

Perspective

Perspective: Challenges and Strategies to Reduce the Sodium Content of Foods by the Food Service Industry



Paula R. Trumbo^{1,*}, Katie M. Kirkpatrick², Jennifer Roberts³, Pam Smith⁴, Patricia Zecca⁵

¹ Paula R. Trumbo Consulting and Liberty University, Mount Pleasant, SC, United States; ² Henry M. Jackson Foundation for the Advancement of Military Medicine, Bethesda, MD, United States; ³ Compass Group North America, Severna Park, MD, United States; ⁴ Shaping America's Plate, Orlando, FL, United States; ⁵ Institute for the Advancement of Food and Nutrition Sciences, Washington, DC, United States

ABSTRACT

Most Americans have dietary sodium intakes that exceed the recommended limits, which is a risk factor for hypertension and CVD. The share of total food expenditures for foods prepared and consumed away from home (FAFH) is ~55%. These foods are consumed at various venues, including restaurants, workplaces, schools and universities, military installations, and assisted living/long-term care facilities. The food service industry has dealt with and continues to deal with various challenges in its attempt to reduce the sodium content in the foods that they prepare and sell. Despite these challenges, there have been various successful strategies used to reduce the sodium content in FAFH. This perspective article provides an overview of the challenges and strategies that have been used by the food service industry to reduce sodium in FAFH, as well as future sodium reduction strategies. Because of the widespread consumption of FAFH, implementing such future strategies could have a profound impact on the sodium content of the American diet.

Keywords: sodium, food service operators, foods away from home, restaurants, public health

Statement of Significance

New information is provided herein as it discusses the most current and collective perspectives of major food service operators in the successes and future strategies of reducing sodium in foods consumed away from home.

Introduction

Sodium is present in a variety of foods that are consumed as part of the American diet, most commonly consumed as salt, also called sodium chloride. Approximately 70% of the total sodium intake comes from sodium added to foods outside the home (for example, commercial food processing, restaurant food preparation) [1]. The remaining 30% comes from sodium naturally present in food, tap water, and dietary supplements and added during food preparation at home and at the table [1].

Approximately 40% of sodium consumed by Americans one year of age and older come from 10 food categories, including prepared foods with added sodium: deli meat sandwiches, pizza, burritos/tacos, soups, savory snacks (for example, chips, crackers, and popcorn), poultry, burgers, vegetables, eggs/o-melets, and pasta mixed dishes) [2].

There is well-established evidence for a positive relationship between sodium intake and increased blood pressure, and risk of hypertension and CVD [3]. Lowering blood pressure has been shown to reduce the incidences of heart attacks,

Abbreviations used: CDRR, chronic disease risk reduction; FAFH, foods away from home; GDSN, global data synchronization network; NHANES, National health and nutrition examination survey; FDA, US food and drug administration; CVD, cardiovascular disease; AHA, American heart association; USDA, US department of agriculture; ARA, Aramark.

* Corresponding author. *E-mail address:* paulatrumbo@yahoo.com (P.R. Trumbo).

<https://doi.org/10.1016/j.advnut.2023.04.013>

Received 17 January 2023; Received in revised form 7 March 2023; Accepted 28 April 2023; Available online 4 May 2023

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strokes, and heart failure [4,5]. The prevalence of hypertension among Americans aged ≥ 18 y is $\sim 45\%$ [6]. As many as 1 in 7 youth, aged 12–19 years, have had high blood pressure [7].

Most current data from the NHANES show that the average sodium intake, excluding sodium from discretionary salt, for Americans aged ≥ 18 y is ~ 3500 mg/d [8,9]. For children (aged 4–8 y), children (aged 9–13 y), and adolescents (aged 14–17 y), the median sodium intake is ~ 2500 mg/d, 2900 mg/d, and 3000 mg/d, respectively [10]. The National Academy of Medicine set a chronic disease risk reduction (CDRR) intake level for sodium at 2300 mg/d for individuals aged ≥ 14 y, 1800 mg/day for adolescents aged 9–13 y, and 1500 mg/d for those aged 4–8 y [11]. Based on most current estimated sodium intakes, $\sim 95\%$ of males aged ≥ 5 y exceed the CDRR, whereas, depending on age, 72%–84% of females exceed the CDRR [12]. Because the CDRR levels for sodium are the intake levels that should not be exceeded to help reduce risk of hypertension and CVD, sodium intake for all age groups need to be reduced.

