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The Potential of Spices and Herbs to Improve the Health of the Public Through the Combination of Food Science and Nutrition

Johanna T. Dwyer, DSc, RD

The ancient civilizations of China, India, and Arabia valued spices and herbs for their taste, fragrance, preservative effects, and medicinal powers.^{1,2} Today, there is growing interest in identifying the physiologic effects of these ingredients and in learning ways that spices and herbs can increase the acceptability of healthier foods, both prepared and home cooked.

TODAY'S CHALLENGE: IMPROVING HEALTH THROUGH NUTRITION

The link between food and health has never been clearer, and yet dietary change has never been more difficult. Substantial numbers of American adults have intakes of potassium, calcium, vitamin D, and dietary fiber that are lower than recommended levels because many consume suboptimal amounts of vegetables, fruits, whole grains, dairy foods, seafood, and other foods rich in these essential nutrients and food components. New nutrition education tools such as ChooseMyPlate.gov may help some consumers make healthier food choices, but taste reigns supreme, and many continue to eat more calories, fat, saturated fat, and sodium than they need.³

Physiologic Roles of Spices and Herbs

Research has begun to identify not only culinary uses but also other potential benefits of spices and herbs in human health. In the past decade, the number of clinical trials involving spices and herbs listed on ClinicalTrials.gov and funded by public and private sources increased 6-fold. Studies of the health effects of bioactive components found

in spices, herbs, and other botanicals are also being carried out through the National Institutes of Health's funding of Botanical Research Centers and its efforts to translate research findings into practical benefits for human health.

Opportunities for Improving Consumer Eating Patterns

Many opportunities exist to improve Americans' dietary patterns. Today, about 38% of consumers report that they use spices and herbs as alternatives to salt for flavoring foods in an effort to reduce their sodium intake.⁴ Dietitians recognize this approach as being effective, but much more can be done to spread the word. Encouraging consumers to use spices and herbs when cooking, for example, can help reduce the intake of less desirable foods and nutrients, particularly salt, solid fats, and sugar, while increasing the intake of vegetables and other high-fiber foods. Their use can also make menus more interesting. The time is ripe to seize opportunities to build awareness about the taste benefits of spices and herbs and how they can contribute to healthy eating patterns. A small number of consumers rank spices and herbs among the top foods with benefits beyond basic nutrition,⁵ but many others do not perceive the added health benefits of spices and herbs. As the research accumulates that supports health benefits, this state of affairs may change. Finally, and perhaps most importantly, new research suggests that adding spices and herbs to foods and meals can increase the acceptance of healthy foods by making them more flavorful. These new data suggest there is an opportunity to help consumers improve their diets by learning to enjoy novel spices and herbs, experimenting with new recipes, and mastering new cooking techniques (see pages S4–S6, S8–S9, and S14–S15).

CONCLUSIONS

The number of studies about spices and herbs in both the scientific literature and in the popular press has increased dramatically since 2004. Moreover, consumers are demonstrating a preference for foods with more flavor as evidenced by the increased national appeal for regional cooking styles

Johanna T. Dwyer, DSc, RD, is a professor of medicine and community health at Tufts University School of Medicine, Boston, Massachusetts. The author is a member of the McCormick Science Institute's Scientific Advisory Council; owns stock in McCormick & Company, Inc; is the editor of *Nutrition Today*; and is a public trustee of ILSI North America. Correspondence: Johanna T. Dwyer, DSc, RD, Frances Stern Nutrition Center Box 783, Tufts Medical Center, 800 Washington St, Boston, MA 02111 (JDwyer1@tuftsmedicalcenter.org). DOI: 10.1097/01.NT.0000453843.06840.2d

such as barbecue and spicy foods such as chili, tacos, and crab cakes. Health professionals, researchers, and policy-makers have an opportunity to work together at the interface of food science and nutrition to help translate the science of spices and herbs into improved consumer eating patterns.

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Oxidative Stress Markers and Inflammation: The Role of Spices and Herbs

David Heber, MD, PhD

Spices and herbs are complex mixtures of natural antioxidants, phytochemicals, vitamins, and minerals. They contain more than 2000 phytonutrients such as capsaicin (chili pepper), curcumin (turmeric), eugenol (cinnamon, clove, and nutmeg), gingerol (ginger), piperine (black pepper), rosmarinic acid (basil, rosemary, lemon balm), and thymol (thyme). Many of these compounds have antioxidant properties and contribute to the total antioxidant intake of usual diets, sometimes at even higher concentrations than fruits, berries, vegetables, and cereals.¹ The *in vitro* antioxidant activity of various spices, herbs, and foods is shown in the Table.

Many experts believe that the use of spices and herbs in cooking and at the table should be encouraged, because many contain antioxidants that may help reduce oxidative stress. Oxidative stress is mediated by free radicals that promote the oxidation of cell lipids, DNA, and proteins² and also activate inflammatory reactions, thus damaging cells and tissues.³ Oxidative stress is a characteristic of aging and most chronic diseases such as heart disease, cancer, obesity, diabetes, arthritis, and neurodegenerative diseases such as Parkinson disease and Alzheimer disease. The effects of oxidative stress may be lessened by eating a diet rich in naturally occurring antioxidants.⁴

David Heber, MD, PhD, is professor emeritus of Medicine and Public Health at the David Geffen School of Medicine at UCLA and founding director of the UCLA Center for Human Nutrition, Los Angeles, California.

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Correspondence: David Heber, MD, PhD, 900 Veteran Ave, Room 1-2-213, Los Angeles, CA 90024 (dheber@mednet.ucla.edu).

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SPICE MIXTURE ADDED TO HAMBURGER DECREASED MDA FORMATION

Malondialdehyde (MDA) is a marker for the oxidation of lipids, which is a key step in the formation of atherosclerotic plaques associated with cardiovascular disease. A study was designed to test whether an antioxidant spice mixture would decrease MDA concentrations in cooked meat and in the plasma and urine of volunteers.⁵ Eleven healthy volunteers ate 2 kinds of hamburgers in random order: 1 burger was seasoned with salt and a spice blend that contained black pepper, garlic powder, ginger, ground cinnamon, ground cloves, oregano, paprika, and rosemary; the other was seasoned only with salt. Lipid oxidation in the cooked spiced hamburger was reduced 71% compared with the salt-only hamburger ($P = .009$). Among the volunteers, urinary MDA concentrations decreased by approximately 50% after they ate the spiced hamburger compared with when they ate the salt-only hamburger ($P = .021$). Postprandial plasma MDA increased significantly after consumption of the salt-only burger ($P = .043$) but showed a trend to decrease following consumption of the spiced burger. A time-trend analysis showed a significant difference ($P = .013$) between the two groups, suggesting the spice mixture helped decrease lipid oxidation.

SPICE MIXTURE ADDED TO HAMBURGER IMPROVED ENDOTHELIAL DYSFUNCTION

We also tested whether spices and herbs could reduce postprandial lipid oxidation and endothelial dysfunction in individuals with type 2 diabetes, a very common condition known to lead to endothelial dysfunction.⁶ Postprandial lipid oxidation refers to the susceptibility of lipids