

Development of the SoFAS (Solid Fats and Added Sugars) Concept: The 2010 Dietary Guidelines for Americans^{1–3}

Theresa A Nicklas^{4*} and Carol E O'Neil⁵

⁴USDA/Agricultural Research Service Children's Nutrition Research Center, Department of Pediatrics, Baylor College of Medicine, Houston, TX; and ⁵School of Nutrition and Food Sciences, Louisiana State University Agricultural Center, Baton Rouge, LA

ABSTRACT

The diets of most US children and adults are poor, as reflected by low diet quality scores, when compared with the recommendations of the Dietary Guidelines for Americans (DGAs). Contributing to these low scores is that most Americans overconsume solid fats, which may contain saturated fatty acids and added sugars; although alcohol consumption was generally modest, it provided few nutrients. Thus, the 2005 DGAs generated a new recommendation: to reduce intakes of solid fats, alcohol, and added sugars (SoFAAS). What precipitated the emergence of the new SoFAAS terminology was the concept of discretionary calories (a "calorie" is defined as the amount of energy needed to increase the temperature of 1 kg of water by 1°C), which were defined as calories consumed after an individual had met his or her recommended nutrient intakes while consuming fewer calories than the daily recommendation. A limitation with this concept was that additional amounts of nutrient-dense foods consumed beyond the recommended amount were also considered discretionary calories. The rationale for this was that if nutrient-dense foods were consumed beyond recommended amounts, after total energy intake was met then this constituted excess energy intake. In the 2010 DGAs, the terminology was changed to solid fats and added sugars (SoFAS); thus, alcohol was excluded because it made a minor contribution to overall intake and did not apply to children. The SoFAS terminology also negated nutrient-dense foods that were consumed in amounts above the recommendations for the specific food groups in the food patterns. The ambiguous SoFAS terminology was later changed to "empty calories" to reflect only those calories from solid fats and added sugars (and alcohol if consumed beyond moderate amounts). The purpose of this review is to provide an historical perspective on how the dietary recommendations went from SoFAAS to SoFAS and how discretionary calories went to empty calories between the 2005 and 2010 DGAs. This information will provide practitioners, as well as the public, with valuable information to better understand the evolution of SoFAS over time. *Adv Nutr* 2015;6:368S–375S.

Keywords: dietary guidelines, public policy, SoFAS, solid fats, added sugars, empty calories

Historical Perspective on Dietary Guidance

Dietary guidelines were issued in the United States as early as 1863. A monograph by Dr. John Ordronaux (1), "Hints on Health in the Armies: For the Use of Volunteer Officers," provided dietary guidelines for soldiers (**Table 1**). According

to Ordronaux (1), "it may be said that a weak soldier is no soldier, costing the state more to support him than his services are worth. It is far cheaper to feed him well in the field than to nurse him in the hospital." This basic premise has continued to be the foundation of dietary guidance for the past 100 y (2). In the 2010 Dietary Guidelines for Americans (DGAs)⁶ (3), a key message from the Secretaries of Agriculture and of Health and Human Services was the belief that Americans will live longer, healthier, and more active lives by following the recommendations in the DGAs. The focus of dietary guidelines has evolved over the years: from prevention of nutrient deficiencies to prevention of chronic disease (4). The research base underlying the dietary recommendations has resulted in subtle differences with regard to nutrient- and food-specific recommendations as the understanding of nutrition and health has evolved. However, according to Davis and Saltos (2), "In spite of these changes,

¹ Published in a supplement to *Advances in Nutrition*. Presented at the University of Massachusetts Roundtable on "Fats and Oils: Where Food Function Meets Health" held in Chicago, IL, 18–19 November 2013. The roundtable was sponsored by the University of Massachusetts and supported by an unrestricted grant from the Alliance for Potato Research and Education. The nonindustry roundtable speakers received travel funding and an honorarium for participation in the meeting and manuscript preparation. The views expressed are those of the authors.

² Partial support was received from the USDA/Agriculture Research Service through specific cooperative agreement 58-3092-5-001 and from the USDA Hatch Project LAB 94209.

³ Author disclosures: TA Nicklas and CE O'Neil, no conflicts of interest.

⁶ Abbreviations used: CNPP, Center for Nutrition Policy and Promotion; DGAs, Dietary Guidelines for Americans; DGAC, Dietary Guidelines Advisory Committee; HEI, Healthy Eating Index; SoFAAS, solid fats, alcohol, and added sugars; SoFAS, solid fats and added sugars.

* To whom correspondence should be addressed. E-mail: tnicklas@bcm.edu.

TABLE 1 Dietary guidelines for soldiers, 1863¹

| Guidelines |
|---|
| 1. Soldiers should be fed a mixed diet of animal and vegetable substances. |
| 2. A variety of foods are needed to avoid monotony and increase assimilation. |
| 3. A healthy diet must conform to the physiologic requirements of the season, with less animal fats in the summer diet and more starch, vegetables, and fruits. |
| 4. Fresh fruits are always preferable to dry or preserved ones. |
| 5. Farinaceous vegetables are more nourishing than roots and grasses. |
| 6. The best soldiers in the world are fed on dark-colored bread. |
| 7. The woody fiber of the vegetable provides bulk as well as nourishment. |
| 8. Each company should have at least one educated cook. |
| 9. Beans, unless thoroughly cooked, are only fit for horses; when half-cooked, they provoke indigestion and diarrhea. |
| 10. Ardent spirits are not necessary for health, and the soldier is better off without them. |
| 11. Soldiers must be well fed to bear the fatigues of marching, to encounter unaffected the changes of climate, and to develop a high muscular tone. |

¹ Adapted from reference 1.

many of today's dietary recommendations remain impressively similar to those of yesterday."

