps keep older Americans healthy and independent by offering congregate dining and programs such as Meals on Wheels, is vulnerable to cuts and restructuring. Robert Blancato explained how these services save millions in Medicaid and Medicare dollars.

• At the ANDPAC signature gala event, Representative Elijah Cummings praised the efforts and skills that registered dietitians offer. He urged us to keep moving forward with all the knowledge and passion we bring to our patients and clients every day to lead the nation to a better state of health.

• Under the Farm Bill, SNAP and SNAP-Ed are facing potential devastating cutbacks affecting the 90 million people eligible for the program. We learned about the innovative and effective SNAP-Ed programs taking place across the nation that are really making a difference in local communities and in the lives of so many in need.

• Senator Heidi Heitkamp, the first female senator of North Dakota, led a passionate session imploring dietitians to use nutrition as “the vanguard of the next great health outcome.” She praised our efforts and inspired us to affect behavior change and continue our force in the lives of so many.

• The issue of GMOs and sustainability were presented by two RDs, Melinda Hemmelgarn and Jennifer Schmidt, who runs her own family farm in the area.

• An update on the process of Menu Labeling and regulations was presented by Dr. Mango Wootan.

• The advancement of informatics and unforeseen questions were explained in the technology forum and order writing and privileging briefs were explained by panel experts.

• White House Chef, Sam Kass, talked about the Let’s Move initiative and Massachusetts Representative Jim McGovern addressed the issue of Hunger in America. Iowa State Representative, Bruce Braley, spoke about the importance of prevention and wellness in healthcare, rewarding patients for outcomes rather than treating sick people.

• 400 PPW attendees ventured to Capitol Hill to speak with their state senators and representatives to emphasize the importance of the issues discussed over the workshop as well as address the Medicare Diabetes Prevention Act, Ryan White Program Reauthorization, and loan forgiveness under the Access to Frontline Health Care Act (H.R. 702).

Policy affects the entire dietetics profession and it is up to us to lead the change or let it lead us. PPW encouraged the attendees to be an advocate, a partner, and a change agent in the ever-evolving healthcare and political environment. It will take all of us and it will take time, but if we start at the local level, to lobby, create, and collaborate, we can make a profound and lasting difference!
Introduction
Stress is on the rise among women. The 2012 Stress in America™ survey from the American Psychological Association found that nearly 7 of every 10 women say they live with unhealthy stress levels. Fully 69% of women rate their stress a 4-10 on a 10-point scale and 23% of women rated their stress an 8, 9 or 10. They consider a healthy level of stress a 3.6 out of 10. New research published in the *Journal of the American College of Nutrition* explores the effective role that boosting immunity can have on helping women manage the symptoms of psychological stress.

The Link Between Stress and Immune Health
Suppression of the immune system is among the many health problems associated with stress. Stress may prematurely age the immune system and can enhance the risk of illness as well as age-related diseases. It is also associated with increased upper respiratory symptoms such as cold and flu. While acute or short-term stress can enhance innate and adaptive immune responses, chronic or long-term stress can suppress immunity in several ways including changes in immune cell numbers and function, increasing active immunosuppressive mechanisms (such as regulatory T cells), and dysregulating immune function by promoting proinflammatory and type-2 cytokine-driven responses.

Current conventional dietary approaches to support immune health and manage symptoms of stress focus on avoiding deficiencies, particularly with weight loss/dieting or appetite suppression. These approaches also focus on getting adequate fluid intake. There is little data and mixed results on “mega dosing” of Vitamin C or E supplementation and data is lacking on the benefits of minerals such as Zinc and Magnesium. Likewise there is negative or inconclusive data with many poorly designed studies with limited or no changes in immune biomarkers for herbal supplements such as Echinacea, beta carotene, ginseng and blueberry extract.

Researchers, however, are finding ways to unlock the body’s natural ability to maintain health.

