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CONTENTS

Feeding the Gut Microbiome

by Colleen D. Webb, MS, RDN

Often referred to as the "forgotten organ," the human gut microbiome and its metabolites dramatically impact human health and disease.[1] This fascinating world of microbes that live inside the human gastrointestinal tract, with the majority residing in the colon, weighs between 1 kg to 2 kg and includes trillions of bacteria, fungi, viruses, and other organisms that impact the immune system, inflammation, digestion, and more.[2] Like a fingerprint, intestinal microbial composition differs from individual to individual, and there are many factors that influence the composition, such as age, stress, intestinal infections, poor hygiene, alcohol, medications, antibiotics, probiotics, smoking, breast-feeding, vaginal delivery versus cesarean section, and diet.[3]

Role of the Gut Microbiome in Health Promotion

The gut microbiome carries out a variety of functions, as follows:

- Influences the development and maintenance of the immune system[1]
- Digests dietary fiber to produce protective metabolites for the colon[4]
- Influences serotonin levels[5]
- Competes with pathogenic and opportunistic microbes, maintaining the integrity of the intestinal epithelial barrier[2]
- Exerts anti-inflammatory activity[6]
- Creates an unlivable environment for pathogens[2]
- Detoxifies drug and other environmental metabolites[7]
- Synthesizes essential vitamins, such as biotin, folate, and vitamin K[2]

By performing all of these functions, the gut microbiome and its metabolites have been linked to protection from various diseases, including type 2 diabetes,[8] obesity,[8] metabolic syndrome,[8] autism,[5] neuropsychiatric disorders,[5] irritable bowel syndrome,[5] and most if not all autoimmune diseases, including multiple sclerosis, rheumatoid arthritis, and inflammatory bowel disease.[9] Changes to the development or composition of the gut microbiome directly affects the immune system and may be a driving factor in almost every chronic inflammatory disease.[6] This condition is known as dysbiosis.[6]

Diet-Induced Dysbiosis

Currently, scientists have not identified a "normal" or "ideal" gut microbiome, but experts agree that a diverse gut microbiome is essential for symbiosis.[10] Dietary factors strongly influence the composition and diversity of the gut microbiome.[10] In a recent study, researchers provided a list of dietary factors that correlated with changes in microbial diversity.[11]

The researchers found that high energy intake, highly processed foods, whole milk, and sugar-sweetened soda were associated with a lower level of microbial diversity, whereas coffee, tea, red wine, fruits, vegetables, and buttermilk were associated with a higher level of microbial diversity. A low level of chromogranin A (CgA), a peptide released from cells in response to stress and active gastrointestinal (GI) diseases, also was associated with higher microbial diversity and increased dietary intake of fruits and vegetables. Conversely, a high level of CgA was associated with high triglycerides, frequent and loose stool, self-reported irritable bowel syndrome, and higher levels of fecal calprotectin, which is a marker for intestinal inflammation. Low calprotectin was associated with higher intakes of vegetables, plants, and chocolate. Furthermore, dietary intake of nuts, fruits, and vegetables correlated with certain bacterial strains that are associated with better quality of life, lower triglycerides, and improved high-density lipoprotein (HDL) cholesterol.[11]

In summary, these findings suggest that eating fruits, vegetables, and other plant foods promote microbial diversity, decrease inflammation, and are helpful for cholesterol management. Previous studies have shown that the "Western" diet, which is low in fruits and vegetables and high in saturated fat, sugar, and animal protein, negatively alters the gut microbiome and microbial diversity.[10,12] Experimental research is needed to determine if these associations can be deemed to be a matter of cause and effect.

Dietary Fiber, and the Gut Microbiome

A major reason why fruits, vegetables, and other wholesome plant foods are essential for a stable microbiome is fiber content.[10,12] Dietary fiber is an undigested carbohydrate in the sense that humans do not have the necessary tools to break it down.[4] However, fiber serves as an important substrate for the gut microbes that possess the necessary enzymes to break down these plant polysaccharides.[4] This fermentation process can produce a variety of fermentation end-products, including short-chain fatty acids such as butyrate.[4] Butyrate is the preferred energy source for the cells in the large intestine. It plays an important role in a variety of functions, including that of maintaining the integrity of the intestinal mucosa, regulating intestinal inflammation, and protecting against colon cancer.[4] High-fiber diets favor the growth of butyrate-producing microbes.[4] This is just one example of how dietary composition can influence microbial composition.

To further illustrate this point, Sonnenburg et al conducted a series of experiments to study how a low-fiber diet might affect the variety of the gut microbes.[13] To do this, he and his team colonized germ-free mice with the same collections of gut bacteria. All of the mice were fed a high-fiber diet, followed by randomly converting half of them to a low-fiber diet for 7 weeks. As hypothesized, the low-fiber diet caused a drastic decrease in the variety of microbial species. What was less expected is that the colonization of some species remained low even after the mice returned to a high-fiber diet. Moreover, low-fiber mice gave birth to offspring with less gut microbial diversity, and it became increasingly difficult to reverse these changes in future generations of mice. The findings of this research support what other studies have shown in humans. The gut microbiomes of Westerners, for example, are much less diverse than those of rural Africans, who traditionally eat a very high-fiber diet.[14]

Dysbiosis, Dietary Fiber, and Inflammatory Bowel Disease

Similar to other autoimmune conditions, individuals with inflammatory bowel disease (IBD) have been shown to have a dysbiotic gut microbiome.[15] Unlike people with other autoimmune conditions, IBD patients are frequently advised to eat a low-fiber diet because fibrous foods can worsen gastrointestinal symptoms,

From The Editor

Go with Your Gut

by Mark Kern, PhD, RD, Editor-in-Chief

I'd like to be able to say that I planned a special issue of *PULSE* focusing on gastrointestinal health, but the truth is that things just tended to fall this way. Given the massive growth of evidence regarding many potentially important implications of a healthy colonic microbioata, my gut reaction is that this fortuitous coincidence will meet with your expectations.

Our cover article, written by Colleen Webb, MS, RDN provides an excellent overview of the roles that bacteria in our large intestine play in human health. Next, in our free CPE article, Melanie Jewell, MCN, RDN, Susan Rodder, MS, RDN, and Jo Ann Carson, PhD, RDN report on their use of the Academy's evidence analysis process to systematically evaluate the specific implications of probiotics on blood lipid profiles. The third article in our line-up also discusses potential consequences of the microbes residing in our bowels, but in that article Pamela Kelle, RDN, CEDRD addresses possible links between disordered eating and eating disorders and our microbiota. Although our fourth feature article doesn't address the alimentary canal, I am confident that you'll be equally interested in the topic. In that article, Michelle Stone, MS, RD, CSSD provides an overview of nutritional connections to fertility in female athletes and presents a descriptive case of a patient encountered in her practice.

Of course, this wouldn't be a complete edition of *PULSE* if we didn't also provide you with plenty of news from SCAN, a book review, highlights of an exciting conference, and abstracts of articles summarized in our "Research Digest," so be sure to keep going after reading the feature articles. After all, as one of the heroes of my youth (Arnold Schwarzenegger) once said about the last three or four reps in bodybuilding: "That's what most people lack, having the guts to go on …"

such as diarrhea, abdominal pain, cramping, bowel urgency, flatulence, and intestinal obstructions in at-risk individuals.[16] People with active IBD or stricturing Crohn's disease may observe fewer symptoms when limiting their intake of fibrous foods.[16,17] In these situations, it is imperative that dietitians educate patients on how to improve tolerance to these nutritious foods by breaking down the rough fiber outside of the body, such as by cooking, blending, juicing, or removing the rough skins or seeds.

Also, it is important to note that having a diagnosis of IBD does not mean that someone has to be on a low-fiber diet. In fact, studies have suggested that people with Crohn's disease who were instructed to eat a fiber-rich diet without refined carbohydrates required fewer Crohn's-related hospitalizations and surgeries than those who did not receive dietary instruction,[18] Researchers have long suspected that the lack of dietary fiber in industrialized diets might be contributing to the sudden rise in Crohn's disease and ulcerative colitis.[19] If this is true, then it is possible that fiber exerts its effects on Crohn's disease through its influences on the gut microbiome.

Animal Protein and Dysbiosis

Most nutrition professionals are familiar with the beneficial fermentation by-products such as butyrate that result from microbes feeding on carbohydrates, but fewer are aware of what happens to undigested protein that ends up in the large intestine. A recent review investigated the harmful effects of protein fermentation and their relationship to irritable bowel syndrome (IBS), ulcerative colitis, colorectal cancer, and foul-smelling gas.[20] Although the human body is well-equipped to efficiently break down protein, some of it can escape digestion and end up in the colon.[20] Factors that increase protein delivery to the large intestine include but are not limited to[20]

- Antacid therapy (e.g. Proton pump inhibitors)
- Rapid gastrointestinal transit
- A diet high in protein-rich sources, especially red meat
- Crohn's disease of the small intestine
- Untreated celiac disease

When undigested proteins reach the large intestine, these proteins can be fermented by colonic bacteria to produce potentially toxic end-products, such as ammonia and hydrogen sulfide.[20] These gases have been shown to erode the protective barrier of the colon and initiate inflammation.[20] Both of these outcomes, among others discussed previously, might contribute to the development and/or progression of ulcerative colitis and colorectal cancer.[19]

Hydrogen sulfide (H2S) has been shown to damage the intestinal mucosa by inhibiting butyrate oxidation and degrading mucin, a mucus component that helps protect the intestinal barrier from microbial invasion.[21] Also, H2S is responsible for foul-smelling gas, which is a common complaint among people following a high-protein, low-carbohydrate diet.[21] High-protein, low-carbohydrate diets have also been shown to favor the growth of harmful pro-inflammatory bacteria and inhibit the growth of beneficial anti-inflamma-

tory bacteria.[3] Fortunately for frequent meat eaters, research suggests that eating a variety of plants along with the animal protein reduces protein fermentation. A detailed description of this appears in a review article.[20]

