Circulation

AHA SCIENCE ADVISORY

Innovation to Create a Healthy and Sustainable Food System

A Science Advisory From the American Heart Association

ABSTRACT: Current dietary intakes of North Americans are inconsistent with the *Dietary Guidelines for Americans*. This occurs in the context of a food system that precludes healthy foods as the default choices. To develop a food system that is both healthy and sustainable requires innovation. This science advisory from the American Heart Association describes both innovative approaches to developing a healthy and sustainable food system and the current evidence base for the associations between these approaches and positive changes in dietary behaviors, dietary intakes, and when available, health outcomes. Innovation can occur through policy, private sector, public health, medical, community, or individual-level approaches and could ignite and further public-private partnerships. New product innovations, reformulations, taxes, incentives, product placement/choice architecture, innovative marketing practices, menu and product labeling, worksite wellness initiatives, community campaigns, nutrition prescriptions, mobile health technologies, and gaming offer potential benefits. Some innovations have been observed to increase the purchasing of healthy foods or have increased diversity in food choices, but there remains limited evidence linking these innovations with health outcomes. The demonstration of evidence-based improvements in health outcomes is challenging for any preventive interventions, especially those related to diet, because of competing lifestyle and environmental risk factors that are difficult to quantify. A key next step in creating a healthier and more sustainable food system is to build innovative system-level approaches that improve individual behaviors, strengthen industry and community efforts, and align policies with evidence-based recommendations. To enable healthier food choices and favorably impact cardiovascular health, immediate action is needed to promote favorable innovation at all levels of the food system.

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A food system includes all the processes and resources involved in producing, processing, distributing, preparing, and consuming food and is interconnected with food supply chains, farm production practices, food waste, natural resources, health, consumer behavior, food culture, social justice, and policies.[1] We define a *healthy food system* as one that promotes and maintains nutrient-dense dietary patterns that optimize health individually and cross-culturally. We define a *sustainable food system* as a food system that meets current population needs without compromising the needs of future generations. Developing a healthy and sustainable food system requires a multilevel innovative approach that includes global, federal, state, and local policies; the food industry; the agricultural industry; public health and medicine; communities, worksites, and schools; and individuals and families.

Our rationale for focusing on the food system is that current dietary patterns of Americans are inconsistent with the *Dietary Guidelines for Americans*,[2] and this is hypothesized to be associated with a food system that precludes healthy foods as the default choices.[2–5] Currently, dietary patterns in the United States include less than the recommended amounts of fruits, vegetables, dairy, whole grains, beans, and legumes and more than the recommended amounts of meat, sodium, saturated fats, refined grains, partially hydrogenated fats, and added sugar.[2] Contemporary lifestyle recommendations from the American Heart Association, American College of Cardiology, and the *Dietary Guidelines for Americans* focus on the individual[2,6,7] (Supplemental Table 1). Practical advice has also been provided for practitioners aiming to implement evidence-based dietary recommendations in the clinical setting.[8] However, more comprehensive strategies to improve adherence to dietary recommendations, address barriers to healthy lifestyles, and ultimately promote cardiovascular health are needed.

There are significant gaps in the literature documenting the impacts of innovations in food systems on cardiovascular health factors such as dyslipidemia, excess body weight gain, high blood pressure, and insulin resistance. Despite these limitations, we identified evidence that innovations can favorably alter eating behaviors. This may be a promising first step toward improving health outcomes. Innovation can occur through policy, private sector, public health, medicine, community, and individual-level approaches. The multiple stakeholders that contribute to a healthy and sustainable food system are shown in the Figure.