Insight into Immunity and Stress
Published research found that Wellmune WGP, a natural immune health ingredient from Biothera, may help moderately and highly stressed women maintain protection against the symptoms of colds, flu and stressors of everyday life. While this is the first published study exploring the effects of Wellmune WGP on stressed women, several other peer-reviewed studies in marathoners, fourth-year medical students and firefighters have consistently demonstrated that Wellmune strengthens immune cells to protect against the harmful effects of stress.

Wellmune is a proprietary baker’s yeast beta glucan that safely boosts the immune system to help keep the body healthy. Nine human clinical studies demonstrate that Wellmune mobilizes billions of innate immune cells that are part of the body’s natural defenses without over-stimulating the immune system.

Study Design and Results
The randomized, blinded, placebo-controlled study included 77 healthy women (age 38 + 12 yrs) pre-screened for moderate levels of psychological stress were given either a placebo or 250 mg of Wellmune WGP daily for 12 weeks.

The Wellmune group had a 58% reduction in reported upper respiratory tract infection symptoms. Only 10% of the Wellmune group reported upper respiratory tract infection symptoms (sore throat, stuffy or runny nose, and cough) compared with 29% for the control group (p value ≤ 0.05).

The study used the Profile of Mood States (POMS) psychological survey to assess: changes in mental/physical energy levels (Vigor) and overall well-being (Global Mood State). Vigor improved 41% in women taking Wellmune WGP compared with 7% in the control group (p value <0.05). Similarly, the Global Mood State of women taking Wellmune improved 29% compared with 16% in the placebo group (p value <0.05).
Implications for Dietitians

The study findings show that daily dietary supplementation with Wellmune reduces upper respiratory symptoms and improves mood state in stressed women. Adding products with Wellmune to the diet is a clinically proven approach to helping women maintain immune protection against the stressors of daily life.

Incidence of Upper Respiratory Tract Infection Symptoms

Total number of subjects reporting any of 11 pre-selected upper-respiratory symptoms at the conclusion of the study. Subjects orally administered placebo or 250mg Wellmune WGP containing supplement daily for 12-weeks. The beta-glucan group reported fewer upper respiratory symptoms at each week (range 4 to 9 symptoms per week) and across all weeks (19 total) versus the placebo group (range 7 to 12 symptoms per week and 30 total).²

Global Mood States

Global Mood State improved 29% in the Wellmune WGP group (140+43 to 99+19) compared to 16% in the placebo group (128 +37 to 108 +23). The global mood state was calculated based on scoring (0-4 with 0 = not at all, 2 = moderately and 4 = extremely) answers to 58 of the 65 adjectives of the POMS (a lower number is a “better” global mood state).²

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²Shawn M. Talbott, PhD, FACN and Julie A. Talbott, MBA, J. of Am. Coll. of Nutr: August 2012, 31(4)295-300
⁴Djuric et al, 2010; Geronimus et al, 2010
⁹http://www.wellmune.com/research/scientific-literature/clinical-research/
Resource Review

Advancing Medicine with Food and Nutrients, Second Edition
Ingrid Kohlstadt, MD, MPH
Hardcover. $149.95
ISBN-10: 1439887721

Advancing Medicine with Food and Nutrients is a comprehensive exploration of the evidence supporting the role of nutrition in disease prevention and health. Written by seventy of the world’s leading functional and integrative medicine physicians and practitioners, including DIFM’s own Colleen Fogarty Draper, MS, RD, LDN, the book is well-organized and divided into sections by systems addressed, e.g., Section II: Cardiovascular, Hematologic, and Pulmonary Conditions; Section III, Gastrointestinal Disorders; and Section IX: Reproductive Health and Toxicology. Each section discusses treatment approaches including dietary interventions and supplement strategies.

