



PROTEIN CONSUMPTION AND PRODUCTION

In the U.S., animal sources account for approximately two thirds of dietary protein. Yet, plants such as nuts, seeds, beans, peas, legumes, grains, and cereals are also important sources of protein. The amount and types of protein consumed can have significant effects on environmental impacts and the risk of chronic diseases and premature death.

In the past several decades, meat production and consumption have increased sharply worldwide, especially in developing countries. Since 1995, per capita meat consumption has grown 25 percent in developing countries and two percent in developed countries, for a 15-percent increase overall. Global demand for livestock products is projected to increase 70 percent by 2050, driven by population growth and rising affluence. While beef consumption in the U.S. is at the lowest level in over two decades, total meat consumption remains high: 118 kg per capita in 2011, the fifth highest consumption rate globally.

Animal-based foods contribute disproportionately to the overall environmental costs of food production. The livestock sector is responsible for over 14 percent of all human-induced greenhouse gas emissions (GHGE), nearly a tenth of global human water use, and 63 percent of reactive nitrogen mobilization, which influences global warming, reduced air and water quality, and biodiversity loss. The main reasons for these impacts are the production of animal feed (corn, soybeans, etc.), enteric emissions from ruminant animals, and emissions to air and water from manure management. Feed conversion efficiencies of raising livestock vary greatly by species: By one estimate, it takes 36 calories of feed to produce one consumed calorie of beef. This ratio is 11:1 for pork, 9:1 for

poultry meat, and about 6:1 for eggs and dairy. As a result, the land use, resource needs, and associated emissions for producing feed crops compound for animal products. In regions with high demand for land, this can also lead to deforestation and biodiversity loss. In addition, ruminant animals (beef and milk cows, and sheep) emit methane, a powerful greenhouse gas, as part of their normal metabolism. The result is even larger carbon footprints for these animal products.

Production methods certainly influence the environmental impact of animal-based foods, but popular alternatives must be fully assessed before being lauded as solutions. For example, while pasture-based beef production may have local benefits such as reduced soil erosion and nutrient losses, it typically involves higher GHGE and system energy use than confinement feeding operations. Future technical advances are expected to improve the environmental efficiency of food production, but analysts project that these improvements will be insufficient to reach GHGE reduction goals, meaning shifts in eating habits are needed to reach such targets.

Meat consumption also has significant impacts on human health. The science is clear that regular consumption of red meat contributes to risk of chronic diseases and premature death. Dietary recommendations should distinguish poultry and fish from beef and pork, as diets that include substantial amounts of red meat and products made from these meats increase risk of diabetes, heart disease, and some cancers. Processed meats are particularly deleterious due to their high contents of saturated fat, sodium, and preservatives; these include lean red meat but especially such items as bacon, hot dogs, sausage, salami, and bologna (which are especially high in sodium). Nearly one in 10 deaths could be prevented in the U.S. if American adults cut their current red meat consumption to less than half a serving per day.

On the flip side, eating plant-based, protein-rich foods, such as legumes and nuts, reduces the risk of chronic diseases and premature death. In the past year, new studies add further evidence to support the notion that replacing animal protein with plant protein can help prevent chronic diseases. In a large

study from eight European countries, higher intake of animal protein was associated with an increased risk of developing type 2 diabetes, whereas vegetable protein was not associated with risk. The authors suggest that replacing animal protein with vegetable protein or other macronutrients may reduce the population-wide risk of diabetes.

Eggs and dairy products should also be distinguished from meats. There is little evidence that moderate consumption of eggs (up to one egg per day) has adverse effects on chronic diseases. However, consumption of dairy products may affect human health in complicated ways, including both benefits and risks, both of which vary among different populations. Dairy has been suggested to confer benefits on weight control and diabetes prevention, but the existing evidence does not support this notion. In a recent study, Harvard researchers followed 41,436 men in the Health Professionals Follow-Up Study, 67,138 women in the Nurses' Health Study, and 85,884 women in the Nurses' Health Study II. The study found that total dairy, milk, and cheese were not significantly associated with risk of type 2 diabetes and that yogurt is the only dairy product that was associated with lower risk of diabetes. This study refutes the widely held assumption that higher dairy intake is beneficial for body weight and diabetes prevention. In other words, higher amount of dairy protein is not required to achieve health benefits.