Nations around the world have implemented sodium reduction initiatives, including food reformulation, consumer education, front-of-package labeling, taxation of foods high in salt, and those in targeted settings (for example, schools and workplaces) [13]. In 2021, the United States FDA published guidance for the industry on voluntary short-term (2.5 y) sodium reduction goals for commercially processed, packaged, and prepared foods [14]. As a first step, the FDA guidance aims to help Americans reduce average sodium intake to 3000 mg/d by encouraging food manufacturers and food service operations to gradually reduce sodium in foods over time. The guidance provides, for 163 categories of food, quantitative (mg/100g food) sodium baselines (for 2010) and goals for reductions in foods, expressed as a sales-weighted target mean and upper bound [15]. FDA plans to monitor the food supply and issue revised subsequent targets in the coming years to facilitate a gradual iterative process to reduce sodium intake.

In 2010, for the first time, the share of Americans' budget for foods that are prepared and consumed away from home (FAFH) surpassed the share for food prepared and consumed at home [16]. In 2017, food sales at restaurants, including full- and limited-service restaurants, accounted for 72% of FAFH expenditures (Figure 1). Although restaurants (also called commercial food service operators) are the largest provider of FAFH, different types of facilities where noncommercial food service operators prepare and provide food, include schools, workplace venues, military installations, sporting events, movie theaters, and hospitals. In 2021, 55% of total food expenditures comprised the FAFH [17].

Lowering the average daily intake of sodium in the US population to 2300 mg/d could prevent millions of cases of hypertension annually [18], as well as thousands of cases of CVD [19]. Because FAFH has become the predominant source of foods Americans consume, improvements in their nutritional quality can have a tremendous impact on the health status of Americans. This article presents perspectives on the unique challenges related to sodium reduction of foods by food service operators and past and future strategies to reduce sodium in FAFH.

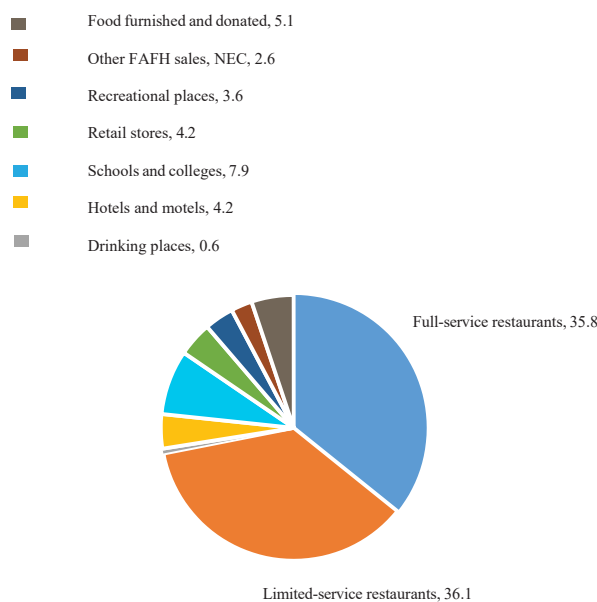


FIGURE. Food away from home expenditures, %. FAFH, food away from home; NEC, not elsewhere classified. US Department of Agriculture [16].

Challenges in Reduction of Sodium in FAFH Service Operators

A survey of 6122 US adults showed that 52% of Americans wanted to consume a low-sodium/salt meal when dining out; however, only 6% requested lower-sodium options [20]. The most common reason for this discrepancy is consumers generally view that low or reduced-sodium foods do not taste good, and they feel that dining out is a treat in which they should be able to indulge. Unpublished observations have shown that the most common reason (77%) that consumers pick a certain restaurant is because of the great taste of the food served; whereas only 29% of consumers choose a restaurant for health reasons (Data-sential, [Datassential.com](https://www.datassential.com), 2022). Food service operators usually do not call out “healthy” or “reduced sodium” options as these are ineffective marketing tools that have the opposite effect on purchase intent. Therefore, operators often reduce the sodium content in foods without consumer awareness. As such, food service operators work in an environment where there is a desire to prepare and provide low-sodium foods with minimal recognition. However, some consumers, especially those who are health-conscious, have a favorable perception of restaurants when they provide healthy options and nutritional information [21]. Depending on the food, a certain percentage of sodium reduction can go unnoticed, but too much of a reduction and the lack of or change in flavor can be noticeable. For example, a meta-analysis demonstrated that the salt content could be reduced by $\leq 40\%$ in bread products and 70% in processed meats without significantly affecting consumer acceptability [22]. Furthermore, salt plays varying roles in the preservation and structure of food products, and, therefore, manufacturers need to ensure that sodium reduction does not compromise the quality and safety of the food [23].