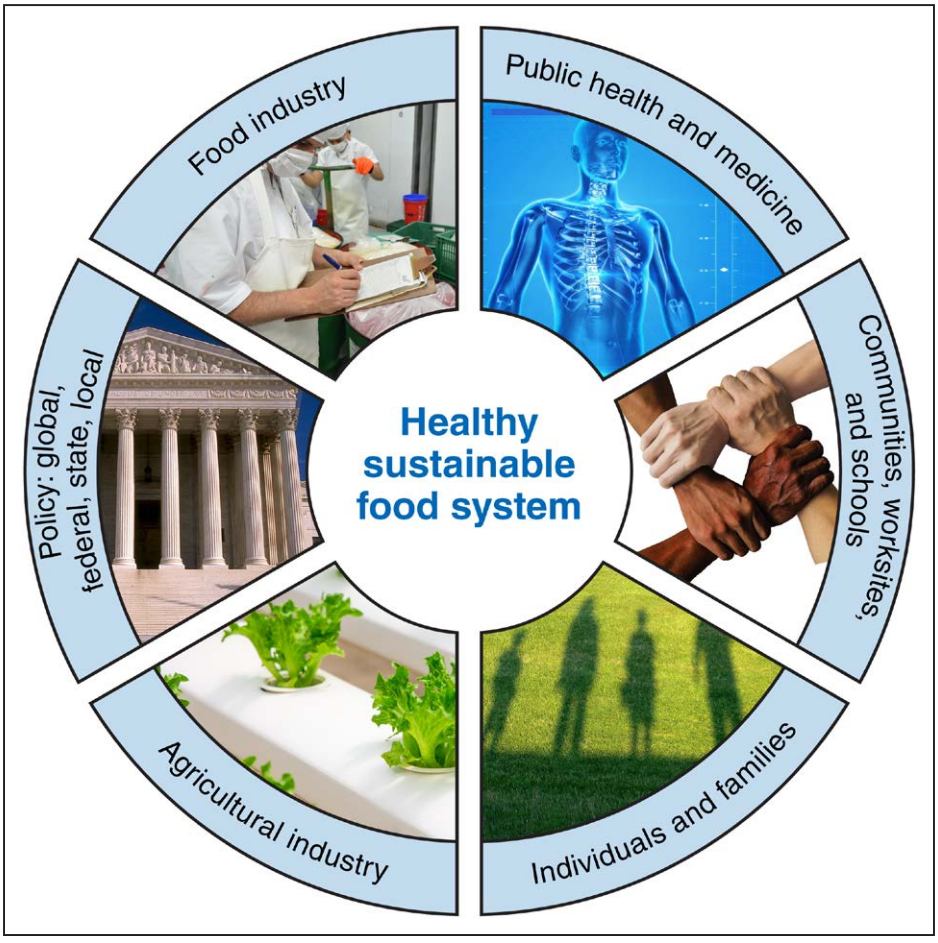

Figure. Multiple stakeholders contribute to a healthy, sustainable food system.

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Table 1. Policy Approaches at Global, Federal, State, and Local Levels to Create a Healthier Food System

Level of Action	Approach	Findings Regarding Effectiveness on Health
Global/federal	Incentivize agriculture and food supply chain to increase supply and decrease cost of nutritious foods	Potential to increase consumption of vegetables and fruits and other healthy foods globally, but no current research evidence
	Ban *trans* fatty acids from the food supply	Reduces intake of *trans* fatty acids[9]
	Mandated national calorie menu labeling for chain restaurants	May reduce calories purchased or consumed, but data are mixed[10]
	Change WIC program to include additional healthy foods, including vegetables and fruits	Results in healthier food purchases and dietary intake by families using WIC[11–13]
	Implement nutrition standards for food and beverages in schools	Beneficially influences diet and weight[14,15]
	Provide SNAP incentives for vegetables/fruits and restrictions of sugary foods	May lead to healthier diets and reduced CVD[16–18]
	Restrict food and beverage marketing to youth	May reduce childhood obesity[19]
State and local	Tax SSBs (Berkeley, CA)	Decreases consumption of SSBs[17,20]
	Implement competitive school food policies	Reduces obesity/overweight and improves dietary intake among children[21,22]
	SNAP incentives for farmers' markets (eg, "Health Bucks" programs)	Increases access to and purchase of vegetables and fruits in low-income communities[23]
	Offer healthy foods and beverages on government property (eg, ban sales of SSBs)	City more likely to sell low-calorie beverages[24]

CVD indicates cardiovascular disease; SNAP, Supplemental Nutrition Assistance Program; SSBs, sugar-sweetened beverages; and WIC, Women, Infants, and Children.