Conclusion

The gut microbiome and its metabolites play an important role in human health, and microbial composition is largely dependent on diet. Registered dietitians need to establish themselves as the "go-to" experts in this field and must consider the effect of diet on the gut microbiome when designing nutrition interventions. Based on the existing research on diet and the gut microbiome, it is not too early for dietitians to start telling patients to eat a wide variety of whole foods, mostly plant foods, limit or avoid highly processed foods and added sugar, and avoid sugar-sweetened beverages in order to support a healthy gut microbiome. Fortunately, this advice supports current dietary recommendations, including those by the 2015 Dietary Guidelines Advisory Committee that identifies a healthy dietary pattern as one "higher in vegetables, fruits, whole grains, low-or non-fat dairy, seafood, legumes, and nuts; moderate in alcohol (among adults); lower in red and processed meat; and low in sugar-sweetened foods and drinks and refined grains."[22]

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CPE article

The Effects of Probiotic Supplementation on Dyslipidemia

by Melanie Jewell, MCN, RDN, Susan Rodder, MS, RDN, and Jo Ann S. Carson, PhD, RDN

This article is approved by the Academy of Nutrition and Dietetics, an accredited Provider with the Commission on Dietetic Registration (CDR), for 1 continuing professional education unit (CPEU), level 1. To apply for ***free*** *CPE credit, take the quiz on SCAN's Web site (www.scandpg.org/quiz/?id=91). Upon successful completion of the quiz, a Certificate of Completion will appear in your My Profile (under the heading, My History). The certificate may be downloaded or printed for your records.*

Learning Objectives

After you have read this article, you will be able to:

- Describe the proposed mechanisms of action by which probiotics achieve a cholesterol-lowering effect.
- Summarize the evidence regarding the effects of probiotics on total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol in individuals with dyslipidemia.
- Identify areas in need of future research regarding the efficacy of probiotic supplementation in managing dyslipidemia.

Introduction

Dyslipidemia is a significant yet modifiable risk factor for atherosclerosis and cardiovascular disease (CVD). As CVD is the leading cause of death for men and women in the United States,[1] evaluating novel approaches to risk management is imperative. Standard care for dyslipidemia in those without familial hypercholesterolemia may involve therapeutic lifestyle changes including diet and exercise, as well as pharmacologic management. Despite the efficacy of pharmacologic therapy, not everyone who is suitable for lipid-lowering medications is treated. Barriers to medical treatment may include cost, preference to avoid medication, and statin-induced myalgias.

A growing number of clinical trials have demonstrated the potential to improve dyslipidemia through the use of probiotics. Probiotic supplements are typically prepared with species that are on the Generally Recognized as Safe list maintained by the Food and Drug Administration, including various species of lactic acid-producing *Lactobacillus* and *Bifidobacterium*. Such species are also commonly found in the gastrointestinal tracts of healthy individuals.[2] Scientific interest in the relationship between intestinal microbiota and cardiovascular health began in the 1960s, when it was identified that germ-free rats had increased absorption of cholesterol and conjugated bile acids, as well as higher blood cholesterol levels.[3] In 1974, Mann[4] described the Maasai tribesmen in Africa who regularly consumed several liters of fermented whole milk each day, yet had low rates of CVD, speculating that an element of the fermented milk was responsible for the hypocholesterolemic effect.

> "Despite the efficacy of pharmacologic therapy, not everyone who is suitable for lipid-lowering medications is treated."

There are several proposed mechanisms of action for the cholesterol-lowering effects of probiotics. One mechanism is through cholesterol assimilation, where probiotic bacteria adhere to cholesterol molecules in the intestinal lumen and are excreted. In addition, some cholesterol may be taken up by the microbiota for incorporation into their cell membranes.[5] Another mechanism suggests that short-chain fatty acids produced by probiotic bacteria interfere with the rate-limiting enzyme in hepatic cholesterol synthesis.[6] Finally, certain bacteria can deconjugate bile acids through bile salt hydrolase (BSH) activity. The impact of BSH activity on serum cholesterol is twofold: first, deconjugation of bile acids leads to increased bile acid excretion and reliance on *de novo* cholesterol synthesis for production of new bile acids. Second, deconjugation decreases the solubility of cholesterol, thereby reducing the amount of cholesterol absorbed intestinally.[6]

The purpose of this review is to evaluate the current research and determine the effect of probiotic supplementation on total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) in adults with dyslipidemia.

Methods

The Academy of Nutrition and Dietetics (Academy) utilizes an evidence analysis process to gather, classify, and appraise relevant research, then summarize and grade the evidence.[7] This methodology was utilized to systematically evaluate the relationship between probiotic supplementation and blood concentrations of TC, LDL-C, and HDL-C in adults with dyslipidemia. OVID Medline and Pub Med search terms included cholesterol, probiotics, and dyslipidemias. Articles were limited to English language, humans, adults, and years 2011-2015, producing a total of 33 studies for consideration. Research involving pregnant women and co-interventions such as weight loss were excluded, and the results were further limited to randomized controlled trials (RCTs) with attrition rates below 20%, providing a total of nine studies for evaluation. Each study was critically appraised using the Academy's quality criteria checklist and assigned a positive, negative, or neutral rating. An expert panel of two registered dietitian nutritionists (RDNs), a cardiologist, and a cardiac rehabilitation registered nurse deliberated on the quality of the evidence and assigned a grade to the conclusion statement.

Results

Key variables of the nine studies and the associated impacts to baseline lipids are presented in Table 1. The studies ranged from 42 to 151 participants, including men and women with average ages of 43 to 67 years and average body mass indexes of 26 kg/m^2 to 31 kg/m^2. Average baseline TC, LDL-C, and HDL-C values were 186 to 258 mg/dl, 120 to 175 mg/dl, and 35 to 57 mg/dl, respectively. In seven of the nine studies, participants were instructed to maintain current dietary practices, with pre- and post-evaluation by dietary questionnaire. Five probiotic strains or combinations of strains at predetermined minimum doses in yogurt or capsule format served as interventions across the nine studies, and all studies were placebo-controlled. In four of the five studies utilizing yogurt as the intervention, both the treatment and placebo groups received conventional yogurt containing naturally occurring bacteria, with only the treatment groups receiving the additional probiotic supplementation as outlined in Table 1.

Of the seven studies rated as positive, six demonstrated significant lipid reductions with probiotic supplementation that ranged from 4.1% to 19.7% in TC and 6.9% to16.9% in LDL-C, compared with placebo. Only the two neutral studies demonstrated significant increases in HDL-C relative to placebo. Both yogurt and capsule delivery formats were associated with significant improvements in lipid profile.

A combination of *L. acidophilus* and *B. lactis* Bb12 served as the probiotic intervention in four trials. Ejtahed[8] studied 60 participants in Iran with type 2 diabetes mellitus (T2DM).

Participants who consumed probiotic yogurt for 6 weeks experienced 4.5% and 7.5% decreases in TC and LDL-C, respectively, compared with placebo ($P<.01$). Nabavi's[9] study intervention and results among 72 Iranians with non-alcoholic fatty liver disease were almost identical to those of Ejtahed. A third study in Iran involving 42 participants with T2DM by Mohamadshahi[10] demonstrated that reductions in TC and LDL-C were not significant compared with placebo; however, TC and LDL-C decreased 11.7% ($P=.044$) and 22.7% ($P=.013$), respectively, compared with baseline. An increase of 11.5% in HDL-C ($P=.023$) occurred in the probiotic group, compared with placebo. Finally, Ivey[11] conducted a factorial study of 151 participants in Australia to evaluate the impact of *L. acidophilus* and *B. lactis* Bb12 yogurt and capsules on the features of metabolic syndrome, but the lipid changes relative to placebo were not significant. A limitation of this study was the use of cholesterol-lowering medications by 78% of participants during the trial.

A study of 64 participants in Thailand by Rerksuppaphol[12] used *L. acidophilus,* this time combined with *B. bifidum* and delivered in a capsule form. Relative to placebo, those consuming the combined probiotics experienced decreases in TC and LDL-C of 19.7% ($P<.001$) and 16.9% ($P<.01$), respectively. A portion of this demonstrated improvement in lipid profile was attributable to significant increases of 9.4% and 14.2% in TC and LDL-C, respectively, experienced by the control group. Additionally, those consuming the probiotic exhibited a 5.4% decrease in HDL-C compared with placebo ($P=.04$). Participants in both groups were instructed to minimize fat intake during the study, but were given no other dietary guidance. The lack of dietary control was considered a limitation of the study.

Jones[13,14] published two studies in the Czech Republic to examine the impact of *L. reuteri* NCIMB 30242 (Cardioviva) on dyslipidemia. The first study provided 114 participants with *L. reuteri* yogurt for 6 weeks. TC and LDL-C were reduced by 4.8% ($P=.031$) and 8.9% ($P=.016$), respectively. A second study provided 127 participants with *L. reuteri* in capsule form for 9 weeks. Compared with placebo, *L. reuteri* supplementation decreased TC and LDL-C by 9.1% and 11.6%, respectively ($P=.001$). In addition, significant improvement in other CVD risk markers, including apoB-100, fibrinogen, and hsCRP levels were observed.