There are various sodium reduction strategies, including salt removal, salt replacers (for example, potassium chloride), and flavor modifications (for example, herbs and spices) [24]. Potassium chloride has been the most common mineral salt used to partially replace sodium chloride in salt substitutes. Potassium chloride salt substitutes have been shown to reduce blood pressure [25]. Risk of overconsumption of potassium is limited [26] and the symptom is hyperkalemia and associated adverse consequences, especially in individuals with kidney disease [25]. Potassium chloride can produce a metallic or bitter flavor, is more expensive than sodium chloride, and its use depends on the food matrix [27]. In studies conducted in various countries that have evaluated the taste perceptions of potassium-enriched salt substitutes, most subjects were unable to distinguish between sodium chloride and potassium salt substitutes that contain <30% potassium chloride [26]. This finding is also generally true when replacing sodium chloride with potassium chloride in meat, cheese, and bread [22]. To overcome the unwanted taste, potassium chloride has been combined with other ingredients, such as magnesium and calcium salts, and various flavors [28]. Therefore, food service operators have considered other ways, or a combination of approaches, to make a variety of lower-sodium foods taste good while maintaining the taste and price-point that consumers expect.

A food service operator, such as a restaurant chain, provides a relatively set menu, whereas food service operators in various noncommercial eating establishments (for example, hospitals, primary schools, colleges, nursing homes, and military venues) have many different menus to consider. These menu variations can be due to the nature of the venue (for example, location, size, staffing, and operational model) and the individuals served (for example, children or elderly hospital patients). Noncommercial facility owners' or managers' control over what foods can and cannot be offered can vary, depending on established nutrition guidelines. The Federal government [29] and many state and local governments, including K-12 schools, have established nutritional guidelines for their eating facilities that include sodium limits. As is the case for other countries, such as Canada and Australia [30], these limits can differ greatly across the state and local government jurisdictions, resulting in the development of multiple sets of menus and recipes for similar types of eating facilities.

The individual foods that are used to design a menu are not procured from the same manufacturer (for example, meat, buns, and beverages). Therefore, food service operators may need to identify multiple new manufacturers that produce a lower-sodium version of a food that the facility currently offers, or work with existing manufacturers to produce a lower-sodium version. Overcoming such barriers with suppliers has also been reported to be relevant in Australia [31]. Unpublished findings from a survey showed that only 26% of food service operators consider services provided by vendors, such as nutritional information, a most important consideration when selecting a vendor (Datassential, [Datassential.com](https://www.datassential.com), 2022).

Availability of low-sodium foods can be a challenge, especially at the volume needed by large food service operators. Bread and bread products are a popular FAFH, as it is consumed as part of menu items such as a hamburger, chicken sandwich, pizza, breakfast sandwich, and on their own (toast or roll). For example, a 59-g serving of a frozen pizza dough crust, the form

commonly used by food service operators, contains 320 mg sodium [32], which is 14% of the CDRR for sodium [11]. Meeting the FDA short-term upper bound target of 460 mg/100g (or 270 mg/59 g) [24], would reduce the sodium content of the frozen pizza dough crust by ~50 mg, or by 16%. A collection of research studies has shown that salt (that is, sodium) could be reduced by ≤40% in bread (baseline: 413–780 mg/100); mean 600 mg/100 g) without significantly impacting consumer acceptability [22, 24]. Thus, this realistic modification would make a significant impact on reducing sodium intake. Such information, along with food service operator requests for these products, can be presented to manufacturers to justify lowering sodium in bread products.

A food that is manufactured for retail (for example, frozen French fries) does not necessarily have identical nutritional content as the same food manufactured for a FAFH facility. The 2021 FDA guidance explains the data limitations to determine the baseline sodium content of foods in restaurants and did not have access to data representing the sodium content of foods sold at noncommercial eating establishments [33]. The USDA provides a database for the nutrient content of several hundred thousand branded retail foods [32] but for a very limited number of FAFH. Therefore, it can be challenging to know the nutritional content of the individual menu items that are sold in restaurants and noncommercial eating establishments.