Detailed reviews of dietary recommendations and how they have changed over time (2, 5) and histories of food guides (6, 7), including the Food Guide Pyramid (6, 8, 9), in the United States have been published. Specific to the current report is the history of dietary recommendations and food guides specifically related to solid fats and added sugars.

Recommendations for intakes of fat, sugar, and alcohol began to emerge in 1894 after Wilbur O Atwater and Francis G Benedict (10, 11) published food composition tables and dietary standards for the US population. Atwater is credited with initiating the scientific base for connecting food composition, dietary intake, and health. In 1916, the first daily food guide appeared in a USDA publication (12), consisting of 5 food groups that included fats and fatty foods and sugars and sugary foods. Since then, the food guides changed from 5 food groups (12) to 12 food groups in 1933 (13), to the basic 7 food groups in 1942 (2, 6), and to the basic 4 food groups in 1956 (2, 6, 14). In 1977, the US Senate Select Committee on Nutrition and Human Needs took a new direction for dietary guidance (15). The focus shifted from prevention of nutrient deficiencies to obtaining adequate nutrients and avoiding excessive intakes of food components linked to chronic diseases. For the first time, the report included quantitative goals for intakes of FAs and sugars, which led to a new food guide, "The Hassle-Free Guide to a Better Diet" (16). This guide not only recommended minimum servings of foods from the basic 4 food groups to provide the foundation for a nutritionally adequate diet but also highlighted a fifth food group to illustrate moderate intake of fats, sweets, and alcoholic beverages. This new emphasis on the total diet resulted from scientific research suggesting that avoiding excess intake of some food components may help prevent disease (2, 6).

With the publication of the first edition of the DGAs in 1980 (17), it became clear that a new food guide would be needed to help consumers follow advice in the dietary guidelines. In the 1980s, the USDA began development of a graphic to illustrate the principles of the DGAs (9). The first edition of the DGAs continued to highlight "sparing use" of fats, oils, and sweets (18). Since 1980, the DGAs have been revised and issued every 5 y. From 1980 to 1995, there were few changes in the overall concepts of the DGAs, although there were subtle changes in the wording of the recommendations (2). For example, recommendations included avoiding too much sugar (1980) (17) or using sugars in moderation (1995) (19). The alcohol recommendation was to consume in moderation in all 4 editions. During that time, the recommendations focused on "avoiding" too much fat, SFAs, or cholesterol (1980) or "choosing" a diet low in total fat and SFAs (1995).

In 1992, the Food Guide Pyramid was released with the objective of helping Americans understand and follow the DGAs' recommendations. Designed after extensive market research and testing, a pyramid was found to be the best graphic to convey the key dietary concepts of variety, proportionality, and moderation (7, 9). The Food Guide Pyramid was divided into 6 horizontal sections containing pictures of foods from each food group. The apex of the pyramid showed fats, oils, and sweets, which were to be used sparingly. Symbols, representing fat (naturally occurring and added) and added sugars, that appeared not only at the tip of the pyramid but also within the 5 food groups showed that fat and added sugars could be found in each of the food groups. This time point was when the SoFAS story began, by reminding consumers to limit solid fats and added sugars (SoFAS) in their diet.

The 1992 Food Guide Pyramid was updated in 2005 (20); the new pyramid (MyPyramid) maintained the key dietary concepts of variety, proportionality, and moderation. Although the familiar pyramid shape was retained, the new icon included colorful vertical bands that replaced the horizontal presentation of food categories in the original Food Guide Pyramid. The vertical bands included not only the 5 food groups but added a new band for oils to emphasize the importance of including healthy oils in the diet. The proportionality of foods consumed was depicted by the different widths of the food group bands. Although the concept of proportionality was abstract in the MyPyramid icon, the actual portions of each food group were elaborated on the corresponding website. The concept of moderation in the MyPyramid graphic was illustrated in the narrowing of the food group bands from the bottom to the top of the MyPyramid. The wider base of MyPyramid represented foods with little or no solid fats or added sugars, emphasizing the importance of choosing the most nutrient-dense foods at the base of MyPyramid. A new feature of the MyPyramid icon was a figure climbing steps on the side of the MyPyramid to stress the importance of daily physical activity. This was the first time that physical activity, balanced with food intake, was addressed in the food guidance symbols. The interactive educational

activities were greatly expanded on the MyPyramid website. The activities included MyPyramid Plan, MyPyramid Tracker, and Inside MyPyramid. All of these activities provided individuals with their own personal pyramid eating and physical activity plan, diet quality assessment tools, detailed information about every food group, and a variety of tips and resources to help consumers move forward toward a healthier eating and physical activity lifestyle. Unfortunately, this effectively limited the “expanded” information about MyPyramid to those with Internet access.