Fuentes[15] studied the impact of three strains of *L. plantarum* (AB-LIFE: CECT 7527, 7528, and 7529) on the lipid profile of 60 participants in Spain. Compared with placebo, participants supplemented with *L. plantarum* experienced a decrease of 13.6% ($P<.05$) in TC and a non-significant decrease of 8.8% in LDL-C. Fuentes stratified participants by baseline TC into high and low initial value categories. Those with the highest initial TC levels (251-300 mg/dl) experienced the greatest improvements with probiotic treatment: reductions in TC and LDL-C of 17.4% and 17.6%, respectively, compared with baseline; however, even participants with the lowest initial TC values saw reduc-

Table 1. Changes in Lipid Profile with Probiotic Treatment Versus Placebo

Study, Year, Quality Rating	Probiotic Strain and Dose (in CFU)	Weeks in Study	TC (mg/dl) Baseline	TC Change	LDL-C (mg/dl) Baseline	HDL-C Change	HDL-C (mg/dl) Baseline	HDL-C Change
Ejtahed 2011 +	*L. acidophilus, B. lactis* Bb12 $1.1x10^9$, $1.2x10^9$	6	201	-4.5% *P*<.01	122	-7.5% *P*<.01	48	NS
Nabavi 2014 +	*L. acidophilus, B. lactis* Bb12 $1.3x10^9$, $1.2x10^9$	8	197	-4.1% *P*<.01	120	-6.9% *P*<.01	48	NS
Mohamadshahi 2014 ø	*L. acidophilus, B. lactis* Bb12 $1.1x10^9$, $1.1x10^9$	8	219	-10.2% *P*=.11*	133	-17.2% *P*=.06*	44	11.5% *P*=.023
Ivey 2015 +	*L. acidophilus, B. lactis* Bb12 $3.0x10^9$, $3.0x10^9$	6	206	NS	125	NS	53	NS
Rerksuppaphol 2015 +	*L. acidophilus, B. bifidum* $1.0x10^9$, $1.0x10^9$	6	237	-19.7%† *P*<.001	158	-16.9%† *P*<.01	57	-5.4% *P*=.04
Jones 2012 +	*L. reuteri* NCIMB 30242 $2.8x10^9$	6	258	-4.8% *P*=.031	169	-8.9% *P*=.016	55	NS
Jones 2012 +	*L. reuteri* NCIMB 30242 $5.8x10^9$	9	246	-9.1% *P*=.001	175	-11.6% *P*=.001	51	NS
Fuentes 2013 +	*L. plantarum* (3 strains) $1.2x10^9$	12	247	-13.6% *P*<.05	167	-8.8% NS¥	44	5.7% NS¥
Rajkumar 2014 ø	VSL#3 (8 strains) $112.5x10^9$	6	186	Not stated	124	-7.0%‡ *P*<.05	35	18.5%‡ *P*<.01

CFU = colony forming units; TC = total cholesterol; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol

+ Positive quality study ø Neutral quality study NS = not significant (*P*>.05)

* NS compared with placebo, but significant changes of -11.7% (*P*=.044) and -22.7% (*P*=.013) in TC and LDL-C, respectively, compared with baseline.

† Control group experienced significant increases in TC and LDL-C of 9.4% (*P*<.001) and 14.2% (*P*<.01), respectively.

¥ NS compared with placebo, but significant changes of -14.7% (*P*<.05) and 6.6% (*P*<.05) in LDL-C and HDL-C, respectively, compared with baseline.

‡ Compared with baseline, but stated as significant compared with placebo.

tions of 9.4% and 11.5% in TC and LDL-C, respectively.

Rajkumar[16] studied the effects of omega-3 and probiotic supplementation (alone and in combination) on the lipid profile of 60 overweight adults in India. VSL#3 is a high-potency combination of eight strains of bifidobacteria, lactobacilli, and streptococci. Compared with baseline values, those supplemented with VSL#3 experienced a decrease in LDL-C of 7% ($P<.05$) and an increase in HDL-C of 18.5% ($P<.01$).

Review of the research determined that in adults with dyslipidemia, there is fair (grade II) evidence supporting the use of probiotics to reduce TC and LDL-C when consumed in yogurt or capsule form for 6 to 12 weeks. The effect of probiotics on HDL-C remains unclear. Probiotic strains with their minimum daily doses analyzed include: *L. acidophilus* (1.11 x 10^9 CFU) with *B. lactis* Bb12 (1.08 x 10^9 CFU), *L. acidophilus* (3.0 x 10^9 CFU) with *B. bifidum* (3.0 x 10^9 CFU), *L. reuteri* NCIMB 30242 (2.8 x 10^9 CFU), *L. plantarum* CECT 7527, 7528, and 7529 (1.2 x 10^9 CFU), and VSL#3 (112.5 x 10^9 CFU).

Discussion

The results of the aforementioned RCTs are consistent with several probiotic meta-analyses[17-19] published in 2015, which reported average reductions in TC and LDL-C of 6.6 to 10.4 mg/dl and 7.3 to 8.9 mg/dl, respectively, compared with placebo. The meta-analyses did not identify significant improvements in HDL-C. Trends noted across the published research on probiotics include greater lipid reduction with higher baseline TC values, longer intervention periods, and the use of lactobacilli strains. The large number of positive quality, recently published RCTs is a strength of this review. The lack of published research studying participants following typical American diets limits generalizability of the results. The impact of probiotics on lipid profiles of individuals consuming an American diet and those using typical lipid-lowering medications such as statin-monotherapy should be the focus of future studies.

"…lifestyle intervention that combines diet and exercise remains the pillar of primary care treatment in this population."

Conclusion

A review of nine recent RCTs indicates that supplementation with formulated combinations of probiotic strains significantly decreases TC and LDL-C in adults with dyslipidemia. While additional evidence is warranted prior to RDNs providing specific strain recommendations, lifestyle intervention that combines diet and exercise remains the pillar of primary care treatment in this population.

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The Gut/Brain Axis: Using the Latest Microbiome Research in Medical Nutrition Therapy with Eating Disordered Clients

by Pamela Kelle, RDN, CEDRD

Well-informed registered dietitian nutritionists (RDNs) will use the latest research to assess their clients' nutrition status, neurobiology (the brain), and emotions as they are linked with the gastrointestinal tract (GIT). In reading this article, the connections between emotions, stress, and the eating habits of eating disordered clients should be kept in mind.

The Tale of Two "Brains"

The universe of the gut microbiome, the genetic information of the microbiota, is as complex as the brain. It has its own individually modulated world, and it figuratively functions as an organ system independent of the brain. The gut and the brain participate in bidirectional communication where the gut sends neuroendocrine signals to the brain, which can then control the motor, sensory, and secretory functions of the GIT.[1] This communication pathway has come to be known as the "gut/brain axis." Unlike the cranial brain, which is protected by the blood brain barrier, the GIT "brain" is exposed and connected to the outside world via the ingestion of substances such as food, drinks, oral medications, oral hygiene products, and all of the microbes that reside on/in them.[2]

This GIT "brain" is highly sensitive, with receptors for taste, mechanical distortion, temperature, osmolarity, acidity, internal secretions, microbes (their antigens and products), and toxins.[2] Dietary habits that promote healthy microbiota result in both "brains" working as a finely tuned, integrated system.[3] Speculation regarding a connection between the gut and brain can be traced as far back as 1907, when Byron Robinson, MD described these two "brains," stating that "in the cranial brain resides the consciousness of right and wrong. Here is the seat of all progress, mental and moral, and in it lies the instinct to protect life and fear death … However, in the abdomen there exists a brain of wonderful power maintaining eternal, restless vigilence (sp) over its viscera … it presides over nutrition. It is the center of life itself."[4] Although the science was rather

simplistic at that time, this statement demonstrates that even then some clinicians recognized the importance of the gut in regulating body processes.

Microbiome Universe

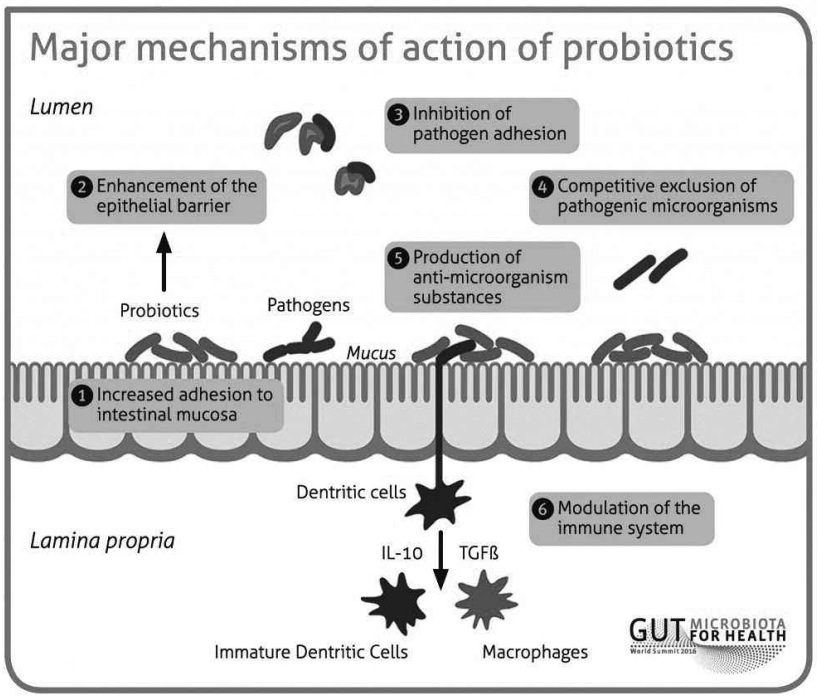
Containing more than a trillion microbes, the human microbiota weighs between 2 and 6 lb.[3] The GIT microbiota, specifically, is a complex system that is interlaced within the digestive organs. It is becoming increasingly clear that the GIT microbiota is both influenced by and influences brain processing through its effects on the gut/brain axis. The GIT is the main production center for the neurotransmitter serotonin, with more than 90% of the body's serotonin being synthesized in the gut.[5] The gut microbiome has been shown to be altered by physiologic stressors and to modulate mood, anxiety, and depressive behaviors.[6,7] Recent studies have shown individuals with major depressive disorder (MDD) to have different microbiomes when compared with individuals without MDD.[8,9] This altered microbiota is known as dysbiosis.

Good brain function depends on a highly functioning GIT, which in turn is directly related to a well-balanced diet.[10] Food modulates the microbiome, which impacts overall health in a variety of ways. Specific dietary components such as dietary-resistant starches, which serves as prebiotics, appear to impact gut microbiota composition as well as modulate gut peptide production of glucagon-like peptide-1 (GLP-1) and peptide YY (PYY).[11,12]

Effects of Poor Nutrition

It is evident that clients who suffer from poor nutrition secondary to eating disorder (ED) behavior are adversely affected in more ways than calorie/protein depletion. Two important factors affecting the microbiome that are likely lacking due to poor nutrition in ED clients are dietary intake of prebiotics and probiotics.

Figure 1. Major mechanisms of probiotics and their beneficial effects. (Source: Gut Microbiota for Health)



The major mechanisms of probiotics and their beneficial effects are shown in Figure 1. Prebiotics are dietary constituents that help stimulate and support good bacteria. The effects of prebiotics are varied and include helping to decrease the pH of the colon and enhance mineral absorption.[13,14] Various prebiotics offer different benefits for the health of the GIT microbiota. This is one example of why it is important to eat a varied diet. Classification of a food or food ingredient as a prebiotic requires a scientific demonstration that it: 1) resists gastric acidity, 2) is fermented by intestinal microflora, and 3) stimulates the growth and/or activity of intestinal bacteria associated with health and well-being.[15-16]

In the presence of poor nutrition in an ED client, it is reasonable to suggest that the needed prebiotic and probiotic substrates will be inadequate, as will the type of bacteria growth in the GIT and subsequently the nutrient cofactors for serotonin production; however, research is needed to confirm this assumption. The cascade effect of under-nutrition is currently being researched from the perspective of the gut/brain axis and the potentially detrimental effects on neurotransmitter function and the microbiota.

