Plentiful, Nutrient-Dense Food for the World: A Guide for Registered Dietitian Nutritionists

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A FEBRUARY 2014 SURVEY OF A representative sample of Academy of Nutrition and Dietetics (Academy) members showed high interest in learning more about domestic and global farming and food production practices, strategies for increasing global food security, care of animals raised for human consumption, and environmental considerations along the food supply chain. In response, the Academy produced a series of four educational webinars exploring the increasingly more complex relationship between agriculture and food and nutrition.

As a follow-up to the webinar series, the Academy Foundation hosted a symposium before the 2014 Food & Nutrition Conference & Expo in Atlanta, GA, titled "The RDN's Guide to Plentiful, Nutrient-Dense Food for the World." The symposium was designed to:

- build awareness of major issues in global food security;
- explore agriculture practices and innovations that address these issues;
- examine key messages registered dietitian nutritionist (RDN) farmers use to respond to common consumer food and agriculture concerns; and
- motivate action to promote healthy food systems locally, nationally, and globally.

The first half of the symposium featured two highly regarded food and nutrition security experts, Robert Thompson, PhD, visiting scholar and professorial lecturer at Johns Hopkins University's Paul H. Nitze School of Advanced International Studies, and William Weldon, PhD, vice president for Global Research and Development at Elanco Animal Health. They presented the current state of global food and nutrition security and explained the importance of innovative advances in agricultural productivity and environmental sustainability. The second half of the symposium featured four RDN farmers, each addressing a consumer question about farming that they are commonly asked, presenting the science supporting their answer to that question, and providing application suggestions for RDNs and other food and nutrition practitioners.

This article features symposium highlights from the both the food and nutrition security experts and the RDN farmers.

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MAJOR ISSUES AFFECTING GLOBAL FOOD SECURITY

The major issues affecting global food security were presented in five categories: food security, poverty, and malnutrition; food demand growth; land and water constraints; food systems productivity; and agriculture innovations.

Food Security, Poverty, and Malnutrition

According to the World Health Organization, food security is built upon three pillars: food availability (sufficient quantities of food available on a consistent basis, also known as food access); resources to obtain nutrient-dense foods; and food use (appropriate use based on a knowledge of basic nutrition and care).[1] Other stakeholders, such as The World Food Programme, include a fourth pillar: The innovation required to overcome threats to food security such as inadequate water and sanitation, poor soil quality and growing conditions, crop failure, food waste reduction, natural disasters, war, illness, lack of education, and unemployment.[2]

Of the 7.2 billion people alive in the world today, 1.2 billion are living on less than an adjusted $1.25/day.[2] One out of eight people cannot afford to purchase enough food to provide 1,800 kcal/day, which is less than what is required to support even a medium level of physical activity.[3] This calorie deficit also leads to devastating malnutrition. For example, from the time of conception to age 24 months, malnutrition can cause permanent stunting of a child's mental and physical development, resulting in reduced learning capacity and labor productivity.[4]

Calories alone are not enough to ensure good health. Whereas approximately 842 million people around the world experience calorie deficiencies, >2 billion people experience micronutrient deficiencies, especially in vitamin A, iodine, iron, and zinc.[5] In fact, mortality from micronutrient deficiencies is higher than deaths from human immunodeficiency virus/acquired immune deficiency syndrome, malaria, and tuberculosis combined.[6] The bottom line is clear: Both calories and micronutrients are critical to sustained good health.

Food Demand Growth

During the next 35 years, world food demand is projected to increase by about two-thirds. One-third of this increase will be due to the growing world population, which is mostly concentrated in developing countries; the other one-third will result from an increase in urbanization and economic growth in emerging countries.[7] The global middle class is expected to

increase from 1.8 billion (in 2009) to 4.9 billion in 2030.[8] As incomes rise, so does demand for animal-source protein, such as meat, dairy, and eggs, and for edible oils, fruits, and vegetables. As the world population grows, and more people achieve middle-class status, we will need to produce more nutrient-dense food without increasing our use of natural resources.