A number of variations of the pyramid have been developed. The pyramid became the most widely distributed and best-recognized nutrition education tool developed in the United States. It was recognized by $\geq 67\%$ of American adults (21). Despite the increased recognition of the pyramid icon over time, consumers did not actually implement the dietary advice promulgated or use educational resources available on the USDA website. This was reflected in the fact that the majority of the US population did not meet the federal dietary recommendations (22), which was shown in low and stagnant diet quality scores (23). This led to a growing concern that Americans lacked the knowledge and skills (24) needed to implement the DGAs. Only recently were the barriers to and facilitators of consumer adherence to the DGAs assessed (25). Consumers’ misunderstanding of the meaning of nutrition advice (21) and how to overcome barriers to implementing the DGAs (25) prompted critics to challenge the effectiveness and conceptual framework of MyPyramid as a teaching tool. By 2010, it became clear that something needed to be done to bring dietary behavior in line with dietary guidance (26). In May 2010, the White House Childhood Obesity Task Force released a report that recommended the following: “The federal government, working with local communities, should disseminate information about the 2010 DGAs through simple, easily actionable messages for consumers, and a next generation food pyramid” (27). The USDA undertook consumer research to develop consumer nutrition messages and to test potential “next-generation” food icons (28). This included the following: interviews with federal nutrition education staff; analysis of media coverage of the 2005 DGAs; a review of 6 communication programs; a literature review analyzing 25 reports and articles on consumer food preferences, attitudes, and habits; consumer focus groups; and quantitative validation to test language in consumer messages and graphic images in support of the 2010 DGAs (28). Based on the 2010 DGAs (3) and the USDA Formative Research Project (28), the pyramid was replaced with MyPlate (29). MyPlate was a substantial departure from the Food Guide Pyramid and MyPyramid. Whereas MyPyramid was designed to communicate the DGAs and represent what and how much to eat over the day, the MyPlate icon “is a simple, yet powerful, visual cue to prompt consumers to think about their food choices across food groups and to build a healthy plate at meal times” (30).

The MyPlate icon is a circle divided into 4 slightly different-sized quadrants, with fruit and vegetables taking up half the area on the plate and grains and proteins making up the other half. The vegetables and grain portions were the largest of the 4 quadrants. At the side of the plate was a circular icon to emphasize the importance of consuming dairy. There was no longer any reference to sugars, fats, or oils, and the meat and beans food groups was replaced with proteins.

Along with the release of the 2010 DGAs and the MyPlate icon, the USDA formulated an aggressive communication initiative that included the MyPlate website with the Super Tracker Tool to personalize food plans, consumer educational materials and e-tools, social media engagement, and a partnership initiative (31) to help coordinate and disseminate consistent messages of the 2010 DGAs. In addition, a framework was developed for evaluating the DGAs communication initiative (32). On the basis of the 2010 DGAs policy document and USDA formative research, 7 key messages were identified as part of this communication initiative (29). The dietary guideline messages include the following:

- Enjoy your food, but eat less
- Avoid oversized portions
- Make half your plate fruit and vegetables
- Make at least half your grains whole grains
- Switch to fat-free or low-fat (1%) milk
- Compare sodium in foods like soup, bread, and frozen meals and choose the foods with lower numbers
- Drink water instead of sugary drinks

From Science to Guidance to Assessment

To understand how the SoFAS concept evolved over time, it is important to have an understanding of the process typically used to make dietary recommendations, translate those recommendations for the consumer (by using pictorial icons to illustrate the recommendations), and assess adherence to the dietary recommendations. It was not until the 2005 DGAs that the DRIs from the Institute of Medicine (33) were used as the foundation for establishing the science behind nutrition recommendations for Americans. Before 2005, the RDAs (34) were used. The DRIs were used as quantitative reference values for recommended intakes and safe upper limits of intake of nutrients. The DRIs, in addition to the evolving science base and the totality of the evidence of scientific findings, were used to guide the Dietary Guidelines Advisory Committee (DGAC) in determining emerging research questions that needed to be addressed. The intent of the DGAs was to summarize and synthesize knowledge about individual nutrients and foods into an interrelated set of dietary recommendations that could be adopted by the public. Once the DGAC report was finalized and released, the committee was disbanded without any opportunity to provide input on the implementation of the dietary recommendations. The translation of the dietary recommendations and consumer education materials became a major responsibility of the USDA. After the issuance of the DGAs, it was important to develop a system to assess adherence to the recommendations. The Healthy Eating

Index (HEI) was developed as a measure of diet quality in terms of conformance to the DGAs (35). It is important to acknowledge that with any translational process, from science to policy to assessment, there are limitations; namely, recommendations are lost, terminology changes, and reasons for the changes are not understood or documented in the scientific literature. Unfortunately, these limitations have created confusion and may in part be responsible for why few Americans meet the dietary recommendations (22).

The development of a food guidance system (36) was initiated after the release of “The Hassle-Free Guide to a Better Diet” (16). The food groups provided the starting point for the development of a food guidance system, which was illustrated by the Food Wheel (37), which showed a pattern for daily food choices. As a first step in developing the food guidance system, nutritional goals were established based on the first edition of the DGAs (38) and the 1980 RDA (34). The nutritional goals were to help individuals select diets that provided an appropriate amount of energy to maintain ideal body weight and to meet the RDA for all nutrients. The guidance system also included expected levels of food energy, total fat, FAs, cholesterol, sugar and caloric sweeteners, alcohol, and sodium.

This food-based dietary guidance was intended to be used in conjunction with a booklet entitled “The Food Guide Pyramid” (39). This booklet was developed to help educators adapt the pyramid to specific age groups. The booklet provided food intake patterns at 3 energy levels: 1600, 2200, and 2800 kcal/d. For each food intake pattern, nutrient profiles and numbers of servings (for each of the 5 food groups) were developed. In determining the nutrient profiles for the 5 food groups, only foods in their lowest-fat form and without added sugars were included. In developing the energy-based food patterns for the 5 food groups, the assumption was that no foods from the fats, oils, and sweets groups were selected. The intent was to show consumers how to meet nutrient needs while allowing them

maximum flexibility in choosing sources of fat and added sugars within the fat and energy limits of the food patterns. The difference between the energy levels and an individual’s energy needs was used to determine the amounts of fat and added sugars that could be added to the diet. Composites of added fats and added sugars were developed to demonstrate the effects of adding varying amounts of these items to the diet. Various numbers of teaspoons of added fats and added sugars were determined for the upper and lower range of servings suggested by the system. The amounts of fats and added sugars represented those that might be included in the diet when less-nutrient-dense selections were made from the major food groups. The development and evaluation of this food guidance system was published (36) and later revised to develop the Food Guide Pyramid (6) (Figure 1).