Often the client with an ED has a very limited (or excessive) diet and either under-consumes or over-consumes certain foods. An imbalance can occur in the microbiota if prebiotics and probiotics are not consumed together every day.[16] It has been my experience that clients with an ED are often more likely to add a probiotic in pill form rather than consume probiotics through foods. To enhance the microbiota, one role of the RDN would be to encourage ED clients to consume both prebiotic and probiotic foods (see Tables 1 and 2). It is also recommended to include resistant starch. Similar to other prebiotics, the inclusion of resistant starch also helps to feed probiotics. These starches are found in cereals, unripe fruit, and cooked starchy products. In today's poorly understood "low carbohydrate world," these helpful nutrients may be completely missing from the diets of many clients, thereby compromising precious microbial function.

Table 1. Prebiotics Often Lacking in Diets of Disordered Eaters

Artichokes (Jerusalem)	Berries
Wheat	Soybeans
Barley and Rye	Chia/flaxseed
Chicory	Burdock root
Onions (2-5 g/100 g for red onion)	Peas
Garlic	Legumes
Shallots	Eggplant
Leeks	Honey (raw)
Chinese chives	Beets
Bananas	Green and mugwort teas

Table 2. Probiotics Often Lacking in Diets of Disordered Eaters

Batters made from rice and lentils	Fish sauce
Kimchi, sauerkraut	Kombucha tea
Vinegar, cider, pickling	Miso
Kefir, cultured milk products such as yogurt	Tempeh

Possible Connections to Anorexia Nervosa

As mentioned earlier, limited crucial nutrition intake in anorexia nervosa (AN) could change the composition of the gut microbial community, thereby leading to dysbiosis. These changes could contribute to the anxiety, depression, and further weight loss among persons with AN.[17] It is a potentially brutal cycle. Could altering the gut microbiota of people with AN help them with weight maintenance and mood stabilization over time? These questions are being researched and only until adequate data are available will we know.[18-20]

We do know that many clients with EDs have high levels of stress and anxiety. Teaching them techniques to improve mindfulness and attunement may help navigate the difficult waters of food fears.[21] If RDNs teach clients that anxiety may be affecting the gut, and those effects actually may be worsening their anxiety and depression, this information may provide another tool to help motivate change. Understanding the huge impact of the world of the microbiota could help clients engage in self-compassion and thereby gain an understanding of the complexities of the whole human experience with less judgment, less fear, and a new willingness for self-care.[21-23] Research in disordered eating and eating disorder populations is needed to confirm this.

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The Female Athlete and Infertility: Key Concepts and an Illustrative Case

by CPT Michelle L Stone, MS, RD, CSSD, ASCM-CPT

Infertility and secondary amenorrhea are concerns among female athletes. Infertility is defined as the inability to conceive after 1 year of unprotected intercourse.[1] Secondary amenorrhea is defined as the failure to menstruate for 3 months or irregular menses for 6 months but previously menstruated regularly. There are multiple hypotheses about infertility, amenorrhea, and their etiology in athletic women. In general, 10% to 15% of all couples trying to conceive are unsuccessful for unexplained reasons.[2] Beyond that, 10% to 15% of infertility cases may be caused, independently or collectively, by abnormal sexual hormones, stress, body weight, body composition, or low energy availability. The purpose of this review and case study is to provide nutrition professionals with clinical applications relating to secondary amenorrhea, infertility, and active woman.

The case study presented profiles a lean recreational athlete as she attempts to start a family, discussing her menstrual, energy intake, and body compositional history. The objective of presenting this case study is to illustrate the multifaceted approach to treating secondary amenorrhea within the dietitian's scope of practice while utilizing evidence-based guidelines. Dietitians who treat female athletes should consider all aspects of secondary amenorrhea and execute expectation management as it relates to timeliness and realistic outcomes. The treatment focus for this patient is dietary-based, as the patient has normal sexual development and hormone balance, and is of appropriate reproductive age. This review focuses on the otherwise healthy underweight female with secondary amenorrhea.

Weight, Body Composition, and Reproductive Health

Approximately one-third of infertility concerns are associated with body mass index (BMI) and weight.[1] Underweight and obese individuals have a higher probability of abnormal hormones, abnormal sexual function, and decreased ability to reproduce.[3] Women with a BMI ≤18.5 are at a higher risk for spontaneous abortion, infertility, and *in vitro* fertilization failure. Successful reproduction tends to increase with a normalized BMI (18.5-24.9).[1,3]

Fat mass and percent body fat (%BF) is a critical assessment for ideal body composition. Women who weigh less than 90% of their ideal body weight (IBW) may experience some type of menstrual dysfunction and abnormal gonadal hormone levels.[3] Gonadal hormone homeostasis is essential to reproductive success. Reproductive hormones that may be affected by low %BF include estrogen, follicle-stimulating hormone, gonadotropin-releasing hormone, prolactin, and luteinizing hormone.[3,4] Low %BF may cause abnormalities in the laboratory values of these hormones, making them critical parameters to assess.[4] Altered laboratory values of these hormones directly influence the ovarian, hypothalamic, and gonadotrophic cell systems, and menses.[2]

A normal BMI does not necessarily translate into ideal body composition. The female reproductive system requires approximately 17%BF to properly function. This threshold is well below 20%BF to 30%BF, which is the overall body fat recommendations for healthy women.[5] Weight and %BF may vary by individual needs, but a woman who reaches 90% of her IBW and normal %BF has a higher return rate of normal

menses and increased reproductive health.[4,6] Competitive and recreational athletes often maintain a low %BF but meet normal BMI standards due to their above-average muscle mass. Solely using BMI and scale weight is inadequate because body composition is not captured. To increase the probability of pregnancy, an emphasis on normalizing all three body measurements is imperative.

Energy Balance and Diet

Reproductive pathways rely on adequate energy. Because reproduction is not a vital life-sustaining process, it may decrease function in an effort to preserve energy for other bodily functions during energy deficits.[7] Energy balance is typically calculated as calorie intake minus energy expenditure.[8] Independent of weight and %BF, calorie deficits are associated with increased risk of amenorrhea, abnormal menses, and decreased reproductive function. A negative net caloric intake of 22% or higher is associated with these risks.[1,7,8] Calorie deficits or a negative energy balance decreases the amount of energy available to efficiently conduct metabolic processes, movement, and daily living activities. This energy deficit or lack of energy availability may be intentional (eating disorders) or unintentional (increased expenditure without increased intake).

It is estimated that 45 kcal per kilogram of fat-free mass (kcal/kg FFM) is adequate for maintaining energy balance and supporting reproductive health in healthy adults.[4] Consuming 30 kcal/kg FFM or less may cause a reduction of growth and gonadal hormones, weight loss, and decreased muscle protein synthesis.[4,9] Sensitivity to energy balance and its effect on menses may vary based on age, exercise frequency, exercise intensity, and psychological stress level, so it is important for the practitioner to use these references as guidelines when assessing and working with each individual.[7]

A simple solution of "eat more" may be difficult to implement. Elevated energy requirements and early satiety may hinder the ability of a health-conscious woman to meet her calorie needs,[5,10] and many health-conscious athletes tend to self-select nutritious foods that are high in fiber and volume but low in energy. Typical self-selected foods include fruits, vegetables, low-fat dairy, and whole grains. These nutrient-dense diets are associated with high intake of fiber, inadequate calorie consumption, high satiety, and weight loss.[10]

Energy-dense foods should be prescribed to maintain a healthy, well-balanced diet with adequate calories and fiber (25 g). Energy-dense foods are defined as foods that have four or more calories per gram (food weight).[10] These foods are lower in fiber and water, which decreases food volume to meet calorie needs. Nuts, cheese, high-calorie beverages/smoothies, and avocados are a few examples.[10]

Avoiding over-the-counter supplements and weight-gain supplements that are not safe for pregnant women is advised. Many women fail to meet preconception nutrition recommendations; therefore, a multivitamin with folic acid and a calcium plus vitamin D supplement may be beneficial.[1,5] Supplement prescriptions should be individualized, rather than general, recommendations.

Stress

Psychological stress and exercise stress can negatively affect fertility.[1,6,8] Consulting a mental health professional is warranted if psychological stress is annotated during an assessment.[5] Infertility is a risk factor for depression among many women,[11] and depression can alter appetite, decrease motivation, and decrease willingness to change.

Exercise, on the other hand, is a physical stressor that alters ovulation, menses, and reproductive hormones.[6,12] Strenuous or excessive exercise, independent of energy balance or %BF, is correlated with decreased ovulation activity, increased conception difficulties, and decreased pregnancy rates.[12] Because there are no specific guidelines for infertile women who are trying to increase %BF, general American College of Sports Medicine (ACSM) exercise guidelines will suffice.[13] For the general healthy population, the ACSM recommends 30 to 60 minutes of aerobic exercise three to five times per week with various intensities, and resistance training two to three times per week.[13]

Gudmundsdottir et al concluded that women who vigorously exercised more than 60 minutes and/or exercised to exhaustion most days of the week had a higher risk of infertility.[14] In addition, Morris et al concluded that women who underwent *in vitro* fertilization and strenuously exercise 4 hours or more per week were 40% less likely to give birth and two times more likely to have *in vitro* fertilization implant failure.[15] Maximizing or exceeding the ACSM exercise recommendations may put women at increased risk for infertility. However, it is important to note the ACSM's guidelines emphasize various intensities. The research above does note that submaximal levels of exercise intensity or frequency did not increase the risk of infertility.[12,14,15]

Return of Menses and Fertility

Hypothalamic amenorrhea, exercise-related menstrual dysfunction, and relative energy deficiency have all been linked to infertility in exercisers. The infertility etiologies discussed can be reversed in most women who normalize their BMI and %BF, maintain an energy balance, and decrease stress.[1,5,6] In a 6- to 8-year observation study, 70% of women with hypothalamic amenorrhea experienced spontaneous recovery and menses regularity with weight gain.[5] In women with exercise-induced menstrual dysfunction, it took up to 7 months to normalize menses after creating a positive energy balance.[16] This positive energy balance was created by increasing overall calorie intake while maintaining moderate-

intensity exercise habits in subjects with a normal BMI and %BF.[16]

Case Study

A 31-year-old female presented with low body weight, secondary amenorrhea, and inability to conceive despite unprotected sex for more than 1 year. The patient's height was 64 in and weight was 102.6 lb. Her BMI was 17.61, which classified her as underweight. Her IBW by the Hamwi method is 120 lb. She had 8%BF using the BODPOD®. Table 1 outlines her anthropometric data from the initial assessment and follow-up visits.