An evidence-based source for prevention and treatment of many of the conditions plaguing Western society, this book delves into topics including obesity, heart disease, fibromyalgia, and breast and prostate cancers, to name a few. Nutrition, lifestyle choices, and environmental exposure to toxins fundamental to health and well-being are explored, as is the specific use of food and nutrients to heal. The authors demonstrate which clinical information helps them formulate clinical decisions in a clear and helpful way. There is an emphasis on restoring optimal nutrient levels to facilitate healing and enhancing detoxification. Food safety in the broadest sense is clearly discussed in chapters on biotoxins, mycotoxin-related illness, and electromagnetic hypersensitivity. The book does not promote alternatives to traditional medical therapies, rather it discusses each therapy’s relevance, appropriateness, drawbacks, and the viable alternatives available. Each section is well referenced with up-to-date evidence-based research and information. However, information on Type 1 diabetes is lacking.

Advancing Medicine with Food and Nutrients would be a valuable addition to any Integrative RD’s library. Despite its massive appearance, the book’s sensible organization and clear writing make it manageable. This reference is sure to become a go-to handbook for any integrative practitioner seeking evidence-based information and real-life, scientific rationale for incorporating effective nutritional approaches in practice.

Sarah Harding Laidlaw, MS, RD, MPA, CDE, The Integrative RD newsletter editor. Contact Sarah at peaknut70@gmail.com or 970-216-2356.
Resource Review

The Essential Cancer Treatment Nutrition Guide & Cookbook: includes 150 healthy & delicious recipes
Jean LaMantia, RD & Neil Berinstein, MD
Softcover. $24.95
ISBN: 978-07788-0298-3

The author is a dietitian who has experience working with cancer patients, but also has dealt with cancer herself and with a family member. The purpose of the book is to promote healthy eating strategies in cancer treatment. The four major parts of the book are Cancer Therapies and Their Side Effects, Keeping Cancer at Bay, Menu Planning for Side Effect Management, and Recipes for Cancer Treatment and Beyond.

The chapter on cancer therapies summarizes the various aspects of cancer treatment. The Keeping Cancer at Bay section features nutrition guidelines that support cancer risk reduction and prevention of cancer recurrence.

Three one-day menus each feature ways to minimize specific side effects or to support adequate food intake (diarrhea, liquid and soft foods, and high-energy/high-protein). Each menu features recipes found in the Recipes section. However, a cross-referencing table that identifies recipes appropriate for the cancer symptoms listed under the “Recommended For” in each recipe would have been useful to identify quickly which recipes are recommended for specific situations.

Throughout the book are sidebars, including “Did You Know?” (short bits of information on various topics), “Survivor Wisdom” (tips and experiences from cancer survivors), “FAQ,” and “Guidelines” (numbered suggestions summarized in a list format).

The chapter on Complementary Cancer Care provides an introduction to some of the therapies that some choose to complement their cancer treatment. However, the two complementary therapies discussed in detail are physical activity and nutrition. It may be odd to consider nutrition as a complementary therapy, since the remainder of the book is devoted to nutrition. Also, it would have been helpful to provide resources for further investigation of the complementary therapies.

The recipes section includes suggestions for managing specific side effects, “Bonus Feature” of the recipe (such as cancer risk reduction, portability, easy prep, and nutrient feature), nutrient analysis, measurements in both U.S. and metric, “Tips,” and “Variation.” Recipes cover a wide variety of eating occasions, including breakfasts, soups and light meals, main dishes, snacks, vegetables, sauces, grains, snacks, desserts, and beverages. The recipes feature familiar foods and pack nutrient-dense ingredients in easy-to-prepare formats.

This book is a valuable resource for patients with cancer, as well as the friends and family involved in their care. Health care professionals looking for an easy-to-read reference guide for the various stages of nutrition care in cancer will also find this book helpful.