Strategies for Reduction of Sodium in FAFH by Food Service Operators

There are various strategies for food service operators to produce and sell lower-sodium content foods and menu items. Some of these strategies are shown in [Table 1](#). Not all currently used recipes and menus need to be changed, and certainly not those foods, beverages, or menus that have been long-term favorites of customers. Recipe development needs to be considered, not only for what needs to be taken out (that is, sodium) but what needs to be added so that the food maintains appeal. Obviously, changing and creating new recipes require the participation and training of culinary teams to reduce salt use and develop foods and menus that are flavorful and acceptable to customers. In addition, food service operators can decrease sodium intake by reducing the portion size of high-sodium foods and increasing the portion size of foods that are low in sodium (for example, fruits, vegetables, and salads). Additionally, high-sodium entrees can be paired with low-sodium side dishes. Adding fresh fruits and vegetables to entrees or as side dishes is an increasingly popular way to reduce a menu's overall sodium content. In 2015, the AHA and Aramark introduced an innovative health impact model as part of a nationwide initiative to help millions lead healthier lives [34]. Aramark committed to achieving a 20% reduction in calories, saturated fat, and sodium, as well as a 20% increase in fruits, vegetables, and whole grains on its menus by 2020. The American Heart Association, Aramark chefs, and menu developers took a holistic approach, pursuing a variety of healthy menu impact strategies—designing new menus, creating new recipes, improving existing recipes, and sourcing ingredients. For example, the sodium content was reduced in marinara sauce, soups, and stews. As of 2020, there has been an overall

TABLE 1
Past and current sodium reduction strategies by food service operators

Work with existing manufacturers and/or identify new manufacturers that can provide low-sodium foods.
Identify the ingredients that can be used to replace or reduce sodium and for what foods.
Replace/modify existing and develop new recipes.
Balance menus to reduce the number of high-sodium foods and increase the number low-sodium foods.
Reduce portion sizes of higher sodium foods and increase the portion sizes of low-sodium foods.
Market lower-sodium foods to be more appealing to the customer.

19% reduction in the sodium content of the foods served. How foods are merchandized and displayed (also called choice architecture) can play a major role in promoting the selection of low-sodium foods, such as fruits and vegetables [35]. Examples of choice architecture strategies to optimize fruit and/or vegetable intake include offering first in serving line, placing in attractive containers, and displaying next to cash registers. Prominently displaying signages and images that promote fruits and vegetables can also be effective.

Using alternative ingredients to reduce the sodium content in foods

One food service operator strategy is to modify and develop recipes that use flavor enhancers to reduce or replace sodium in foods. Much research has been conducted on the testing of food ingredients to replace sodium [36]. An approach to a salt alternative is to modify the crystal structure of the salt molecule such that a larger and coarser salt crystal (for example, Kosher salt) provides a great salt flavor. Therefore, when adding salt by volume (for example, 1 teaspoon), less sodium is added compared with table salt. This way, less sodium is being consumed for the same amount of flavor.

A group of salt replacers known as flavor enhancers have become extremely useful in developing lower-sodium foods that are acceptable to consumers. Categories of flavor enhancers include umami ingredients, herbs and spices, glutamates, and amino acids/peptides [36]. Umami ingredients include seaweed, dairy, soy and yeast derivatives, odor-induced saltiness enhancements (for example, soy sauce), acidulants (for example, citric acid), and glutamate-rich ingredients, such as mushrooms. Flavor enhancers have been shown to feasibly reduce the sodium content in a wide variety of foods including breads, condiments, sauces, meats, savory snacks, and mixed dishes [36]. For example, when mushrooms replaced 80% of the beef in a taco blend, resulting in a 25% reduction in sodium, consumers could not detect a difference in flavor when compared with the original taco [37]. Such results have led to numerous food service companies providing beef-mushroom blended patties in K-12 school nutrition programs and other noncommercial facilities, as well as restaurants [38–40]. Table 2 [Unpublished information from Healthy Menus R&D Collaborative, 2022] shows how the replacement of salt with salt alternatives or flavor enhancers can reduce the sodium content in ½ cup of marinara sauce by 36% or more.