The patient's last known menstrual cycle was 4 months prior, equating to three menstrual cycles in 2015. In 2014, her weight was 118 lb, BMI was 20.3, and her menstrual cycles were considered normal. There was no history of stress fractures or bone fractures. The patient had a history of low vitamin D status but denied any other family, medical, or surgical history. She did not smoke and had normal blood pressure. She takes a prenatal multivitamin with iron and a 500 mg calcium plus 200 IU vitamin D supplement. The following laboratory test results were evaluated and were within normal limits: estrogen, prolactin, luteinizing hormone, follicle stimulating hormone, thyroid stimulating hormone, renal panel, hepatic profile, complete blood count with differential, and vitamin D.

The patient lives at home with her husband, who is overweight and was diagnosed with high cholesterol in 2015. She is the primary household grocery shopper and cook. In an attempt to assist her husband with his medical condition, the patient embraced all aspects of the "therapeutic lifestyle changes" (TLC) diet. She started the TLC diet in 2015. She limited total fat intake, increased total fiber intake, and increased exercise. The patient reported no behavioral health concerns or eating disorders. She had a 10 out of 10 "readiness to change" score and her motivation stems from her desire for pregnancy.

Her weekly exercise routines are outlined in Table 2. Several 168-h (1 wk) metabolic equivalent (METs) analyses were conducted and calculated into energy expenditure. This activity factor was added to her measured resting metabolic rate to represent total energy expenditure (TEE).[15] At baseline, her TEE was approximately 1,895 kcal/day. Prior to seeing a dietitian, she started a self-intervention in efforts to gain weight. Through self-intervention, the patient increased energy consumption by 200 kcal/day and used a food journal application to monitor intake. Her journal revealed the following daily consumption: 1,800 kcal, 105 g protein (2.23 g protein per kg), and 50 g fiber. She complained of quick onset of satiety with meals and snacks, bloating, distension, and uncomfortable fullness during her self-intervention.

The patient's baseline food recall indicated excessive intake of fruits, vegetables, beans, legumes and whole grains. She had slightly elevated protein intake with inadequate calorie intake. Her measured resting metabolic rate was 1,130 kcal/day. Table 2 outlines the patient's initial food recall and subsequent food recalls that reflect change in diet to achieve goals.

After initial evaluation, the nutrition diagnoses were as follows: 1) inadequate energy intake related to a food- and nutrition-related knowledge deficit regarding energy intake, as evidenced by estimated energy intake from diet less than needs based on current energy expenditure; 2) underweight related to inadequate energy intake, as evidenced by BMI <18.5 and 8% body fat; and 3) excessive fiber intake related to eating patterns that involve high-fiber foods, as evidenced by excessive flatulence and estimated fiber intake higher than generally recommended.

The intervention included calorie balance manipulation, utilization of energy-dense food items, reduction of fiber content, and body composition monitoring. Four nutrition interventions were used: 1) food and nutrient delivery: meals and snacks; 2) nutrition education: content and application; 3) nutrition counseling: cognitive-behavioral theory, health belief model, stages of change, motivational interviewing, and goal setting; and 4) coordination of nutrition care: collaboration with physician and the wellness center for BODPOD® and indirect calorimetry.

The dietitian monitored and evaluated the following: energy intake, beliefs and attitudes, adherence, physical activity, body composition and weight, social support, and nutrition-focused physical findings for vi-

Table 1. Body Composition, Weight, and BMI

Date (2016)	Fat Mass (lb)	Fat-Free Mass (lb)	Percent Body Fat (%)	Body Weight (lb)	BMI
March	Body composition not available			102.6	17.6
April	8.3	95.9	8	104	17.8
May	9.9	97.5	9.2	107	18.4
June*	13.0	97.3	11.8	110	18.9
July	15.5	95.7	13.9	111	19.1
August	17.3	95.8	15.1	113	19.4

BMI = body mass index

*Note: No dietitian intervention in June; weight gain rate decreased to 1 lb per month

Table 2. Intervention Timeline

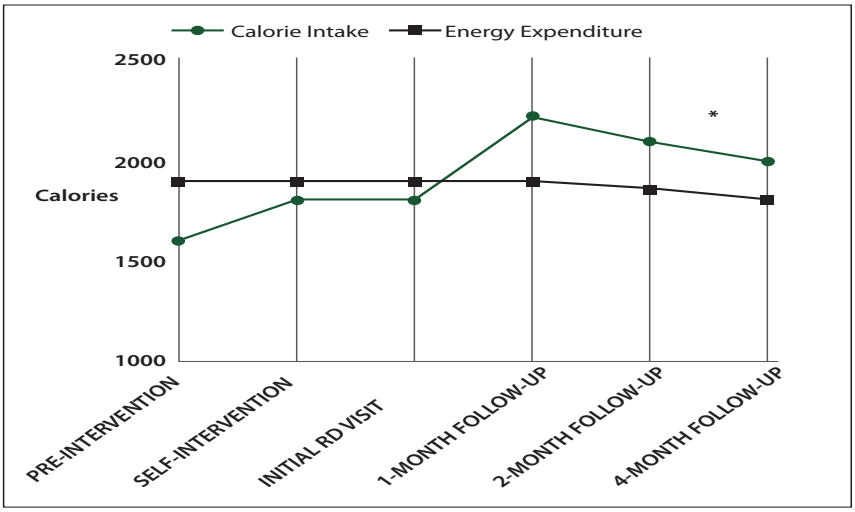
	Self-Intervention (February)	Initial Appointment (March)	Follow-Up Appointment (April)	Follow-Up Appointment (May)	Follow-Up Appointment (July)
Diet	Granola with muesli, brown rice, quinoa, Greek yogurt, skinless chicken, 5-6 c vegetables (raw & steamed), 3-4 c berries No added fat to cooking Added 200 kcal to daily intake: nuts, peanut butter, whole milk in coffee		↑ Granola, full-fat yogurt, hummus, avocado, nut butters, dried fruit, smoothies with coconut, tea with honey, olive oil, whole milk in coffee ↔ Chicken & vegetables	↑ Granola, chia seeds, nut butters, full-fat yogurt, banana, white rice/pasta, chick peas, honey, hummus, raw nuts, mango, oil ↔ Chicken ↓ Fiber, whole grains	↔ Granola, chia seeds, coconut, full-fat yogurt, peanut butter, nuts ↑ Whole grains, vegetables, cream ↓ Use of food journal, honey, whole milk, oil ↑ Self-selection/low-energy foods, high fiber
Weekly Exercise & TEE[17]	I h yoga Run 35 miles (5.8 h) Resistance training (RT): 2-3 sessions (3 h) 24 h TEE: 1,895 kcal			1 h yoga Run 30 miles (5 h) RT: 2-3 sessions (3 h) 24 h TEE: 1,857 kcal	1 h yoga Run 25 miles (4.1 h) RT: 2 sessions (2 h) 24 h TEE: 1,814 kcal
Intervention	↑ Nuts, peanut butter, whole milk	↑ Energy, ↑ carbohydrates, ↑ fats, ↔ protein (1.5-2 g/kg body weight) ↑ Energy-dense foods, ↓ low-energy-dense foods, ↓ fiber, ↑ red meat (2-3 times per wk) Nutrition education, nutrition counseling, coordination of care with physician & wellness center for BODPOD®			
	5 h aerobic exercise per wk + RT 2-3 times per wk + stretching/flexibility 2-3 times per wk				
Kcal Goal & Weight Gain	2,395 kcal (TEE +500)	2,395 kcal (TEE +500)	2,460 kcal (45 kcal/kg FFM +500)	2,493 kcal (45 kcal/kg FFM +500)	2,457 kcal (45 kcal/kg FFM +500)
Calorie Balance	-95 (1,800 kcal)	-95 (1,800 kcal)	+303 (2,198 kcal)	+233 (2,090 kcal)	+175 (1,989 kcal)

↑ = increase; ↓ = decrease; ↔ = remains the same; TEE = total energy expenditure; FFM = fat-free mass

tamin, mineral, or protein defi- ciencies. The intervention continued after 5 months and will continue until menses returns or pregnancy occurs. It is not uncommon for athletes to take months or years to restore normal menses.[5,16] It is important to note milestones to highlight the patient's progress. Weight gain was noticed quickly and BMI normalized within the first few months. Normalizing the percent body fat and maintaining a chronic positive energy balance were more difficult tasks. Motivation and goal orientation assisted this patient in focusing on her daily and meal time goals.

Table 1 reveals that %BF remains low, but BMI, weight, and energy balance have been normalized. As shown in Figure 1, great progress occurred between the first and second follow-up visit. As noted in Tables 1 and 2, the patient saw the slowest weight gain rate and lowest energy intake from

Figure 1. Calorie Balance



*Calorie intake decreased between the 2- and 4-month follow-up visits, which resulted in slow weight gain between follow-ups.

May to July, despite decreased exercise. The patient stopped journaling about food intake and reverted back to her self-selected (high-fiber/low-energy dense) foods during the extended follow-up period. Because this patient proved to be more successful with frequent follow-up visits, appointments were reverted back to every 30 days. The interventions listed in Table 2 will continue and will be updated to reflect changes. The decreased frequency of running indcated in the July follow-up (Table 2) is more consistent with the ASCM guidelines for aerobic exercise. The flexibility recommended was still not met.[13]

Conclusion and Applications

When working with underweight women who have low %BF, it is important for dietitians to understand that normalizing weight and BMI may not fully correct the problem. Despite the inaccuracies inherent in assessing energy intake and expenditure, the dietitian should review energy balance and body composition. Prior to starting any intervention, it is important to review medical diagnoses, stress levels, reproductive health, laboratory values, and frequency, intensity, and type of exercise. Knowing what motivates the athlete and discussing psychological stress can assist in individualizing interventions and may identify mental health concerns. Changes in exercise and eating habits may not happen immediately, and regular menses may take months or years to achieve. Follow-up visits should be scheduled every 30 days until all nutrition-related diagnoses are resolved.