Land and Water Constraints

How we use natural resources such as land and water to meet this demand is critical to environmental sustainability. According to the World Wildlife Fund,[9] we are currently using 1.5 "earth's worth" of ecological resources to support our population. There is at most only 12% additional arable farmland available worldwide—land that is neither forested nor subject to erosion or desertification.[10] Most available cropland is in remote areas of South America and Sub-Saharan Africa where infrastructure is minimal and soils are inferior in quality.[10]

Demand for fresh water also constrains food production. As global populations continue to urbanize, cities may outbid agriculture for available fresh water, thus requiring farmers to increase the productivity of water they already have available. And as climate change reduces the amount of potable water in many areas of the world, the need for agricultural systems that require less water will continue to rise. Investment in innovation is critical to finding the most environmentally sustainable solutions to looming land and water constraints.

Food System Productivity

Escalating demand for food must be met with improved productivity along the supply chain. Food loss occurs during all stages of the production cycle—in the fields, during harvest, and from spoilage during shipment and storage.[11] An estimated one-third of world food production—1.3 billion tons of food—ends up in landfills each year as food waste.[12] Converting unusable soil into productive farmland, increasing the genetic potential for crops or farming systems, and reducing postharvest losses are ways to increase food system productivity while preserving natural resources, including land, water, energy, and fertilizer.

Agriculture-Based Innovation

There is no one silver bullet to solve all of the issues that affect global food security. Advances in agricultural innovation, however, have yielded benefits across the food supply chain and will continue to be a driving force in achieving food security.

For example, food fortification can play a lifesaving role in reducing population-wide nutrient deficiencies. Examples of long-standing fortification in the United States and other developed countries include adding vitamins A and D to milk; adding iodine to salt; and adding thiamine, riboflavin, niacin, and folate to wheat flour. An example of using biotechnology to help enhance a crop with valuable nutrients is golden rice. The Golden Rice Project is a technology that enriches rice with provitamin A to help combat vitamin A deficiency in developing countries. In 2012 the World Health Organization reported that about 250 million preschool children experience vitamin A deficiency and that providing those children with vitamin A could prevent about one-third of all deaths of children younger than age 5 years, which amounts to approximately 2.7 million children that could be saved from dying unnecessarily.[13]

In certain areas of the world—such as the United States, Canada, and Mexico—soil quality, precipitation, temperature, disease, weed control, and supplementation with fertilizer produce higher crop yields. Innovations in plant breeding and transgenic technology (ie, genetic modification) have increased productivity through development of drought-tolerant and disease-resistant crops.[14] Improved plant propagation techniques have led to reduced need for pesticides and herbicides and have slowed down product spoilage. Other advances include no-till farming, nitrogen use efficiency, precision agriculture, and soil fertility management. In addition, innovations in animal nutrition and the prevention and treatment of disease have brought dramatic change to animal management.[15]

Many factors addressed in the first half of the symposium are supported by the Academy's position that "all people should have consistent access to an appropriately nutritious diet of food and water, coupled with a sanitary environment, adequate health services, and care that ensure a healthy and active life for all household members. The Academy supports policies, systems, programs, and practices that work with developing nations to achieve nutrition security and self-sufficiency while being environmentally and economically sustainable."[16]

RDN FARMERS ANSWER COMMON CONSUMER FOOD AND AGRICULTURE QUESTIONS

During the second portion of the symposium, four RDN farmers—Amy Myrdal Miller, MS, RDN, founder and president of Farmer's Daughter Consulting, LLC; Dayna Green-Burgeson, RD, senior dietitian, Food and Nutrition Services at University of California, Davis, Medical Center; Abigail Andrew Copenhaver, RDN, Farmstead Nutrition and Consulting, LLC; and Jennie Schmidt, MS, RD, Schmidt Farms Inc—identified and presented talking points on topics that consumers commonly ask them.