INNOVATIVE POLICY APPROACHES TO CREATE A HEALTHY AND SUSTAINABLE FOOD SYSTEM

Table 1 highlights selected innovative food system policies that currently have documented evidence of favorable impact on dietary behaviors and, in some cases, health outcomes. For example, policies banning *trans* fatty acids from the food supply as well as national calorie menu labeling have recently been implemented with the goal of reducing the prevalence of cardiovascular disease and obesity.[9,10] Such policies could stimulate development of new food items containing fewer calories; food packaged or sold in smaller portion sizes; increases in vegetable and fruit consumption; and reductions in the consumption of sugar-sweetened beverages and other unhealthy foods and beverages.[11–24]

Table 2. Approaches by Food Suppliers/Producers/Distributors, Retailers, Restaurants, and Worksites to Create a Healthier Food System

Level of Action	Approach	Evidence for Effectiveness on Food Choice Behaviors and Health
Food suppliers, producers, and distributors	New product formulation (eg, reduction in amounts of *trans* fatty acids, sodium; food items with fewer calories; foods packaged into smaller portion sizes)	Reductions in caloric consumption[25]
Retailers (supermarkets, superstores, convenience stores)	Product placement (choice architecture)	Increases healthier food and beverage purchases[26]
	Pricing strategies to promote healthy foods and discourage unhealthy foods	Increases purchase and consumption of healthy foods (eg, vegetables/fruits) and reduces purchase and consumption of unhealthy foods (eg, SSBs)[27]
	Food and shelf labeling strategies	Small increases in healthier purchases[28,29]
	Online shopping strategies to promote healthier purchases	Potential to increase healthier food purchases, but research is limited[30]
Restaurants	Menu labeling	Increases healthier food choices[31]
	Restrictions on children's meals with toys	May reduce children's intake of calories, sodium, and fat[32,33]
	Healthy default choices (eg, no SSBs in children's meals, smaller portion sizes, whole grain rather than refined grains in breads/rolls)	Potential to reduce intake of calories and unhealthy nutrients, but no research has been published
Worksites	Cafeteria programs and healthy worksite food procurement	Increases healthier worksite food purchases[34–36]
	Worksite wellness programs with nutrition counseling	Improves diet and results in weight loss[37]

SSBs indicates sugar-sweetened beverages.

Although federal, state, and local policies restricting unhealthy fats, reducing purchases of sugar-sweetened beverages, and promoting consumption of vegetables and fruit are proven effective for changing dietary behaviors, documenting quantifiable effects on health outcomes of these policies remains a challenge.

INNOVATIVE APPROACHES FOR THE PRIVATE SECTOR THAT COULD PROMOTE HEALTHIER DIETARY INTAKE

Private sector approaches are voluntary but, when practiced widely, can favorably impact health behaviors and outcomes population wide (Table 2). Research is

needed, but formulation of new food products in alignment with the *Dietary Guidelines for Americans* could reduce population-wide calorie consumption.[25] In addition, retailers, restaurants, institutions, and worksites, by increasing healthy choices among consumers through marketing and nudging strategies, can systematically achieve healthier intakes.[26–37] Point-of-purchase interventions promoting healthier food choices in restaurants, supermarkets, worksites, and schools have produced changes in food selection behavior but no data on health outcomes. When modeled statistically, a reduction in cardiovascular disease can be expected as a result of vegetable/fruit incentives in the Supplemental Nutrition Assistance Program (SNAP) and taxes on sugar-sweetened beverages. A summary of food innovations by selected food companies is shown in Supplemental Table 2.