Nutrition interventions should focus on correcting energy deficits, assisting in weight gain, educating, and contributing to a multidisciplinary team. Patients need 45 kcal/kg FFM plus an additional 300 kcal to 500 kcal per day for weight gain.[4] For the patient to meet energy needs, it may be recommended to decrease (or normalize) the intake of vegetables, fruits, and whole grains while increasing energy-dense foods.[10] Exercise recommendations should align with the ACSM's healthy population guidelines, which may require the patient to decrease exercise frequency and/or intensity. Utilizing a food journal can assist in reaching goals, as this population tends to self-select low-calorie food choices that are high in fiber.

Michelle Stone, MS, RD, CSSD, ACSM-CPT is currently enrolled as a doctorate of clinical nutrition student, Rutgers University, New Brunswick, NJ. The views expressed in this paper are those of the author and do not reflect official policies and procedures of William Beaumont Army Medical Center, the Department of the Army, or the U.S. Government.

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From The Chair

Are You in a Silo? – Differentiate Yourself with SCAN

by Karen Collins, MS, RDN, CDN, FAND

In the world of nutrition, where so many people offer nutrition advice, how do you differentiate your expertise and support the value of what you bring to the table as a nutrition expert?

That can be a vital question for your professional success, and SCAN is here to help you.

Depth of Knowledge: Go Deep

Through *PULSE,* as well as our webinars, practice-focused newsletters, an information-packed website, and Symposium, SCAN offers you many opportunities to go beyond the surface knowledge on sports, cardiovascular, and overall wellness nutrition, and to learn how to view this knowledge through the lens of how it relates to eating disorders and disordered eating. You don't need to spend time searching to stay up to date; SCAN brings the experts in all these areas to you.

It can be disappointing to see information shared in social and traditional media that represents outdated knowledge. Staying current with SCAN gives you the solid background to respond to questions and claims with solid, evidence-based recommendations. And there's no need to reinvent the wheel to provide outstanding handouts, as you have many at your fingertips through SCAN fact sheets that are free to members only.

Breadth of Knowledge: Get Out of Your Silo

Although many of us specialize in one specific area, the eating choices of people with whom we work affect them in multiple ways. Even if someone comes to you about one particular area in which you have expertise—sports performance, disordered eating, cardiovascular health, weight management, diabetes, or whatever it is—you stand out and provide even more valuable service when you can point out, among those nutrition strategies considered, the important wider ramifications that might have otherwise gone overlooked.

Helping you to more effectively address specific nutrition needs within the context of overall wellness is a key element of the strategic plan that SCAN has undertaken. You can already access breadth-supporting resources and tools by taking advantage of SCAN webinars and website offerings outside of whatever is your usual turf.

In the past year you have graciously taken time to share your insights and needs through several member surveys probing what you need regarding wellness, disordered eating, and the broader-scope ("Blue Ocean") area of sports nutrition. In the months ahead you'll be seeing the payoff from that input as we introduce a practice-focused newsletter specifically designed to support cross-expertise. We have great things coming in learning opportunities, tools you can use in practice, and ways to help you connect with others.

All this will help you stay on track toward the goals you set, or perhaps create a vision for a new track you want to pursue.

Connect with Colleagues

If there's been a theme conveyed in my *PULSE* messages to you this past year, it probably involves the value of connecting with fellow professionals through SCAN. This has been a lesson that I am sorry I did not learn early in my career, because once I did, my professional life became richer—and more fun, too!

> "It's an exciting time for SCAN, and I encourage you to stay involved."

SCAN offers volunteer opportunities that can fit any degree of time commitment, from single projects to strategic visioning in leadership and interaction with other important organizations.

This is my last message as SCAN chair before I pass the baton to the very capable hands of your incoming chair, Cheryl Toner. SCAN is far from a one-man band! We couldn't do all that we do without the dedication of countless volunteers sharing their skills and enthusiasm. I feel both humbled and honored to have worked with SCAN's talented leadership team over this past year. Saying "Thank you" will never be enough.

It's an exciting time for SCAN, and I encourage you to stay involved. See you soon in Charlotte for what will be an incredible 2017 Annual Symposium!

Conference Highlights

Academy of Nutrition and Dietetics Food & Nutrition Conference & Exposition™

Boston, MA
October 15-18, 2016

The Academy's 2016 Food & Nutrition Conference & Exposition™ (FNCE®) was bursting with new information. The following is a summary of just some of the latest research that might be of interest to SCAN members. Abstracts for this research can be found in the September 2016 *Supplement to the Journal of the Academy of Nutrition and Dietetics*. The page number is in parentheses (A-XX).

Weight Management

■ Children learn by observing their parents. Among fifth and sixth graders in rural Nebraska, the students whose parents reported being physically active performed better on a fitness assessment tool (FitnessGram) compared with children with parents who reported being more sedentary. Family fitness is important! (A-30)

■ "Parents as Partners" is a tennis program for obesity prevention. Eighteen families (23 children and 19 adults) enjoyed weekly sessions that included tennis lessons as well as brief nutrition education sessions. The overweight children played tennis with their parents and the other children. Several families continued playing tennis outside of the program. Exercise that is enjoyable can become sustainable (A-9).

■ Should calorie-counting be highlighted in a weight reduction program? While calorie education can be helpful, an alternate and equally effective method is to teach clients how to choose primarily wholesome foods. By choosing fewer refined grains and foods with added sugar, dieters simultaneously reduced their calorie intake. They lost the same amount of weight as those who counted calories (A-71).

■ Health-beneficial lifestyle behaviors include having a healthy body mass index (BMI), eating a healthful diet, not smoking or binge drinking, and being physically active. Research involving about 1,600 students at the University of New Hampshire indicates that the average student maintains about three beneficial lifestyle behaviors, with females in general having more healthful lifestyle behaviors than males have. However, high-stressed females reported having fewer heathful lifestyle behaviors (A-33). Would teaching stress management to students contribute to improved weight management and health behaviors?

■ Does measuring the body fat of older (ages 66-81) men and women with skinfold calipers offer valid information? Yes, at least in this small study involving 34 community-dwelling seniors. Prediction equations using the sum of four skinfolds gave results similar to those using dual energy X-ray absorptiometry (DXA), the "gold standard" for body fat measurement (A-82).

Sports Diets

■ Youth who play soccer and other recreational sports commonly eat recovery snacks that fail to be nutrient-dense. A survey indicated that more than half of the sports parents would welcome suggestions for healthful snacks (A-28). RDNs who are sports-parents might want to get involved with youth sports.

■ A survey indicates that 80% of 291 soldiers consumed nutritional supplements. The soldiers' key sources of information regarding which supplements to purchase came from the Internet (60%), friends (45%), magazines (32%), salespeople (22%), and health professionals (19%). The average amount spent on supplements each month was $74 by males and $38 by females. The soldiers reported they would prefer to get dietary supplement information (including easily accessible print and online material) from nutrition professionals earlier in their careers (A-58). They seemed to be receptive to professional nutrition help.

"The soldiers reported they would prefer to get dietary supplement information … from nutrition professionals earlier in their careers."

■ Soldiers who were top performers on the Army Physical Fitness Test (259 of 362 soldiers) made healthier choices than the poorer-performing soldiers. Two days of food records (collected by photos of their meals) indicated that the top performers consumed more protein, fiber, and whole grains, and fewer fatty foods and refined grains than the soldiers who scored lower on the fitness test. The higher performing soldiers reported their food choices helped them feel energized all day (50% vs.

32% of the soldiers with lower fitness), be mentally sharp (45% vs. 35%), have improved response to stress (40% vs. 29%), and sustain fewer injuries (37% vs. 21%). The fitter soldiers believed that good nutrition played a role in their performance outcomes (A-28). May they become role models for the other soldiers!

Eating Disorders and Athletes

■ Perfectionism is a trait that contributes to high levels of achievement, but it can also lead to the pursuit of a "perfect" but biologically unrealistic body type. Among dancers, many of whom are perfectionists, perfectionism often contributes to eating disorders. A survey of 245 dancers from one collegiate dance program and four professional dance companies suggests that both collegiate and professional dancers had similar scores on the Eating Attitudes Test (EAT). Dancers with EAT scores suggestive of having an eating disorder reported having more anger, depression, and physical discomfort (A-33). If RDNs could get more involved with dancers at the collegiate level (if not earlier), perhaps they could improve both the health and quality of life for students who go on to become professional dancers.

■ A study compared traits of female athletes (n=12) and female non-athletes (n=17), all of whom had eating disorders. Results indicate that 75% of the women shared at least three common traits that contributed to the onset of their eating disorders: low self-worth, poor body image, and peer issues. Additional triggers for disordered eating behaviors included depression, anxiety, and for the athletes, getting injured (A-83). Sports dietitians might want to give extra attention to injured athletes.

Food Marketing and Foodservice

■ Food manufacturers use bright, colorful packaging to allure children to their products. How much does that impact food purchases? Among 74 six-year-olds, food packaging influenced their food choices nine out of twelve times. Fifty-eight percent of parents reported purchasing what their children requested (A-22). It seems that companies that make nutrient-rich foods might want to jazz up their packaging.

■ Foodservice directors, take note: A healthful beverage initiative contributed to an 8.5% drop in soda purchases. This accounted for saving at least 7 million sugar calories that year. It also resulted in a drop of revenue from beverage purchases (A-22). Perhaps consumers should be encouraged to swap soda for another healthful beverage, such as (dairy or soy) milk?

■ Offering samples of healthful foods at grocery stores can increase sales—but only for certain items. For example, samples of Greek yogurt, Ezekiel bread, and soymilk boosted sales of those items, whereas samples of fish did not (A-63). Some items are marketing challenges.