After 13 y, the 1992 Food Guide Pyramid was replaced with MyPyramid (Figure 1), a new symbol, and a new interactive food guidance system (40–42). Reasons for replacing the Food Guide Pyramid were to ensure that the new USDA food guidance system reflected the latest nutritional science and would hopefully increase its effectiveness in motivating consumers to apply its messages. The food patterns in the Food Guide Pyramid needed updating to reflect new data on the nutrient content of foods and food consumption patterns, the most recent nutrient standards published between 1997 and 2002 (specifically the Institute of Medicine’s DRIs), and the emerging science reported in the 2005 DGAC report (43). Although an update was needed, it is important to acknowledge that the Food Guide Pyramid and the DGAs were familiar to most Americans (24, 44, 45). In 2005–2006, 81% of US adults had heard of the Food Guide Pyramid, up from 33% in 1994, and 49% knew about the DGAs compared with 30% in 1994. Despite the progress the USDA has made in educating consumers on the DGAs and the accompanying education tool, the Food Guide Pyramid, few Americans actually followed the advice illustrated by the pyramid (22).

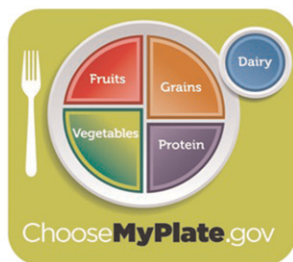


FIGURE 1 Visual aids for the Food Guide Pyramid, MyPyramid, and MyPlate.

The majority (>50%) of the population did not meet the recommended number of servings for all of the MyPyramid food groups, except for total grains and meats. This may in part have resulted from the low percentage of Americans having knowledge of the food guide recommendations, specifically the ability to identify food groups, the appropriate number of servings from the different food groups, and portion sizes (25, 44, 46).

MyPyramid was designed to communicate recommendations outlined in the 2005 DGAs. The intent was to replace the one-size-fits-all Food Guide Pyramid with a more personalized approach to healthful eating and physical activity. The MyPyramid symbol was designed to motivate consumers to use the website (www.mypyramid.gov) (20) to customize their diet and exercise program for a healthier lifestyle.

The USDA began a comprehensive reassessment in 2000 to “rebuild” the Food Guide Pyramid. This reassessment included a technical update based on the 2005 DGAC report (43). The revision included updating the daily food intake patterns in the Food Guide Pyramid (47) so that they met the current nutritional standards. The final food intake patterns provided the basis for the MyPyramid food guidance system. The system resulted in the identification of the amounts of food from the 5 basic food groups and oils that were needed to meet recommended nutrient intakes at 12 different energy levels, ranging from 1000 to 3200 kcal/d for specific groups on the basis of age, gender, and physical activity. The development of the new MyPyramid Food Guidance System was the topic of peer-reviewed articles (41, 42) and was available on www.mypyramid.gov (20). Consumer education was updated to include a new graphic to represent the food guidance system and individualized educational tools and focused on consumer messages. On the basis of consumer testing and comments from consumers (48), health professionals, and food industry representatives, the MyPyramid graphic and web-based interactive educational tools were revised and finalized.

The latest revision of the food guidance system was released based on the 2010 DGAC report (3, 49). The MyPyramid icon was replaced with MyPlate (Figure 1) as the current tool to translate guidance into strategies to improve food choices (29). The 2010 update of the USDA food patterns was conducted by using the same general procedure used in previous revisions (14, 47). The approach used to revise and evaluate the 2010 USDA food patterns, changes in the patterns from 2005, the rationale for changes in the food groups or amounts recommended, and a comparison of the patterns to their nutrition goals are discussed in detail elsewhere (50). Briefly, the 12 energy-level food patterns remained intact, yet the names of the basic 5 food groups changed and the number of and amounts for new subgroups changed. The food groups lean meat and beans and milk were renamed protein and dairy, respectively. The other-grains subgroup was changed to enriched grains, and the protein food group included 3 subgroups: seafood, meat/poultry/eggs, and nuts/seeds/soy products. The discretionary

calorie allowances were changed to maximum limits for SoFAS. On the basis of consumer research (28), an aggressive USDA communication and partnership initiative (31, 32) was conducted to develop and disseminate consistent messages of the 2010 DGAs. Since the release of the DGAs in 2010 and the MyPlate icon in 2011, there was considerable media coverage (12 newspaper, 14 television, and 2 magazine stories) that informed the public about the key elements of the 2010 DGAs and MyPlate (51).

What Happened between the 2005 and the 2010 DGAs?

The question remains how the dietary recommendations went from SoFAAS [solid fats (SoF), alcohol (A), added sugars (AS)] to SoFAS and from discretionary calories to empty calories. When and, more important, why these terminology changes were made continues to be a question asked by the scientific community—and one that potentially demonstrates why consumers may continue to be confused with dietary guidance (26) and fall short of the food group recommendations (52).

The 2005 DGAs

The USDA method of food pattern modeling is a well-documented approach for developing the food pattern (7). The method was intended to develop the food pattern that meets the DRIs and that was as realistic and practical as possible (53). The food intake pattern became the scientific basis for the Food Guide Pyramid. Since then, the USDA has slightly revised the food pattern to account for the evolving science base and updated dietary/nutrient recommendations. Major changes in the food patterns, based on the 2005 DGAs (18), included the following: 1) increasing the number of patterns with different energy levels from 3 to 12, 2) separating discretionary fats into solid fats and oils and soft margarines, 3) shifting the proportions recommended for solid fats and oils (i.e., 58% to 40% for solid fats and 42% to 60% for oils), and 4) introducing the concept of discretionary calories allowed in the 12 calorie-based food patterns. The discretionary calorie allowance was the “remaining amount of calories in each calorie level food pattern after nutrient-dense forms of foods in each food group was selected.”