Christian Calaguas, MPH, RD, LDN, CDE is an outpatient dietitian at the Wilmington Veterans Affairs Medical Center in Wilmington, Delaware. He is the facility coordinator for the MOVE! Weight Management Program. He also co-facilitates a mindfulness-based eating program. Contact Christian at cbcalag@hotmail.com.
The Importance of Nutrition to Healthy Immune Function

Presented by Philip Calder, BSc (Hons), PhD, DPhil, RNutr
Professor of Nutritional Immunology, University of Southampton Faculty of Medicine
Webinar originally presented on February 13, 2013.

This one-hour webinar explores the immune system, a complex system of cells and tissues that protects the human body from invading pathogens. Dr. Calder, a leading nutritional immunologist, highlights the growing body of clinical understanding about the role that good nutrition plays in immune health throughout the lifecycle, and the importance of immune health to overall health and well being. He shares the latest clinical insights on enhancing immune function and conclude with several examples of novel dietary immune interventions.

For an archive of the presentation and a link to FAQs answered by Dr. Calder, click here.

Keys to Understanding Studies on Clinical Nutrition of the Immune System

Presented by Don Cox, Ph.D.
Senior Vice President, Research & Development, Healthcare Group, Biothera, the Immune Health Company
Webinar originally presented on April 11, 2013.

There’s a growing body of clinical evidence to support strengthening the immune system through the use of dietary interventions. Identifying food, beverage and supplement offerings that are credible and clinically relevant can be a challenge. In this one-hour webinar, learn techniques for assessing whether a dietary intervention is based on sound science. Dr. Cox draws on best practices in clinical research programs for functional ingredients and provides insight into the rigorous four-step process to secure regulatory approval of a nutritional intervention.

For an archive of the presentation and links to FAQs answered by Dr. Cox, click here.

These continuing education modules are sponsored by Biothera, maker of Wellmune WGP®. Wellmune is a natural immune health ingredient for foods, beverages and supplements.

www.wellmune.com
Nutritional Genomics Research Publications:
January/February, 2013

Ron Martin, MS received his BS and MS degrees in Food Science and Nutrition from Chapman University, in Orange, California. He worked for more than 35 years in the nutraceutical and food industries, including Hunt-Wesson/ConAgra, Plus Products, the William T. Thompson Co., and the Nutrilite division of Alticor, where he served as Senior Research Scientist in Nutrilite’s New Concepts group. Ron has been a Professional member of the Institute of Food Technologists (IFT) since 1981, and is President of Nutrigenetics Unlimited, Inc., which he founded in 2007 (www.nutrigenetics.net). To contact Ron L. Martin, MS, President, Nutrigenetics Unlimited, Inc., email him at ron@nutrigenetics.net. Please check out www.isnn.info/ to learn more about the dietitian membership discount.

Overweight modulates APOE and APOA5 alleles on the risk of severe hypertriglyceridemia. Clin Chim Acta. 2012 Nov 22. pii: S0009-8981(12)00526-8. doi: 10.1016/j.cca.2012.10.054. [Epub ahead of print] (PubMed ID: 23178747) Being overweight in combination with carrying the 4E variant of the APOE gene was associated with more than a 13-fold increased risk of severe hypertriglyceridemia. Similarly, being overweight in combination with carrying the rs2075291 variant of the APOA5 gene was associated with more than a 15-fold increased risk compared to those with neither of these risk factors. Potentially synergistic gene-environment interactions, such as with elevated body mass index, should also be monitored in clinical practice.

Associations of the FTO rs9939609 and the MC4R rs17782313 polymorphisms with type 2 diabetes are modulated by diet, being higher when adherence to the Mediterranean diet pattern is low. Cardiovasc Diabetol. 2012 Nov 6;11:137. doi: 10.1186/1475-2840-11-137. (PubMed ID: 23130628) Case-control study of 7000+ subjects showed that lower adherence to a Mediterranean diet was associated with about a 1.2-fold higher risk of type-2 diabetes among carriers of specific gene variants in or near the FTO and MC4R genes (rs9939609 and rs17782313, respectively). However, with greater adherence to a Mediterranean diet, this increased risk disappeared. Although folic acid may be involved in these differences, additional study is still required.