■ As part of a research study, Dunkin Donuts customers who ordered a latte were asked, "Would you like to make that a Latte Lite?" With this nutrition nudge, sales for Latte Lite increased from 19% to 52% during the 10-day experiment. In the 20 days afterwards (with no prompting to buy the lite product), sales of Latte Lite dropped by only 1%. If this choice were to be maintained throughout the year, a consumer could save 60 kcal per latte and 4,550 kcal per year. That savings could potentially thwart a 1.3-lb weight gain that year. (The typical American gains 1-2 lb per year) (A-43). Nutrition nudges can be impactful!

■ Does adding calorie information to food items alter food choices? Yes, according to a study with 726 Midwest college students. The students completed an online survey that contained two menu variations: one menu with food photos plus calorie information and one with photos but no calorie information. The students were instructed to make meals from the food photos. They created higher calorie meals (by about 110 kcal) when no calorie information was visible. Additional research is needed to see if menu labeling in student dining halls would have the same effect (A-56

■ Does the description of a food influence taste perception? Yes. A study that used the terms "meatless" or "vegetarian" suggests that meatless lasagna, soup, spaghetti sauce, and pizza elicited a positive taste perception. In contrast, both meatless and vegetarian nuggets elicited a negative taste response (A-60). Apparently, choosing appealing names for foods is important.

■ The National Heart, Lung, and Blood Institute recommends using color-coded food cues to guide nutrient-rich food selection. To teach students about foods that are "Go" (green), "Slow" (yellow), or "Whoa" (red), researchers placed signs on snack vending machines and created a food marketing campaign via intranet, email, and posters. Two months after the campaign ended, food-purchasing records indicated that the signs improved the nutritional quality of the students' buying habits (A-14). Nutrition education works!

■ How much nutritional value gets lost when you cook broccoli? Not much. A 100-g portion of uncooked broccoli (about 1 c of chopped flowerets) has about 68 mg of vitamin C. When steamed for 10 or 15 minutes, the broccoli lost only an insignificant amount of vitamin C (A-44). By enjoying a slightly larger portion of broccoli, a consumer could more than compensate for any loss of Vitamin C.

■ Have you ever wished you could offer your clients ice cream as a health-enhancing food choice? Stay tuned for Raspberry Beet (A-60).

Summarized by "Conference Highlights" editor Nancy Clark, MS, RD, CSSD, who has a private practice in the Boston area and is author of Nancy Clark's Sports Nutrition Guidebook, *available at www.NancyClarkRD.com.*

Reviews

Performance Nutrition for Tackling Stress

Lisa Dorfman, MS, RD, CSSD, LMHC
Momentum Media Sports Publishing/MAG, Inc., 20 Eastlake Rd., Ithaca, NY 14850
607/257-6970
www.MomentumMedia.com
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Stress is a relatable experience for many individuals, because it is something many people have encountered in their own lives. However, there are as many methods of coping as there are sources of stress. Lisa Dorfman presents her guide to tackling stress through the lens of performance nutrition.

This guide begins with a background of the author's hardships throughout life and how she was able to overcome adversity through performance nutrition. She proposes that readers can take three approaches to reading. The first is to read the book in its entirety to learn the science behind stress, stories of several individuals' personal adversity, and general tips on proper nutrition while dealing with stress. The second and third approaches are abbreviated readings of her plan for tackling stress.

Dorfman presents her "Stress Detox" philosophy with a personal performance nutrition program categorized into three parts: calming, power, and endurance. The guide takes a holistic approach to stress management with added focus on the nutrition component. The plan incorporates several meal and snack recommendations, as well as techniques for dealing with stress both physically and emotionally. The author also paraphrases evidence-based research, which presents the technicalities of stress and the effect that nutrition can have. In addition, the book includes 50 recipes submitted by individuals she dubs as "stress survivors."

> "The techniques offered are an intuitive method to deal with the reality of stressors."

In all, the book presents a unique approach to a topic that is relevant to anyone with stress in his or her life. The techniques offered are an intuitive method to deal with the reality of stressors. Readers will likely find it easy to relate to several aspects of the book because of its personable touch and broad range of methods discussed.

Lisa Dorfman is a sports dietitian and a personal nutritionist for high school athletes and dozens of professional athletes. She was the US Sailing Olympic and Paralympics Team nutritionist for the 2008 Olympics, serves on the USOC Sports Dietitian Network, and nutritionally coaches current and future athletes to Olympic Gold. She is an athlete herself and is a competitive runner and triathlete residing in Miami, FL.

Reviewed by Carl Barnes, MS, RD, foodservice and informatics dietitian in Bethesda, Md.

Research Digest

Self-Regulator Intervention and Sugar-Sweetened Beverages in Adolescents

Ames SL, Wurpts IC, Pike JR, et al. Self-regulation interventions to reduce consumption of sugar-sweetened beverages in adolescents. *Appetite*. 2016;105:652-662.

Studies indicate that large consumption of sugar-sweetened beverages (SSBs) by adolescents may result in excess energy intake and increased obesity risk. A contributing factor to the reduced ability of teenagers to resist SSBs may be related to underdevelopment of the brain areas involved in decision making. Discovering strategies to help teenagers control SSB consumption may decrease excess sugar intake. This between-subjects randomized study examined 168 high school students with inhibitory control deficits concerning unhealthful food. Investigators implemented an intervention (SSB-II) to program an automatic self-regulating inhibitory response to preferred SSBs. SSB-II engages brain regions achieved by adolescence. To increase resistance to consuming SSBs, the study included a Go/N-Go training involving choices between water and SSBs. A homework-specific implementation intervention and Go/No-Go training involving choices between homework and popular media devices served as controls. After completing the intervention, participants were left alone with free access to a variety of SSBs, water, sugary snacks, and healthful snacks for 10 minutes. Video surveillance was recorded without participants' knowledge. Results showed no difference in total calories consumed (P=.219) or grams of sugar consumed (P=.158) between treatment groups. When

analysis of covariance (ANCOVA) was used, the group participating in both SSB-II and the drink Go/No-Go training consumed fewer calories from SSBs (*P*=.028) than the other groups. The study authors conclude that implementing an intervention may be a simple method of increasing inhibitory responses to SSB in adolescents. This study was supported by grants from the National Heart, Lungs, and Blood Institute, the National Institute of Child Health and Human Development, the National Institute on Drug Abuse, and the National Cancer Institute.

Summarized by Kimberly Funk, graduate student, Department of Nutrition and Integrative Physiology, Coordinated Master's Program Nutrition Education and Research Concentration, University of Utah. Salt Lake City, UT.

Celiac Screening in Eating Disorders

Saldanha NE, Weiselberg EC, Fisher M. Screening for celiac disease in patients with eating disorders. *Int J Adolesc Med Health.* 2016; Jun 14. [Epub ahead of print] doi: 10.1515/ijamh-2016-0007.

Eating disorders (ED) and celiac disease (CD) can present with similar gastrointestinal (GI) symptoms, as well as changes in weight and dietary habits. Research has found increased rates of disordered eating among patients with CD, although recent prospective data have shown similar prevalence of CD in eating disordered patients when compared with the general population. Thus, the utility of screening for CD in ED populations is unclear. This retrospective chart review looked at the prevalence of CD in adolescents presenting for ED evaluation in a larger cohort than prior research. From 2011 to 2014, 1,160 patients (ages 7 to 22) presented for ED evaluation, 494 of whom were screened for CD. Of the screened patients, 10 (2%) had positive serology for CD (tissue transglutaminase IgA antibody >20), and of those, 4 had confirmed CD via intestinal biopsy (0.8% of screened patients). All 10 patients were diagnosed with disordered eating according to the *Diagnostic and Statistical Manual of Mental Disorders (*DSM-5) criteria. In line with prior research, this study demonstrated a similar prevalence of CD in an ED cohort when compared with the general population. The investigators concluded that regular screening of ED patients is therefore unnecessary, but should still be considered in instances where patients have concurrent GI complaints.

Summarized by Julie A. Cooper, MS, RD, clinical dietitian, Children's Hospital of Philadelphia, Philadelphia, PA.

"Carbohydrate mouth rinsing has no effect on power output during cycling in a glycogen-reduced state."

Whey Protein and Resistance Training

Hulmi JJ, Laakso M, Mero AA, et al. The effects of whey protein with or without carbohydrates on resistance training adaptations. *Int J Sport Nut.* 2015;12:48-61.

Increased adiposity and decreased muscle mass are associated with negative health outcomes. Resistance training (RT) followed by protein and carbohydrate supplementation alone or in combination is often used to lower body fat and increase muscle mass. The purpose of this study was to examine the effects of protein and carbohydrate supplementation on RT adaptations, specifically body composition and strength. Healthy, recreationally active non-RT men underwent 4 weeks of preparatory RT to standardize training status. Participants were then randomized into three groups: 37.5 g of whey concentrate (30 g whey concentrate, 5 g lactose <1 g fat); isocaloric carbohydrate (34.5 g maltodextrin); or whey protein and carbohydrate (37.5 g whey concentrate and 34.5 g maltodextrin). A 12-week RT program was performed two to three times per week followed by supplement ingestion immediately post-exercise. Maximal strength testing and body composition estimations by dual-energy X-ray absorptiometry (DXA) were performed before and after intervention. Fat-free mass (FFM), muscle size, and muscle strength increased significantly in all three groups (*P*<.05). However, compared with carbohydrate, protein alone increased relative FFM (+2.5% vs. +0.5%) and reduced total (-6% vs. 0%) and abdominal fat (-8% vs. 0%) (*P*<.05) with no significant differences compared with combined protein plus carbohydrate. These results suggest that the addition of carbohydrates to post-exercise protein ingestion has only a small effect on RT adaptations and that whey protein may increase abdominal fat loss and relative FFM when compared with carbohydrate alone. Thus, if the goal is to reduce fat mass in response to RT without compromising muscle hypertrophy, post-exercise recommendations should include predominantly whey protein.

Summarized by Michelle Meinking, graduate student, Department of Nutrition and Integrative Physiology, Coordinated Master's Program Sports Nutrition Concentration, University of Utah. Salt Lake City, UT.