The USDA food modeling method counted solid fats, alcohol, and added sugars as discretionary calories. A 355-mL soft drink = 150 discretionary calories; 237 mL 2% milk = 32 discretionary calories; and a 355-mL can of beer = 150 discretionary calories. The number of discretionary calories in the 12 food patterns ranged from 165 kcal/d (1000-kcal/d food pattern) to 648 kcal/d (3200-kcal/d food pattern). To increase the number of discretionary calories, individuals would need to increase their physical activity or consume nutrient-dense foods that were relatively low in energy density in a manner consistent with the food patterns recommended. A limitation with the discretionary calorie concept was that additional amounts of nutrient-dense foods beyond the

recommended amounts were also considered discretionary calories.

HEI-2005

The HEI is a tool developed by the USDA's Center for Nutrition Policy and Promotion (CNPP) to measure compliance with federal nutrition guidance. The original HEI (54, 55) was later revised to reflect the 2005 DGAs. Food and nutrient intakes on the HEI-2005 were expressed on a density basis (amounts per 1000 kcal) to characterize diet quality while controlling for diet quantity. The HEI-2005 consisted of 12 components: 5 components represented the major food groups found in MyPyramid and 7 additional components represented food subgroups and oils, SFAs, sodium, and energy from SoFAAS. For the first time, the CNPP developed a component in the HEI-2005 that specifically captured the calories from SoFAAS, which served as a proxy for discretionary calories in MyPyramid. An in-depth discussion of the development of the HEI-2005 scoring system has been published (56) and will not be discussed in this review. However, there was one major limitation of the HEI-2005 scoring system. Excess fat from meat, poultry, and milk products was counted as solid fat and contributed to both SFAs and energy from the SoFAAS components. It is unclear why excess fat from various food groups was counted twice in the HEI-2005 scoring system. This may explain, in part, why Americans' HEI-2005 score in 2003–2004 was 57.2 out of 100 (57), indicating that Americans' diets needed improvement.

The 2010 DGAs

The 2010 DGAs encompassed 2 overarching concepts: maintaining energy balance over time to achieve and sustain a healthy weight and focusing on consuming nutrient-dense foods and beverages. On the basis of published studies (58–60), Americans consumed too many calories from solid fats and added sugars. Thus, the 2010 DGAs recommended limiting intake of foods high in these nutrients because they replaced the consumption of nutrient-dense foods/beverages, making it difficult for individuals to achieve recommended nutrient intakes without exceeding overall energy needs. The SoFAS became the substitute for the discretionary calories that were included in the 2005 DGAs dietary patterns. SoFAS also replaced SoFAAS because alcohol was not included in the 2010 DGAs. It was determined that alcohol made a very minor contribution to overall energy intake in the diets of most Americans and did not apply to children (49). SoFAS contributed little or nothing to the overall nutrient adequacy of the diet but added from 500 to 1050 calories to total energy intake each day for many Americans (49). The USDA food patterns offered guidance on the maximum amount of SoFAS that could be accommodated within an individual's energy allotment only after nutrient requirements were met.

HEI-2010

The HEI-2005 was updated to the HEI-2010 after the issuance of the 2010 DGAs. The HEI-2010 retained several features of the HEI-2005, but some changes were made to capture the key recommendations of the 2010 DGAs (61). The development (61) and validation (62) of the HEI-2010 have been reported elsewhere. The HEI-2005 SoFAAS component was slightly modified and renamed "empty calories" because the CNPP felt that was a more concise term to convey the concept of SoFAS to consumers (63). A major distinction between the 2005 discretionary calories and the 2010 empty calories was that empty calories did not include additional amounts of nutrient-dense foods consumed beyond the recommended levels. Actually, consumers could potentially perceive empty calories as calories that do not count and that can be consumed in amounts that will not exceed one's energy requirements. In the HEI-2010, energy from alcohol was considered to be empty calories but only when consumed beyond moderate amounts (61). Another change specific to fat in HEI-2010, FAs, a ratio of PUFAs +MUFAs to SFAs, replaced oils and SFAs to emphasize the importance of replacing SFAs with a balance of MUFAs and PUFAs.

Potential Unintended Nutritional Consequences of the SoFAS Concept

One of the key 2010 DGAs messages is to reduce one's intake of added fats and added sugars. Although this may be one strategy for decreasing calories, it may also inadvertently decrease key micronutrients in the diet and further compromise overall dietary quality. A recent study that used national cross-sectional data examined the top food sources of energy, added sugars, and SFAs (many of which contain added fats) and their contribution to essential nutrients in the US diet (64). The authors found that the top 5 food sources contributed 83% to total added sugars intake, with minimal contribution to the intake of micronutrients and fiber from cakes/cookies/quick breads/pastries and fruit drinks/ades. However, the contribution of ready-to-eat cereals (3.9%) and yeast breads/rolls (2.1%) to total intake for added sugars was 6% but was a source of many micronutrients in the diet. Three of the top 10 sources of SFAs contributed 46% of the calcium, 50% of the vitamin D, 42% of the vitamin B-12, as well as other essential nutrients to the US diet.