INNOVATIVE APPROACHES BY PUBLIC HEALTH AGENCIES, NATIONAL COALITIONS, AND HEALTH CARE

Public health and healthcare interventions have improved food choices among low-income and medically ill populations (Table 3). The Access to Nutrition Foundation has advocated for changes in food industry approaches by publishing a report ranking the 10 largest US food companies on their nutritional policies, practices, and products by evaluating 7 categories: governance, products, accessibility, marketing, lifestyles, labeling, and engagement.[38] Although it does not evaluate health outcomes, this report highlights food industry practices that could improve diet quality and reduce obesity worldwide. The international EAT-Lancet Commission recently published a report outlining an integrated food system framework that provides quantitative scientific targets for healthier diets and sustainable food production to improve human health worldwide.[39]

Table 3. Innovative Public Health and Healthcare Approaches to Create a Healthier Food System

Level of Action	Approach	Evidence for Effectiveness on Food Choice Behaviors and Health
International public health foundation	Access to Nutrition Foundation's Index: US Spotlight Index 2018[38]	Comprehensive rating/ranking of 10 large US food companies' corporate and product profiles for addressing obesity and diet-related diseases; no research examining diet or health outcomes
	EAT-Lancet Commission on healthier diets from sustainable food systems; international collaboration of 37 scientific experts[39]	
National and local coalitions	National Salt Reduction Initiative (national coalition of city/state health departments and organizations)	Modest progress for voluntary sodium reduction by food companies[40]; research is needed for health effects
	Community campaign to reduce SSBs	Reduces purchases of SSBs[41]
Health care	Medically tailored meals (eg, low sodium, diabetic diet)	Reduce emergency department visits and hospitalizations of Medicaid/Medicare participants[42]
	Limit options in hospital foods for patients, employees, and visitors to those consistent with the *Dietary Guidelines for Americans*	Strong evidence that hospitals' healthy beverage initiatives reduce purchase of SSBs by hospital employees and visitors[34,43]
	Nutrition prescriptions	Research evaluating outcomes is limited; small studies show increased vegetable/fruit consumption and awareness of diet-related messages[44–47]

SSBs indicates sugar-sweetened beverages.

INNOVATIVE COMMUNITY-, FAMILY-, AND INDIVIDUAL-BASED APPROACHES

Community-based approaches offer potential to improve healthier food selection, purchase, and consumption[48–55] (Table 4). For example, community organizations and school districts have implemented traffic light labels and choice architecture to increase healthy choices of food pantry customers and students. Some schools have tested the effectiveness of increasing water availability and have shown that students increase consumption of water at school.[50] There is growing interest in implementing and testing smart technologies, including nutrition and health applications (apps), wearable tracking and assessment devices, and gaming approaches, to improve healthy food choice behaviors among adults and children.

ACHIEVING A HEALTHY AND SUSTAINABLE FOOD SYSTEM WITH A MULTILEVEL INNOVATIVE APPROACH: THE EXAMPLE OF SODIUM

For 5 decades, Americans have consumed more than the recommended amount of dietary sodium,[56–58] despite recommendation reductions from authoritative

Table 4. Innovative Community-, Family-, and Individual-Based Approaches to Creating a Healthier Food System

Level of Action	Approach	Evidence for Effectiveness on Food Choice Behaviors and Health
Community and nonprofit organizations	Food pantry healthy food initiatives (eg, traffic light labeling)	Potential to increase healthy food purchases, but research is limited[48]
School districts	Chef-enhanced meals	Increases student consumption of healthier meals[49]
	Product placement in cafeterias	Increases student selection of healthier foods[50]
	Increasing water availability and convenience	Increases student consumption of water at school, but no evidence for decreased consumption of SSBs[51–53]
Individual/family	Mobile health apps to improve food selection	Some evidence for weight loss and improved dietary intake, but research is limited[54]
	Gaming to improve children's dietary intake	Behavior change strategies (eg, vegetable and fruit consumption) can be incorporated into a video game[55]; research is needed to determine whether behavior and health can be influenced