Educating culinary teams to prepare low-sodium foods

Recipe creation and menu development rely on the culinary team. Therefore, training and educating a food service culinary

TABLE 2
Alternatives to commercial salt

Sodium source mg sodium per ½ C tomato sauce
Commercial salt 470–520
Salt alternative
Kosher salt 249
Buffered potassium chloride 249
Flavor modification
Yeast extract 280
Mushroom powder blend 249
Ground mushrooms 257
Monosodium glutamate 298
Ponzu + pomegranate 298

Unpublished information from Healthy Menus R&D Collaborative, 2022.

team to develop low-sodium recipes to fit the food service operator's need can be a strategic way to produce reduced-sodium menus. In addition to training staff on how to produce lower-sodium recipes, it is important to teach the health benefits of doing so. Learning the preparation of flavorful, low-sodium recipes at culinary schools is a foundation for not only the graduates but to further teach culinary team members at a food service facility. Not all culinary schools may provide education on how to build flavor while using less salt, and not all chefs or lead cooks receive formal education at culinary schools.

Food service directors have used local area chefs to successfully train their staff to prepare low-sodium meals for meeting sodium targets already set into place for school meals [41]. Partnerships between culinary schools and food service operators have proven to be a successful strategy to reduce the sodium content in foods. In 2010, the Culinary Institute of America initiated the Healthy Menus R&D Collaborative to advance the development of healthy menus for food service operations, with sodium reduction being a top priority [42,43]. This cross-industry partnership includes a group of food service culinary experts, food scientists, nutritionists, and manufacturers/suppliers. The group has identified challenges and priority areas, gathered data and insights from experts, experimented in the Culinary Institute of America kitchens, and worked independently in their R&D facilities or with vendor partners and suppliers to create reduced-sodium foods and meals. One particular focus of this collaboration is the gradual lowering of sodium in foods through the flavor development of recipes, as discussed above. Within 4 y of this collaboration, sodium concentrations across all food and beverages on the menus of the US member companies decreased by 12%. Successful culinary staff training to reduce use of salt has also been demonstrated beyond the United States [44].

Marketing and merchandising to optimize appeal

What makes food appealing can depend on the venue and consumer. Altering the physical environment by optimizing the availability, placement, marketing, and promotion of nutrient-dense options could increase the purchase of low-sodium foods. Dine-in restaurants have multiple zones (for example, entry, order, and pay), and the amount and way consumers spend their time in a particular zone can affect where and how information can be communicated, indicating that different strategies should be used for different zones [45]. At a venue where time is a priority, such as lunchtime at a busy workplace,

modifications to place low-sodium foods at eye level or the beginning of a serving line can help increase purchasing. It has been reported that 48% of consumers replace meals with snacks ≥ 3 –4 times per wk, and on half of those occasions, health concerns influence consumers' decisions. Nutrient-rich, low-sodium snacks (for example, yogurt with granola, vegetables, and a low-sodium dip) can be displayed in convenient locations (for example, grab-and-go shelves, near the cash register) as mini-meals in various nonretails settings [46]. In an interview of several school food service directors, they identified a strategy to provide a limited number of pre-packed condiments rather than pump bottles in school cafeterias [41]. Some provide pump bottles with lower-sodium condiments, and even provide reduced-sodium spicy alternatives.

Because of the public's negative perception of low-sodium foods [47], marketing foods as "low" or "reduced sodium" in food service facilities is not a cost-effective strategy [48–50]. Instead, marketing strategies that target consumers' priorities and interests can be helpful. For example, and the use of positive identifiers, such as "wellness" logos, might be most successful in health-related food service venues such as hospitals or fitness centers. In a military dining facility program, foods and beverages are categorized based on their nutrient content as it relates to "performance" [51], connecting food selection to achieving success.

Expand nutrient composition databases for food service operators

Nutrition information on foods manufactured specifically for food service allows operators to make comparisons between the products, such as sodium content, for procurement decisions and to meet other nutrition standards or program criteria. Efforts are needed to expand or include food service nutrition information in databases, such as GS1 Global Data Synchronization Network (GDSN), to make such databases more complete. For settings where there are sodium limits, such as the USDA school meals programs [52], the database has been helpful to food service operators. Through the GS1 GDSN and USDA contractual agreements, manufacturers of USDA school meals are to provide nutrition and ingredient information, via GS1 GDSN, into the USDA foods database [53]. The USDA foods database helps inform ordering decisions of food service operators and manage menu planning, meet USDA meal pattern requirements, and comply with nutrition standards. Contractual agreements between food service operators and manufacturers, requiring that nutritional information of procured foods be submitted to GS1 GDSN, would be an effective way to increase access to the nutritional information.