Although it is possible that food sources with a high content of SoFAS may also contribute essential nutrients, more peer-reviewed studies are needed to confirm the findings from this single study before any inferences can be made on potential unintentional consequences of the SoFAS concept. On the basis of the current scientific evidence, the 2010 DGAs recommend reducing the consumption of solid fats (major sources of SFAs and *trans* FAs) and added sugars to allow for increased intake of more nutrient-dense foods without exceeding calorie needs, as well as to help reduce chronic disease risk (3). The 2010 DGAs place a major emphasis on the selection of nutrient-dense foods and has

awarded nutrient-dense status to all fruit, vegetables, lean meats, poultry without skin, beans, nonfat/low-fat milk products, and whole/enriched-grain products by fiat (3). This recommendation needs to be considered in our communication efforts to translate food guidance and key elements of the 2010 DGAs into strategies consumers can use to improve food choices. A major challenge will be defining the nutrient density of foods given the lack of a quantifiable definition of nutrient density and the many unresolved questions that revolve around this ambiguous term with an implied definition (65).

Acknowledgments

Both authors read and approved the final version of the manuscript.

References

1. Ordranax J. Hints on health in armies: for the use of volunteer officers. 2nd ed. New York: D Van Nostrand; 1863 [cited 2015 Feb 19]. Available from: <http://books.google.com/books?id=iJA-AAAIAAJ>.
2. Davis C, Saltos E. Dietary recommendations and how they have changed over time. In: Frazao E, editor. America's eating habits: changes and consequences. Washington (DC): USDA, Food and Rural Economics Division, Economic Research Service; 1999. Agriculture Information Bulletin No. 750.
3. USDA, Center for Nutrition Policy and Promotion. Dietary guidelines for Americans, 2010 [cited 2015 Feb 19]. Available from: <http://www.cnpp.usda.gov/publications/dietaryguidelines/2010/policydoc/policydoc.pdf>.
4. Nestle M, Porter DV. Evolution of federal dietary guidance policy: from food adequacy to chronic disease prevention. *Caduceus* 1990; 6:43–67.
5. Watts ML, Hager M, Toner C, Weber J. The art of translating nutritional science into dietary guidance: history and evolution of the Dietary Guidelines for Americans. *Nutr Rev* 2011;69:404–12.
6. Welsh S, Davis C, Shaw A. A brief history of food guides in the United States. *Nutr Today* 1992;27:6–11.
7. Welsh S, Davis C, Shaw A. USDA's Food Guide: background and development. USDA, Human Nutrition Information Service; 1993. Miscellaneous Publication 1514 [cited 2015 Feb 19]. Available from: <https://archive.org/details/usdasfoodguideba1514wels>.
8. Davis CA, Britten P, Myers EF. Past, present, and future of the Food Guide Pyramid. *J Am Diet Assoc* 2001;101:881–5.
9. Nestle M. In defense of the USDA Food Guide Pyramid. *Nutr Today* 1998;33:189–97.
10. Atwater WO. Methods and results of investigations on the chemistry and economy of food. Washington (DC): US Government Printing Office; 1985. Bulletin No. 21 [cited 2015 Feb 19]. Available from: <https://archive.org/details/methodsresultsof00atwarich>.
11. Atwater WO, Benedict FG. Memoirs of the National Academy of Sciences: an experimental inquiry regarding the nutritive value of alcohol. Washington (DC): US Government Printing Office; 1902 [cited 2015 Feb 19]. Available from: <http://dx.doi.org/10.5962/bhl.title.44658>.
12. Hunt CL. Food for young children. USDA; 1916. Farmers' Bulletin No. 717 [cited 2015 Feb 19]. Available from: <http://www.sirc.org/timeline/1916.shtml>.
13. Stiebling HK, Ward MM. Diets at four levels of nutritive content and cost. Washington (DC): USDA; 1933. Circular 296 [cited 2015 Feb 19]. Available from: <https://archive.org/details/dietsatfourlevel296stie>.
14. USDA, Agricultural Research Service, Consumer and Economics Research Division. Food for fitness—a daily food guide. Washington (DC): US Government Printing Office; 1958. Leaflet No. 424 [cited 2015 Feb 19]. Available from: https://archive.org/details/foodforfitnessda424unit_3.