Dear members,

It has been an honor to serve as Chair of DIFM this past year. DIFM has strived to achieve many of our strategic goals and our work will continue in the year ahead.

DIFM has garnered the respect of the broader integrative nutrition/medicine community as a leader in the field of integrative nutrition and our outreach continues to grow. It is important that we foster this momentum! We recognize that it is a challenging time for the integrative RDN with competition from multiple segments of the healthcare arena. Many of our members have expressed that being a part of our practice group is the reason they will renew their membership with the Academy. This warrants our dedicated and persistent attention to continue to influence and to collaborate with the Academy. We are being asked for our input as authors, reviewers, subject matter experts, and participants with the new MNT project. Let’s step up and help affect the change we want to see in the Academy. It will serve our profession. Each of us has a responsibility to let our voice be heard! I encourage you to help us set a strategic agenda for next year by taking a few minutes to complete the survey that was sent to you on Monday, April 22. Please send in your personal responses to this survey. We asked that it be sent in by May 1, but send it in now if you haven’t already done so. The link to the survey is: https://www.surveymonkey.com/s/BY8LK7P?utm_source=Copy+of+DIFM+Annual+Member+Survey+2013&utm_campaign=member+survey+2013&utm_medium=email. Your responses will make a difference, so we need to hear from you!

As you are aware from previous e-blasts, the Center for Professional Development of the Academy will begin working on online modules in integrative and functional nutrition therapy that will become available in the next 12-18 months. These modules will serve as a foundation for integrative and functional nutrition therapy that will be accessible to the Academy’s entire membership. Although this is not a win for the Board Certification (Certified Specialist in Integrative and Functional Nutrition) that we worked diligently to pursue, I can assure you that DIFM leadership will continue to work towards the realization of this goal in the future. And, DIFM will continue to offer cutting edge education for our members as well.

I am grateful and very proud of the many accomplishments in the past year. To highlight a few:

- 2012 pre-FNCE symposium on CardioMetabolic Syndrome
- Webinars that are consistently well attended both live and through the archives on our website
- Our exceptional Integrative RD Newsletter; a first-rate publication
- Access to Natural Medicines Comprehensive Database at no charge
- An active EML where members can connect, share concerns, and collaborate
- www.IntegrativeRD.org, our home base that will soon be re-launched with a new look and integrative platform.

Thank you for your membership in our DIFM community! Together we will continue to make a difference. Stay tuned for more exciting education opportunities from DIFM in the year ahead. I know that I will…

Healthy Regards,

Alicia
Alicia Trocker MS, RDN
Chair - Dietitians in Integrative and Functional Medicine 2012-2013
Welcome Spring! The season has been long in coming here in Colorado. Late freezes and snow storms have threatened our famous Palisade peaches and other crops, but have brought needed moisture. Just as it is time to sow seeds in the garden that will offer a bountiful crop in summer and fall, DIFM is planting their own types of seeds in the form of articles and educational opportunities that will bear fruits of knowledge that we can use to nourish our brains and practices.

Continuing with the theme from the Fall 2013 DIFM newsletter we are offering a CPE article that provides additional detail on autism spectrum disorders (ASD) and nutrition therapies to address the condition. This article was written by a well-respected authority on ASD, Geri Brewster RD, MPH, CNN. I am certain that you will find this piece as thought provoking as I did.

The International Society of Nutrigenetics/Nutrigenomics has been kind enough to share abstracts from their 6th Annual ISNN Congress held last year. This Congress should be on your bucket list if you have an interest or practice in the area of nutritional genomics. Information about the 7th Congress to be held this fall is included in the News You Can Use column. And a big thank you to Ron L Martin MA for providing some of the latest research in his Hot Nutritional Genomics Research Publications that he compiled for the newsletter.