Is Grass-Fed Beef Better than Grain-Fed Beef? (Amy Myrdal Miller, MS, RDN)

Although many factors affect beef quality, there is little difference in nutrient value between grain-fed and grass-fed beef. Grass-fed beef is slightly lower in calories and total fat, and slightly higher in protein. It is important to remember that all cattle start their lives eating grass. In cases where cattle are not receiving enough nutrition from grazing in a pasture, the rancher may supplement their diets with other grains, including corn or sorghum or with soybeans.

Although there is little difference in nutrient value, there is a difference in environmental impact between grass-fed and grain-fed cattle. Grass-fed cattle take longer to reach slaughter weight, and therefore produce more methane gas during their lives compared with grain-fed cattle. Grass-fed cattle also produce more methane than their grain-fed counterparts due to the quality of the diet. Cattle are ruminants; methane is produced by bacteria in the stomach or rumen of cattle. The less digestible the feed, the

more that is available for the bacteria that produce the methane.

Application. RDNs and other nutrition and dietetics practitioners can help consumers select lean cuts of beef as part of a nutrient-dense diet while clarifying confusion about the differences between grain-fed and grass-fed beef. Recommending and, when applicable, demonstrating healthy cooking techniques, recipes, and proper portion sizes can also help consumers include recommended amounts of lean beef and other proteins in their diet.

What Influence Do Dairy Cows Have on the Environment? (Abigail Copenhaver, RDN, CDN)

There are approximately 9.2 million dairy cows in the United States producing 201 billion lb milk each year.[17] Dairy farmers work to ensure that their cows are as healthy as possible. The cows' housing, nutrition, water access, and physical health are closely monitored. It is common for veterinarian nutritionists and environmental consultants to be part of the team engaged in monitoring dairy cow health.

Dairy farmers use sustainable practices when caring for their land, such as rotating crops and partnering with neighboring farms to share resources.[18] The production of dairy products in the United States contributes only about 2% of the total US greenhouse gas (GHG) emissions. The US Dairy Innovation Center's Sustainability Council has committed to help dairy farmers improve the sustainability of their operations even more by reducing dairy's GHG emissions by 25% by 2020.[19] Technology can be used to convert manure into fertilizer for crops and electricity for farms and communities.[20] Other best practices include creating efficiencies in fuel and electricity use, water management, conservation, recycling, and wastewater treatment techniques.[19]

Application. RDNs and other nutrition and dietetics practitioners can organize continuing professional education meetings with their district and/or affiliate dietetic associations, local farmers, veterinarians, and extension specialists to increase understanding about how animals intended for human consumption are raised and fed affects the environment and how regulations influence the livestock industry. Hosting journal club discussions about the latest research, evaluation methods, and innovations in sustainable agriculture and sharing information through presentations, blogs, and social media are other ways RDNs can engage in connecting agriculture to nutrition and health.

How Can I Reduce the Environmental Impact of My Diet? (Dayna Green-Burgeson, RD)

As the world's population continues to grow, the need for improved food system efficiency looms large. Globally, an estimated one-third of all food produced is lost between the farm and consumer. In low-income countries, the losses typically occur between the field and retail outlet. In higher-income countries, the losses occur more often between retail and the landfill.[21] The amount of farmland used to produce food that is wasted is larger than the total land area of the United States, and the total GHG emissions associated with the production and decay of wasted food are greater than the emissions of any country except the United States or China.[22] Fruits and vegetables are the biggest source of food waste in the United States. More than half of all the fruits and vegetables produced are never eaten. These losses occur from "farm to fridge," with a 20% loss occurring on the farm, 16% between farm and consumer, and 28% after the consumer is in possession of the produce.[23]

Application. RDNs and other nutrition and dietetics practitioners have an important role in educating the public about reducing the environmental impact of their diet, especially by reducing food waste through purposeful selection, storage, use, and consumption. Organizing worksite, community, or school campaigns to decrease food waste and educating consumers about gardening and home cooking—using seasonally available foods—and safely preserving and storing perishables helps reduce food waste, increase consumption, and protect the environment.[24,25]