15. Dietary goals for the United States, 95th Congress, 1st session. Prepared by the Staff of the Selected Committee on Nutrition and Human Needs, US Senate. Washington (DC): US Government Printing Office; 1977 [cited 2015 Feb 19]. Available from: http://www.google.com/url?sa=t&rc=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0CEQQFjAD&url=http%3A%2F%2Fzerodisease.com%2Farchive%2FDietary_Goals_For_The_United_States.pdf&ei=Jg4jU5yRAYiA2gWU7IHACA&usg=AFQjCNGGmZckihXuqRUS9KGxbTZ_lt6NPA&sig2=-wXdlcmOCvXIX2TWVwjNFw.
16. USDA; Science and Education Administration. Hassle-free guide to a better diet. Washington (DC): US Government Printing Office; 1980. Leaflet No. 567 [cited 2015 Feb 19]. Available from: <http://www.vmps.us/node/350>.
17. USDA, Center for Nutrition Policy and Promotion. Nutrition and your health: Dietary Guidelines for Americans. 1980 [cited 2015 Feb 19]. Available from: <http://www.health.gov/dietaryguidelines/history.htm>.
18. US Department of Health and Human Services; USDA. Dietary guidelines for Americans, 2005. Washington (DC); USDA; US Department of Health and Human Services; 2005 [cited 2015 Feb 19]. Available from: <http://www.health.gov/dietaryguidelines/dga2005/>.
19. USDA, Center for Nutrition Policy and Promotion. 1995 guidelines, 2013 [cited 2015 Feb 19]. Available from: <http://www.health.gov/dietaryguidelines/history.htm>.
20. USDA. Choose MyPlate.gov. Archived MyPyramid material [cited 2015 Feb 19]. Available from: <http://www.choosemyplate.gov/health-nutrition-information-educators/mypyramid-archived-information-educators.html>.
21. American Dietetic Association. Nutrition trends survey. Chicago: American Dietetic Association; 1997 [cited 2015 Feb 19]. Available from: http://books.google.com/books/about/The_American_Dietetic_Association_Nutrit.html?id=PkB7HAAACAAJ.
22. Krebs-Smith SM, Guenther PM, Subar AF, Kirkpatrick SI, Dodd KW. Americans do not meet federal dietary recommendations. *J Nutr* 2010;140:1832–8.
23. Krebs-Smith SM, Reedy J, Bosire C. Healthfulness of the U.S. food supply: little improvement despite decades of dietary guidance. *Am J Prev Med* 2010;38:472–7.
24. Guthrie JF, Derby BM, Levy AS. What people know and do not know about nutrition. In: Frazao E, editor. America's eating habits: changes and consequences. Washington (DC): USDA, Food and Rural Economics Division, Economic Research Service; 1999. p. 243–80. Agriculture Information Bulletin No. 750.
25. Nicklas TA, Jahns L, Bogle M, Chester D, Giovanni M, Klurfeld D, Laugero K, Liu Y, Lopez S, Tucker K. Barriers and facilitators for consumer adherence to the Dietary Guidelines for Americans: the HEALTH Study. *J Acad Nutr Diet* 2013;113:1317–31.
26. Rowe S, Alexander N, Almeida NG, Black R, Burns R, Bush L, Crawford P, Keim N, Kris-Etherton P, Weaver C. Translating the Dietary Guidelines for Americans 2010 to bring about real behavior change. *J Am Diet Assoc* 2011;111:28–39.
27. White House Task Force on Childhood Obesity. Let's move! Solving the problem of childhood obesity within a generation. White House Task Force on Childhood Obesity Report to the President. 2010 [cited 2015 Feb 19]. Available from: http://www.letsmove.gov/sites/letsmove.gov/files/TaskForce_on_Childhood_Obesity_May2010_FullReport.pdf.
28. USDA, Center for Nutrition Policy and Promotion. Development of 2010 Dietary Guidelines for Americans (2011). Consumer messages and new food icon. Executive summary of formative research [cited 2015 Feb 19]. Available from: <http://www.choosemyplate.gov/food-groups/downloads/MyPlate/ExecutiveSummaryOfFormativeResearch.pdf>.
29. USDA; Human Nutrition Information Service. Choose MyPlate.gov. Getting started with MyPlate [cited 2015 Feb 19]. Available from: <http://www.choosemyplate.gov/downloads/GettingStartedWithMyPlate.pdf>.
30. Post R. New approach to dietary guidelines communications: make MyPlate, your plate. *Childhood Obesity* 2011;7:349–51.