We are looking forward to another education packed year with DIFM and one that will be offering many changes and opportunities for our members. Our newly elected Executive Committee members have a lot planned for 2013-2014. That said, I encourage you to continue your membership with DIFM (or join if you are reading a colleague’s copy of the newsletter) as we are the cutting-edge DPG. The knowledge we gain will be the foundation for functional and integrative nutrition for RDs, now and in the future. As always, do not hesitate to contact me if you have questions, would like to author an article for the newsletter or are interested in volunteering for one or more of the many opportunities with DIFM. 

Sarah Harding Laidlaw MS, RD, CDE
peaknut70@gmail.com
Registered Dietitian and Certified Nutritionist Mary Beth Augustine is an integrative and functional nutrition expert. Practicing since 1995 and serving as faculty at the Center for Health & Healing since 2000, Mary Beth marries the knowledge of science with the wisdom of nature to make personalized recommendations for the prevention and management of acute and chronic conditions.

Mary Beth is the recipient of the 2012 Excellence in Practice Award from the Dietitians in Integrative and Functional Medicine group, a Dietetic Practice Group of the Academy of Nutrition and Dietetics. Mary Beth’s key insights into the natural, holistic and integrative nutrition field have made her a speaker of choice at leading integrative health and dietetic association conferences. Speaking highlights include the United Nations Committee on Aging, American Institute for Cancer Research Cancer Survivor Conference and Integrative Healthcare Symposium. Mary Beth has been featured on CBS News, ABC News, Fox 5 News, Today in New York, CNN Market Watch, Discovery Health TV, National Public Radio, and has been interviewed as a food and nutrition expert in many print media publications and radio programs.

A twenty plus year survivor of cancer, former staff of Memorial Sloan Kettering Cancer Center, and current Nutrition Advisor to the Colon Cancer Challenge Foundation, Mary Beth is dedicated to sharing her personal and professional passion to educate people about the interconnected health of people, food and land.

Leigh Wagner is a Registered Dietitian at the University of Kansas (KU) Integrative Medicine. She earned her master’s degree and is working toward a PhD in Clinical Nutrition Sciences at KU Integrative Medicine, where she also provides personalized Medical Nutrition Therapy and teaches cooking classes in their Healing Foods Kitchen. She emphasizes whole foods to promote the body’s innate ability to heal itself and function optimally. She is founder and member of the campus organization, “Food is Medicine,” with the goal to create an environment of health and wellness at KU Integrative Medicine.

Currently, Leigh and KU Integrative Medicine are collaborating with KU Dietetics and Nutrition to create a practicum for dietetics students interested in Integrative Medicine. She is hosting two of the first interns at KU Integrative Medicine who will earn a certificate of Dietetics and Integrative Medicine from KU.

Leigh works with a broad spectrum of patients and clients from pediatrics to geriatrics and wellness to chronic disease. Specifically, she works with patients diagnosed with cancer, autoimmune disease, endocrine-related conditions, inflammatory bowel diseases, environmental toxicity and others. Her master’s research was on methylation status among patients of KU Integrative Medicine. She was born and raised in Lincoln, Nebraska and is proud to be from the heart of America.

After receiving her undergraduate degree from Texas Tech University, Kathy Moore completed her internship at University of Arizona and soon became an RD. She spent many years as a Director of Nutrition and Dietetics in a hospital in southeastern New Mexico, then moved to a small mountain town near Albuquerque in 1996. Since then her professional career has included clinical dietetics, management, long-term care consulting, product development and marketing, telephonic health coaching, and private practice. Kathy has been active in her state affiliate, serving as President twice, and in many other offices and appointments. She became a CCN (Certified Clinical Nutritionist) in 2002, and after joining the DIFM Dietetic Practice Group, became active serving on the Nominating Committee, as Treasurer, Chair-Elect, and Chair, and is currently Past Chair. For the past 11 years her interest and focus has been on integrative and functional nutrition, and she is wholeheartedly behind the integrative medicine model.
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