Does Soil Have Any Influence on the Nutritional Value of Food? (Jennie Schmidt, MS, RD)

Soil is a complex ecosystem of living organisms. Maintaining a healthy balance of microorganisms and nutrients in the soil is vital for growing high-quality, nutrient-dense foods.[26] Many soil characteristics affect nutrient availability, including the texture, drainage levels, moisture, temperature, pH, and cation exchange capacity.[27] Farmers use soil analysis to measure soil nutrients. Enhancements optimize soil health and fertilizers fill in missing nutrient gaps. Other techniques used to naturally sustain soil nutrients include crop rotation, cover crops, and no-till practices that keep the previous season's crop residue on the land to decompose and return nutrients to the soil.

Application. Soil health is an interesting consumer education opportunity for RDNs and other food and nutrition practitioners. A rapidly growing body of research is focused on microorganisms in the soil and how they may be beneficial to nutrient quality and quantity of food produced. RDNs and other food and nutrition practitioners could contribute to this evolving research, both domestically and internationally, and also advocate for innovations that enhance soil health, particularly in countries with poor growing conditions.

RESOURCES

The Future of Food Initiative

The Academy Foundation's Future of Food initiative began as a collaboration with the Academy Foundation, Feeding America, and the National Dairy Council. The initiative, through an educational grant from Elanco, has devoted efforts to increase member awareness about agriculture and advances in agricultural technology to support sustainable food systems and a safe and nutritious food supply for the growing world population. The new collaboration brings together health professionals, including RDNs, the agriculture and food production industry, and hunger relief professionals (educational resources, webinars, infographics, and more information are available at www.eatrightfoundation.org/Foundation/content.aspx?id=6442483988).

Kids Eat Right

The Academy Foundation's Kids Eat Right initiative aims to provide resources to assist members in working with schools and communities to help kids eat better and move more. Becoming a Kids Eat Right volunteer grants access to a variety of educational resources—preconstructed, science-based presentations to help educate children and their families on topics ranging from food insecurity to healthy snacking. Throughout the year, there are many opportunities for members to apply for a minigrant to give these presentations in their community (www.eatrightfoundation.org/foundation/kidseatright).

Hunger and Environmental Nutrition Dietetic Practice Group (HEN DPG)

HEN is a diverse and growing DPG comprising Academy members; international RDNs and nutrition and dietetics technicians, registered; student members; Friends of HEN (individual and corporate); networks; and sponsors. HEN has a vision of optimizing the nation's health by promoting access to nutritious food and clean water from a secure and sustainable food system. Their resources, webinars, and the Academy's Food & Nutrition Conference & Expo sessions are valuable tools to help empower members to be leaders in sustainable and accessible food and water systems (www.hendpg.org).

Food and Culinary Professionals DPG Agriculture Subgroup

This DPG has a vision to help tell the story of food from ground to table by educating members with stories from farmers and evidence-based agriculture-related resources (www.foodculinaryprofs.org/page/agriculture).

CONCLUSIONS

Since the early days of land grant colleges, the dietetics profession has had strong roots in agriculture. Today, agricultural science, like nutrition science, is far more complex, and maintaining the pillars of food security—food availability, accessibility, and use—has become a far more difficult task. The information presented in "The RDN's Guide to Plentiful, Nutrient-Dense Food for the World" symposium supports current efforts and can guide future directions for the Academy. The world is far more connected than ever before, and the Academy and its members can help strengthen international nutrition efforts in food and nutrition security. Now, more than ever, it is imperative that RDNs and all nutrition and dietetics practitioners do more to contribute to healthy, sustainable food systems that ensure the best nutrition—beginning at the farm and all along the food supply chain. Firmly positioned at the nexus of agriculture, nutrition, and health, RDNs and other nutrition and dietetics practitioners have new and exciting opportunities to develop and execute innovative strategies aimed at achieving food security for a growing world population.

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