31. USDA; Human Nutrition Information Service. Choose MyPlate.gov. Partnering programs [cited 2015 Feb 19]. Available from: <http://www.choosemyplate.gov/partnering-program.html>.
32. Levine E, Abbatangelo-Gray J, Mobley AR, McLaughlin GR, Herzog J. Evaluating MyPlate: an expanded framework using traditional and nontraditional metrics for assessing health communication campaigns. *J Nutr Educ Behav* 2012;44:S2–12.
33. USDA; National Agricultural Library. DRI reports [cited 2015 Feb 19]. Available from: <https://fnic.nal.usda.gov/dietary-guidance/dietary-reference-intakes/dri-reports>.
34. Subcommittee on the Tenth Edition of the RDAs. Recommended Dietary Allowances. 10th ed. Washington (DC): National Academy of Sciences; 1989 [cited 2015 Feb 19]. Available from: <http://www.nap.edu/openbook.php?isbn=0309046335>.
35. USDA, Center for Nutrition Policy and Promotion. Healthy Eating Index [cited 2015 Feb 19]. Available from: <http://www.cnpp.usda.gov/HealthyEatingIndex.htm>.
36. Cronin FJ, Shaw AM, Krebs-Smith SM, Marsland P, Light L. developing a food guidance system to implement the Dietary Guidelines. *J Nutr Educ* 1987;19:281–302.
37. American Red Cross. Better eating for better health: instructor's guide and participant's packet. Washington (DC): American National Red Cross; 1984 [cited 2015 Feb 19]. Available from: http://books.google.com/books/about/Better_Eating_for_Better_Health.html?id=eMyOtgAACAAJ.
38. USDA; US Department of Health and Human Services. Nutrition and your health: Dietary Guidelines for Americans. Washington (DC): US Government Printing Office; 2000. Home and Garden Bulletin No. 232 [cited 2015 Feb 19]. Available from: <http://agnic.msu.edu/hgpubs/modus/00000232.htm>.
39. USDA; US Department of Health and Human Services. The Food Guide Pyramid. Washington (DC): Government Printing Office; 1996. Home and Garden Bulletin No. 252 [cited 2015 Feb 19]. Available from: <http://fnic.nal.usda.gov/dietary-guidance/myplate-and-historical-food-pyramid-resources/past-food-pyramid-materials>.
40. Yamini S, Juan W, Marcoc K, Britten P. Impact of using updated food consumption and composition data on selected MyPyramid food group nutrient profiles. *J Nutr Educ Behav* 2006;38:S136–42.
41. Britten P, Lyon J, Weaver CM, Kris-Etherton PM, Nicklas TA, Weber JA, Davis CA. MyPyramid food intake pattern modeling for the Dietary Guidelines Advisory Committee. *J Nutr Educ Behav* 2006;38(6 Suppl):S143–52.
42. Marcoc K, Juan W, Yamini S, Carlson A, Britten P. Development of food group composites and nutrient profiles for the MyPyramid Food Guidance System. *J Nutr Educ Behav* 2006;38(6 Suppl):S93–107.
43. US Department of Health and Human Services. Dietary guidelines for Americans: the report of the Dietary Guidelines Advisory Committee on Dietary Guidelines for Americans, 2005 [cited 2015 Feb 19]. Available from: <http://www.health.gov/dietaryguidelines/dga2005/report>.
44. Reeves-Tuttle C. Consumer understanding of the food guide pyramid and dietary guidelines. *J Ext* 2001;39.
45. Wright JD, Wang CY. Awareness of federal dietary guidance in persons aged 16 years and older: results from the National Health and Nutrition Examination Survey 2005–2006. *J Am Diet Assoc* 2011;111:295–300.
46. International Food Information Council Foundation. Food and Health Survey: consumer attitudes toward food, nutrition, and health. 2006 [cited 2015 Feb 19]. Available from: <http://www.foodinsight.org/Content/3651/2006foodandhealthsurvey.pdf>.
47. Britten P, Marcoc K, Yamini S, Davis C. Development of food intake patterns for the MyPyramid Food Guidance System. *J Nutr Educ Behav* 2006; 38(6 Suppl):S78–92.
48. USDA, Center for Nutrition Policy and Promotion. Research summary report for MyPyramid Food Guidance System development. 2005 [cited 2015 Feb 19]. Available from: http://www.cnpp.usda.gov/sites/default/files/myplate_miplate/ResearchSummaryReport.pdf.
49. USDA, Center for Nutrition Policy and Promotion. Dietary guidelines for Americans: report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010 [cited 2015 Feb 19]. Available from: <http://www.cnpp.usda.gov/DGAs2010-DGACReport.htm>.
50. Britten P, Cleveland LE, Koegel KL, Kuczynski KJ, Nickols-Richardson SM. Updated US Department of Agriculture food patterns meet goals of the 2010 Dietary Guidelines. *J Acad Nutr Diet* 2012;112:1648–55.
51. Epstein SB, Jean-Pierre K, Lynn S, Kant AK. Media coverage and awareness of the 2010 Dietary Guidelines for Americans and MyPlate. *Am J Health Promot* 2013;28:e30–9.
52. USDA, Economic Research Service. U.S. diets are out of balance with MyPlate recommendations. 2011 [cited 2015 Feb 19]. Available from: <http://www.ers.usda.gov/data-products/chart-gallery/detail.aspx?chartId=41060#Ux3zSYWGdGM>.
53. Food labeling; trans fatty acids in nutrition labeling; consumer research to consider nutrient content and health claims and possible footnote or disclosure statements; final rule and proposed rule. *Federal Register* 2003;68(133):4143341506. Available from: <https://www.federalregister.gov/articles/1999/11/17/99-29537/food-labeling-trans-fatty-acids-in-nutrition-labeling-nutrient-content-claims-and-health-claims>.
54. Kennedy ET, Ohls J, Carlson S, Fleming K. The Healthy Eating Index: design and applications. *J Am Diet Assoc* 1995;95:1103–8.
55. Bowman SA, Lino M, Gerrior SA, Basiotis PP. The Healthy Eating Index: 1994–96. Washington (DC): USDA, Center for Nutrition Policy and Promotion; 1998.
56. Guenther PM, Reedy J, Krebs-Smith SM, Reeve BB, Basiotis PP. Development and evaluation of the Healthy Eating Index-2005: technical report. Washington (DC): USDA, Center for Nutrition Policy and Promotion; 2007.
57. Ervin RB. Healthy Eating Index–2005 total and component scores for adults aged 20 and over: National Health and Nutrition Examination Survey, 2003–2004. *Natl Health Stat Report* 2011;44:1–9.
58. Reedy J, Krebs-Smith SM. Dietary sources of energy, solid fats, and added sugars among children and adolescents in the United States. *J Am Diet Assoc* 2010;110:1477–84.
59. Marriott BP, Olsho L, Hadden L, Connor P. Intake of added sugars and selected nutrients in the United States, National Health and Nutrition Examination Survey (NHANES) 2003–2006. *Crit Rev Food Sci Nutr* 2010;50:228–58.
60. Bachman JL, Reedy J, Subar AF, Krebs-Smith SM. Sources of food group intakes among the US population, 2001–2002. *J Am Diet Assoc* 2008;108:804–14.
61. Guenther PM, Casavale K, Reedy J, Kirkpatrick S, Hiza H, Kuczynski K, Kahle L, Krebs-Smith S. Update of the Healthy Eating Index: HEI-2010. *J Acad Nutr Diet* 2013;113:569–80.
62. Guenther PM, Kirkpatrick SJ, Reedy J, Krebs-Smith SM, Buckman DW, Dodd KW, Casavale KO, Carroll RJ. The Healthy Eating Index-2010 is a valid and reliable measure of diet quality according to the 2010 Dietary Guidelines for Americans. *J Nutr* 2014;144:399–407.
63. USDA. Choose MyPlate.gov. What are empty calories? [cited 2015 Feb 19]. Available from: <http://www.choosemyplate.gov/weight-management-calories/calories/empty-calories.html>.
64. Huth PJ, Fulgoni V III, Keast D, Park K, Auestad N. Major food sources of calories, added sugars, and saturated fat and their contribution to essential nutrient intakes in the U.S. diet: data from the National Health and Nutrition Examination Survey (2003–2006). *Nutr J* 2013;12:116.
65. Fulgoni VL III, Keast DR, Bailey RL, Dwyer J. Food fortificants, and supplements: where do Americans get their nutrients? *J Nutr* 2011; 141:1847–54.