Effect of Carbohydrate Mouth Rinsing on Power Output During Cycling

Ali A, Yoo MJY, Moss C, Breier BH. Carbohydrate mouth rinsing has no effect on power output during cycling in a glycogen-reduced state. *J Int Soc Sports Nutr.* 2016;13: 19. Published

online 2016 Apr 23. doi: 10.1186/s12970-016-0131-1

Carbohydrate (CHO) ingestion during prolonged exercise has been shown to have ergogenic effects but may cause gastrointestinal upset. Whether similar performance benefits are observed with CHO mouth rinsing in a low glycogen state is unclear. Therefore, the purpose of this study was to compare the effects of CHO ingestion and CHO mouth rinse on time trial (TT) performance and power output during a 1-hour time trial in cyclists. Nine recreationally trained cyclists completed four cycling time trials separated by 7 days in a randomized counterbalanced design. For each trial, participants completed a glycogen-reducing exercise followed by a low-CHO meal of 1g·kg^{-1} body mass (BM) and subsequent overnight fast. The following morning cyclists performed a 1-hour time trial ride at 75% maximum power output (Wmax). Following every 12.5% of completed exercise, participants were given either a solution of 15% CHO to mouth-rinse (0.33 mL kg^{-1} BM), 7.5% CHO to ingest (1.5 mL kg^{-1} BM), placebo mouth rinse, or placebo ingestion. Although performance time with CHO ingestion was 4.5% to 5.2% faster (3,920 ± 288 sec) than other trials (4,096-4,124 sec), there was no statistical difference (P=.21). However, power output was higher with CHO ingestion (231±33 Watts) compared with other trials (221–223 Watts; (P<.01). There were no performance differences between CHO rinsing and placebo trials. The results of this study suggest that CHO ingestion in a fasted and glycogen-depleted state during high-intensity exercise may enhance power output relative to a CHO mouth rinse. Athletes who are unable to ingest adequate CHO prior to an event or who are competing in multiple events should be encouraged to ingest CHO during exercise.

Summarized by Cassidy Moore, Coordinated Master's Program Sports Nutrition Concentration, Department of Nutrition and Integrative Physiology, University of Utah, Salt Lake City, UT.

Of Further Interest

■ News from Wellness/CV RDs Subunit

Here's an update on developments from the Wellness/CV RDs:

• **Wellness Task Force Update.** Thank you to all members who completed the Wellness Task Force Survey last fall. We received valuable feedback about member needs related to this broad practice area. Information regarding the findings from the survey and how these responses will inform SCAN's wellness-related efforts and programming will be presented at the 2017 SCAN Symposium and will become available on SCAN's website (www.scandpg.org).

• **Fact Sheets Get a Spring Cleaning!** Out with the old, in with the new. Several of the Wellness/CV RDs fact sheets have been updated to reflect the latest evidence-based practice information. You can locate these new versions at www.scandpg.org. Click on "Nutrition Info" on the top bar, then "Wellness/Cardiovascular Nutrition," and then "Fact Sheets" on the left side.

• **Public Policy-Focused Opportunities**. The Wellness/CV RDs subunit recently filled two new volunteer positions to help support public policy initiatives for cardiovascular health. Watch for updates on these efforts via our electronic mailing list (EML).

■ News from Sports Dietetics—USA (SD-USA) Subunit

Below are some highlights from the SD-USA subunit:

• **New Partnership.** SCAN and the National Strength and Conditioning Association (NSCA) have formalized a network agreement. One initiative in this agreement is to develop a referral network in which Certified Strength and Conditioning Specialists will be able to easily find a sports dietitian/CSSD in their area. We also look forward to having an NSCA speaker at the 2017 SCAN Symposium who will discuss opportunities for RDs to make connections with other health and fitness professionals and expand their reach.

• **Discover Our Updated Fact Sheets.** After an extensive revision process, the following fact sheets are now available: *Alcohol & Athlete Performance; Athletes with Type 1 Diabetes; Caffeine & Athlete Performance; Eating Before Exercise; Eating During Exercise; Eating for Recovery; Eating on the Road; Exercise Hydration; Fueling the Pregnant Athlete; Nutrition for the Injured Athlete; Optimal Bone Health in Athletes; Protein Needs for Athletes; Reversing Iron Depletion; Smart Supplementation; Sports Foods; The Female Athlete Triad; The Sunny Side of Vitamin D; Vegetarian Eating for Athletes;* and *Weight Gain in Sports.* As always, our fact sheets are free with your SCAN membership. To access, go to www.scandpg.org, click on "Nutrition Info" on the top bar, then "Sports Nutrition," and then "Fact Sheets" on the left side.

• **Next CSSD Exam Window.** The 2017 exam window for this summer is July 10-28; the final date to register is May 31. For more information on application deadlines and fees, visit www.cdrnet.org/certifications/board-

certification-as-a-specialist-in-sports-dietetics. Also, check out the 20-minute webinar, *CSSD: Prepare Yourself and Succeed!* The webinar can be accessed under "Sports Nutrition Information" at www.scandpg.org. Click on "Become a CSSD."

• **Graduate Sports Nutrition Programs and Certificates List.** Consider earning a graduate degree in a sports nutrition-focused program. You'll find information on this at www.scandpg.org/sports-nutrition-education-programs/.

• **Volunteer Opportunities.** SD-USA has a wide range of volunteer opportunities, from editing and reviewing webinars and publications to working with the social media team. Sign up today at www.scandpg.org/volunteer-opportunities/.

• **SD-USA Is Connected!** Don't miss an easy way to keep up with the latest in sports nutrition: You can follow SD-USA on Twitter at our handle @SportsDietetics, and link to our profile page at http://twitter.com/SportsDietetics.

• ***Sports Nutrition Care Manual*® *(SNCM).*** The Academy's online *SNCM* contains research-based nutrition information written by authors who are CSSDs. The price is $75 for Academy members. Preview the manual and selected pages at http://sports.nutritioncaremanual.org/.

News from DEED Subunit

Following are announcements from the Disordered Eating & Eating Disorders (DEED) subunit:

• **DEED e-Newsletter.** The most recent *Bite by Bite* e-newsletter explores the topic of the thin ideal in society. It also discusses SCOFF, a series of five questions to ask any client during assessment. In addition, the latest issue provides a long list of upcoming eating disorder conferences for 2017. To read this issue, as well as all past issues, go to www.scandpg.org/disordered-eating/deed-newsletter/.

• **Let's Hear from You!** We welcome your ideas for DEED and our upcoming publications. To share your thoughts contact the DEED director, Sarah Gleason RDN, CEDRD at sarah@sarahthedietitian.com.

Free CPEs Through Academy Evidence Analysis Library®

The Commission on Dietetic Registration (CDR) has sponsored the creation of free continuing professional education (CPE) opportunities for RDs and DTRs. These free opportunities—on the topics of adult weight management, chronic obstructive pulmonary disease, heart failure, hypertension, and unintended weight loss—are available at the Academy Evidence Analysis Library®.

The Academy Evidence Analysis Library® is a synthesis of the best, most relevant nutritional research on important dietetics practice questions in an accessible, online, user-friendly library, utilizing evidence-based practice. To access the library's CDR-sponsored topics, visit www.andeal.org/default.cfm.

New Practice Competencies Initiative

The CDR Competency Assurance Panel collaborated with the Academy's Quality Management Committee on the development of dietetics practice competencies and performance indicators. These competencies and performance indicators replaced the current learning need codes for the Professional Development Portfolio recertification system in 2015 beginning with new registrants whose registration began on or after June 2, 2015 and current registrants beginning their June 1, 2016 recertification cycle. An article describing the development and validation of the practice competencies was published in the June 2015 *Journal of the Academy of Nutrition and Dietetics.*

The CDR website has been updated to include a Practice Competencies page (www.cdrnet.org/competencies), which provides several practitioner resources, including recordings of webinar presentations made during 2015–2016.

CDR has scheduled webinars to introduce CDR-credentialed practitioners and students to the new Professional Development Portfolio practice competencies. All webinars are recorded and placed on the CDR website. Upcoming webinars will take place on April 26 and May 17, both at noon Central time. For more information, visits www.cdrnet.org/competencies/webinars.

Manuscripts for *PULSE* Welcomed

SCAN'S PULSE welcomes the submission of manuscripts to be considered for publication. In particular, *PULSE* is interested in receiving original research reports and review articles. Manuscripts presenting practical guidelines, case studies, and other information relevant to SCAN will also be considered.

Manuscripts must be prepared and submitted in accordance with *PULSE's* Guidelines for Authors; only manuscripts that follow these guidelines will be considered. The Guidelines for Authors can be accessed at www.scandpg.org/nutrition-info/pulse/.

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Upcoming Events

March 31–April 2, 2017
Join your colleagues at the 33rd Annual SCAN Symposium, *Syncing Nutrition Science & Practice: Advancing Knowledge and Building Skills,* at the Sheraton Charlotte Hotel, Charlotte, NC. For information: www.scandpg.org.

April 6-9, 2017
ACSM's Health & Fitness Summit & Exposition, San Diego, CA. For information: acsmsummit.org

April 22-25, 2017
Experimental Biology (EB) 2017, Chicago, IL. For information: experimentalbiology.org/2017/Home.aspx

May 30-June 3, 2017
ACSM Annual Meeting, World Congress on Exercise is Medicine®, and World Congress on the Basic Sciences of Exercise and the Brain, Denver, CO. For information: www.acsmmannualmeeting.org

June 19-21
National Wellness Conference, St. Paul, MN. For information: National Wellness Institute, www.nationalwellness.org

July 10-28
CDR Board Certified Specialist in Sports Dietetics examination (at various U.S. sites). Postmark deadlines for applications are **April 20-May 31, 2017** (application fee rises with later postmark). For information: Commission on Dietetic Registration: www.cdrnet.org

SCAN'S PULSE

Publication of the Sports, Cardiovascular, and Wellness Nutrion (SCAN) dietetic practice group of the Academy of Nutrition and Dietetics. ISSN: 1528-5707.

Appropriate announcements are welcome. Deadline for the Fall 2017 issue: **June 1, 2017.** Deadline for the Winter 2017 issue: **Sept. 1, 2017.** Manuscripts (original research, review articles, etc.) willl be considered for publication. Guidelines for authors are available at www.scandpg.org. E-mail manuscript to the Editor-in-Chief; allow up to 6 weeks for a response.

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