Future Strategies

While maintaining the current strategies discussed above, there are several new strategies, including partnerships, that could help food service operators further reduce the sodium content of FAFH (Table 3). There is a need to develop a strategy to increase the percentage of foods service operators that consider nutritional information when selecting a vendor for making procurement decisions. Partnerships and collaborations

TABLE 3
Future sodium reduction strategies by foodservice operators

Through partnerships among food service operators,
• Increase the percentage of foods service operators that consider nutritional information when selecting vendors for making procurement decisions.
• Develop a mechanism to quantify food sales.
• Expand the inclusion of food service foods and their nutrition information in the GS1 GDSN.
• Identify those priority foods that are most likely to make the greatest impact in lowering sodium intake.
• Identify a sodium concentration for the priority food(s).
• Request suppliers to manufacture priority food(s) with an identified sodium concentration.

across the food service sector could prioritize a list of foods and ingredients across the food service sector that are highest in sodium, contribute to the greatest intake of sodium, and are most easily modified. This requires information about the sodium content of the various foods currently manufactured, and sales and consumption data. Although there is a need for a mechanism to better determine food sales data, expanding nutritional information would heavily rely on the GS1 GDSN database. As such, expansion of foods used by food service operators and their nutrition information in the GS1 GDSN should be considered. Partnerships to expand the nutrient content of retail foods currently exist [54] and could be used as a model for expanding the GS1 GDSN database. With the above information, then a sodium target level could be identified by the food service industry for the priority food(s). A consistent request to suppliers for a certain concentration of sodium for priority food(s) would increase demand and, in turn, availability.

In conclusion, food service providers experience constraints and real-world challenges that can make it difficult to reduce the sodium content of foods or offer lower-sodium alternatives. The objectives need to be aligned to improve population health with their need to maintain sales. Availability of ingredients, professional culinary training, consumer preference, taste, food safety, and overall concerns about costs are some important considerations when working with food service providers to reduce sodium. The food service industry has made progress in reducing the sodium content of the foods that they sell. However, there is still great room for improvement, and the provided strategies have the potential to make an impact on FAFH sodium content across food service venues and, therefore, on the American diet and cardiovascular disease risk.

Funding

This work was supported by the Institute for the Advancement of Food and Nutrition Sciences (IAFNS) Sodium Committee. IAFNS is a nonprofit science organization that pools funding from industry and advances science through the in-kind and financial contributions from private and public sector members. This perspective article, in part, includes information from a meeting, "Food Service Dialogue," organized by IAFNS and held on 25 October, 2022 in Washington, DC (<https://iafns.org/event/invitation-only-food-service-sector-sodium-dialogue/>). This dialogue

included presentations from the FDA and food service operators. PRT received travel funding to participate in the October 2022 IAFNS meeting and to prepare the manuscript.

Author disclosures

During the past 5 years, PRT has served as a consultant to General Mills, PepsiCo, Johnson & Johnson, Nestle USA, Ocean Spray, GlaxoSmithKline, Tate & Lyle, Ingredion, Bioneutra, Lantmännen, Hayashibara, Quebec Maple Syrup Producers, Colgate Palmolive, Constellation Brands, Kappa Biosciences, Bay State Milling, Intertek, The Protein Brewery, ILSI North America, GRAS Associates, and 8Greens. Additionally, she received speaker travel expenses from the Council for Responsible Nutrition. PZ previously worked for the Campbell Soup Company.

KMK, JR, and PS have no conflicts to declare.

The opinions and assertions expressed herein are those of KMK and do not reflect the official policy or position of the Uniformed Services University or the Department of Defense. The contents of this publication are the sole responsibility of the author(s) and do not necessarily reflect the views, opinions or policies of The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. Mention of trade names, commercial products, or organizations does not imply endorsement by the US Government.

Acknowledgment

The authors' responsibilities were as follows—PRT: was responsible for designing and writing the manuscript; KMK, JR, PS, and PZ: critically edited the manuscript; all authors: were responsible for the final content of the manuscript; and all authors: read and approved the final version of the manuscript. The authors acknowledge Amy Siverling MS RDN LDN of Aramark Corporation for her valuable contributions at the 25 October, 2022, Institute for the Advancement of Nutrition and Food Sciences' Dialogue.

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