Yet, meat and dairy products are the foods that receive the most support by the federal government's generic commodity check-off advertising programs, which are established by Congress and managed jointly by producer boards and USDA. The idea with these advertising campaigns—which have included “Beef. It's What's for Dinner”; “Ahh, the Power of Cheese”; “Pork. The Other White Meat”; “Got Milk?”; and the milk mustache campaign—is not to sell a specific brand but to increase overall demand for a generic category. Yet, there is no check-off support for poultry, fish, or whole grains, and only very little for fruits and vegetables. It is difficult to lead U.S. consumers to eat more plant-based proteins, and to shift a greater proportion of their diets in general to plant foods, while simultaneously pushing for increased consumer demand for milk, cheese, butter, beef, and pork.

The past year has also seen numerous studies exploring the environmental effects of diet change and the potential for diet shifts as a climate mitigation strategy. There is clear consensus that reducing animal-based foods in the diet can result in lowered environmental impact, as confirmed in a systematic review published this year. In one of the few U.S.-based studies, Heller and Keoleian (see For Further Information, page 54) found that, despite a recommended 20-percent decrease in calories and reductions in meat consumption, the GHGE of the average recommended diet in the *2010 Dietary Guidelines for Americans* would be about the same as that of the current diet. However, the vegetarian and vegan adaptations of the *Dietary Guidelines* reduce GHGE by 33 percent and 53 percent, respectively. A dietary pattern aligned with the Healthy Eating Plate recommendations made by Harvard T. H. Chan School of Public Health also shows a 33 percent reduction in GHGE without eliminating meat, largely through a shift from red meat to chicken, and reductions in dairy consumption. Studies also demonstrate that reducing animal products in the diet can be an effective means of conserving water and energy resources.

In a comprehensive analysis published in *Nature* in 2014, Tilman and Clark (see For Further Information, page 54) compared diets with less or no meat (for example, a Mediterranean or vegetarian diet) to the average American diet. The authors conclude that, “Alternative diets that offer substantial health benefits could, if widely adopted, reduce global agricultural greenhouse gas emissions, reduce land clearing and resultant species extinctions, and help prevent certain diet-related chronic non-communicable diseases.”

Finally, fish and seafood present an interesting dietary paradox. Farmed fish often show high feed conversion efficiencies (typically less than 2:1), and there are well-known health benefits to fish consumption. At the same time, overfishing has had significant impact on wild fish stocks. Improvements to aquaculture practices mean farmed fish may become an important future protein source.

RECOMMENDATIONS:

Chefs and the foodservice industry have an important role to play in leading and inspiring the new cultural norms necessary to prompt dietary shifts. Research shows that, when asked about changing meat consumption habits, individuals experience complex moral and psychological barriers. Information about negative outcomes is not enough: Eaters need leaders. Chefs should aspire to move red meat from the center of the plate and consider its value as a condiment. They should also ask themselves whether meat of any kind is really key to delivering the flavor and experience consumers seek. There are many creative and delicious ways to prepare meals in high-volume foodservice operations that put plant-based proteins front and center—while cutting costs, reflecting global cuisines, and reducing environmental damage along the way. A shift from a meat-based diet to a plant-based diet will improve the health of both humans and the planet.

In practice, healthy protein sources like fish, chicken, beans, and nuts should be used in place of red meat (including processed red meat). There is no need to go overboard on dairy protein: 1-2 servings of dairy products can be recommended for people who choose to include dairy as part of a healthy dietary pattern.



SCORE: 3

While red meat production and consumption in the U.S. is falling moderately, it continues to grow in the developing world. Climate conditions, such as droughts throughout the American West, are reducing supplies and driving up costs, stressing the need to further reduce red meat consumption. There is a maturing conversation in the academic literature on the environmental and health effects of diet change. This conversation is beginning to enter into policy realms, as concerns around climate change and future food security escalate. For the first time, the 2015 Dietary Guidelines Advisory Committee report considers diet sustainability as part of the evidence base to develop *Dietary Guidelines for Americans*. The report concludes that, “a dietary pattern that is higher in plant-based foods, such as vegetables, fruits, whole grains, legumes, nuts, and seeds, and lower in animal-based foods is more health promoting and is associated with lesser environmental impact (GHG emissions and energy, land, and water use) than is the current average U.S. diet.” The 2015 Dietary Guidelines Advisory Committee recommends that the U.S. population reduce consumption of animal products, especially red and processed meats, for both health and sustainability reasons.

IN SUMMARY:

- High meat consumption has harmful effects on both human health and the environment.
- New studies add to existing evidence that shifts in eating habits toward more plant-based proteins, fruits, and vegetables can reduce the risk of certain chronic diseases, greenhouse gas emissions, and the burden on water and energy resources.
- Through culinary strategies that make plants the stars on menus, chefs and foodservice professionals can lead cultural shifts away from an overreliance on animal protein in the diet.