SSBs indicates sugar-sweetened beverages.

public health agencies.[59–61] Improving adherence requires innovations that effectively reduce the ubiquitous use of sodium in the food supply that is highly processed commercially. Innovative policy, private sector, public health, medical, community, and individual-level approaches are needed (Table 5).

Table 5. Multilevel Approaches to Innovations That Reduce Sodium Intake

Innovation	Description
Policy	FDA should modify the "generally regarded as safe" status of sodium[57]
Private sector	Potassium chloride substitution for sodium chloride[57] Technology to enhance taste with less sodium (eg, salt crystals,[62] spices and herbs[63])
Public health/ health care	Reduction of sodium in hospital and institutional foods[64] Raising physician awareness and counseling about the health risks of high sodium intake[65]
Community, family, individual	Campaigns to raise awareness of health consequences of excessive sodium intake[57] Sodium tracking apps[57]

FDA indicates US Food and Drug Administration.

GAPS IN KNOWLEDGE AND FUTURE DIRECTIONS

This science advisory from the American Heart Association describes innovative approaches needed to create a healthier and more sustainable food system and the existing evidence base for linking these approaches with positive changes anticipated in population-wide dietary behavior and health outcomes. Three key issues inform future directions:

- First, although some evidence suggests that recent innovations in the food system can change dietary behaviors, evidence directly linking innovations to health outcomes is lacking. It is well known that demonstrating improvement in health outcomes is challenging for innovative preventive programs, especially those involving diet. We advise that partnerships be created to generate sponsored research in this important area.
- Second, there are major gaps in the literature regarding the impact of previous innovations by the food industry and the agricultural industry on eating behavior and health. We advise the American Heart Association to partner with the food and agricultural industry to promote transparency and availability of data regarding food products and consumption patterns. This will increase important knowledge about the impact of product reformulation and marketing strategies on behavior and health.
- Lastly, innovation in creating a healthy and sustainable food system requires engaging stakeholders at every level of the food system. The American Heart Association is advised to partner with policy makers, the private sector, and community public health agencies to facilitate the integration of strategies that affect marketing and product development. This will accelerate progress toward a healthier and more sustainable food system that is expected to improve dietary intake and health outcomes of all people.

There is a need for immediate action to promote and fund innovative food systems approaches and their evaluation, especially given recent debates in highly respected research journals, by prominent scientists, about the promises and pitfalls of nutrition research.[66,67] Innovation throughout all levels of the food system is necessary to see improvements in the public's health.

ARTICLE INFORMATION

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

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Disclosures

Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

*Modest.

†Significant.

Reviewer Disclosures

Reviewer	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
Mary E. Camire	University of Maine	None	None	None	None	None	None	Institute of Food Technologists (scientific editor stipend)*
Brenda M. Davy	Virginia Polytechnic Institute and State University	NIH (CO-I on NIH R21)*	None	Academy of Nutrition and Dietetics (honorarium for research presentation for weight management practice group)*	None	None	None	California Walnut Commission (grant reviewer, summer 2018)*
Victor L. Fulgoni	Nutrition Impact, LLC	Numerous members of the food industry (as Senior Vice President of Nutrition Impact, we conduct data analyses for numerous members of the food/beverage/ dietary supplement industries)†	None	None	None	None	Several members of the food/ beverage industry†	None
Christopher Gardner	Stanford University	None	None	None	None	None	None	None
Maha Tahiri	Tufts University	None	None	None	None	General Mills†	ilSI*; IFIC*; EUFIC*	None

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*Modest.

†Significant.

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