

Comparing the Recommended Eating Patterns of the EAT-Lancet Commission and Dietary Guidelines for Americans: Implications for Sustainable Nutrition

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ABSTRACT

The purpose of this research was to compare the global reference diet from the EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems (EAT-Lancet) with the healthy eating patterns from the 2015–2020 Dietary Guidelines for Americans (DGA). Conversion factors were developed to quantitatively compare the patterns. These factors are provided to enable investigators to incorporate the EAT-Lancet diet into analyses while maintaining relevance to US-based dietary guidance. Our findings show several areas of agreement between EAT-Lancet and the DGA but key differences in the amounts of whole grains, fruit, starchy vegetables, red meat, nuts and seeds, and discretionary calories. Many of the differences between the patterns reflect divergent approaches to developing dietary recommendations, not only methodologically but also regarding whether current food consumption patterns are considered as constraints on recommendations. Continued interdisciplinary collaboration is needed to advance dietary guidance that promotes sustainable nutrition. *Curr Dev Nutr* 2020;4:nzaa015.

Keywords: dietary guidelines, food systems, nutrition policy, sustainability, diet, environment, health

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Manuscript received October 30, 2019. Initial review completed January 9, 2020. Revision accepted January 30, 2020. Published online February 4, 2020.

The authors reported no funding received for this study.

Author disclosures: NTB and ZC, no conflicts of interest.

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Abbreviations used: DGA, Dietary Guidelines for Americans; FICRCD, Food Intakes Converted to Retail Commodities Database; FNDDS, Food and Nutrient Database for Dietary Studies; FPED, Food Patterns Equivalents Database; EAT-Lancet, EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems; HUS, Healthy US-Style Pattern of the 2015–2020 Dietary Guidelines for Americans; MED, Healthy Mediterranean-Style Pattern of the 2015–2020 Dietary Guidelines for Americans; VEG, Healthy Vegetarian Pattern of the 2015–2020 Dietary Guidelines for Americans.

Introduction

The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems (EAT-Lancet) recently published a new global reference diet (1). This eating pattern was developed to promote human health while staying within the ecological carrying capacity of the planet. Analyses demonstrated that widespread adoption of this eating pattern, in addition to curbing global food waste and improving the resource-use efficiency of agriculture, could put the food system on a sustainable trajectory by 2050 (1–3). An open question is how the EAT-Lancet pattern diverges from existing dietary guidance, since most food-based dietary guidelines have been developed without reference to environmental sustainability (4). This question is particularly salient in the USA, where recent attempts have been made, unsuccessfully, to include sustainability in the Dietary Guidelines for Americans (DGA) (5, 6). Importantly, recent research has demonstrated that the patterns currently recommended by the DGA vary considerably in their potential environmental impacts (7, 8).

Comparing the EAT-Lancet pattern and DGA patterns is not straightforward, however. The EAT-Lancet pattern includes some

different food subgroups than the DGA; but more challenging is that recommended intake amounts for each food subgroup in the EAT-Lancet pattern and DGA patterns were determined using different methods. Specific amounts of each food group in the EAT-Lancet pattern were based on expert interpretation and judgement of available data collected from a wide range of international studies, and appropriately wide ranges were suggested. The DGA patterns were derived through established modeling procedures that optimized nutrient adequacy from a balanced combination of foods within each food subgroup (5). As a result, the units for the EAT-Lancet pattern are mass-based (grams), whereas the DGA patterns are servings-based (food pattern equivalents). In most cases, EAT-Lancet does not indicate how the mass-based recommendations correspond to servings. For the subgroups where EAT-Lancet does mention a correspondence to servings (dairy, fruit, and nonstarchy vegetables), an additional issue emerges; the correspondences are approximate and do not necessarily match how the DGA operationalizes servings.

Given the aforementioned differences, the objectives of this research were to: 1) develop conversion factors that enable a quantitative comparison between the EAT-Lancet and DGA patterns, and 2) compare

the EAT-Lancet and DGA patterns, highlighting points of alignment and divergence. This comparison is needed so that investigators can incorporate the EAT-Lancet diet pattern into their analyses while maintaining relevance to US-based dietary guidance.

Methods

Four recommended eating patterns were assessed at the 2500 kcal/d level: the Healthy Reference Diet from the EAT-Lancet Commission on Sustainable Food Systems, and the Healthy US-Style (HUS), Healthy Vegetarian (VEG), and Healthy Mediterranean-Style (MED) patterns from the 2015–2020 DGA (1, 9). For the DGA patterns, 2500 kcal/d patterns were derived by taking an average of recommendations at the 2400 and 2600 kcal/d levels.

The EAT-Lancet pattern and DGA patterns are different in 4 key aspects: the types of food subgroups included, the units of measurement (grams versus serving-equivalents), whether the recommended amounts of grains and beans and peas are based on dry versus as-consumed weights, and whether ranges are provided. Several data sets were used to develop a direct comparison between these eating patterns. We briefly describe these data sets here, with their uses described later in this section. The Technical Tables for the 2015 USDA Food Patterns include data on the representative foods (types and proportions) and nutrient composition of the HUS, MED, and VEG food patterns (10). The representative foods were ascertained from the Food and Nutrient Database for Dietary Studies (FNDDS) (11). FNDDS provides gram weights and nutrient composition of all foods included in the national nutrition monitoring survey of the USA. The Food Patterns Equivalents Database (FPED) converts the gram weights of FNDDS foods to food pattern equivalents (or serving-equivalents) (12). Finally, the Food Intakes Converted to Retail Commodities Database (FICRCD) converts FNDDS foods, which are on an as-consumed basis, to an as-purchased or retail commodity basis (13).

DGA food groups (e.g. protein foods) were disaggregated into individual subgroups (e.g. seafood, red meat, poultry, eggs, nuts, seeds, and soy products) using the Technical Tables for the 2015 USDA Food Patterns (7, 10). Correspondences were developed between the EAT-Lancet and DGA subgroups. In cases where direct mapping was not possible, the following correspondences were made: “beef and lamb” and “pork” from EAT-Lancet were mapped to “red meat” in the DGA; “tree nuts” and “peanuts” from EAT-Lancet were mapped to “nuts and seeds” in the DGA; and “palm oil”, “lard or tallow”, and “added sugars” from EAT-Lancet were mapped to “discretionary calories” in the DGA. To provide a direct comparison to the EAT-Lancet pattern, beans and peas were reclassified as protein foods in the DGA patterns.

To address differences in units, conversion factors (grams per food pattern equivalent) for the DGA food groups and subgroups were developed using the procedures below (Table 1). First, the FNDDS foods ($n = 321$) that comprise the DGA patterns were mapped to the patterns at the 2500 kcal level, using the Technical Tables for the 2015 USDA Food Patterns (10) and lists of corresponding FNDDS food codes (TR Pannucci, Center for Nutrition Policy and Promotion, personal communication, 2017). FPED was then used to calculate the gram weights of each FNDDS food in the patterns (12). Finally, the

TABLE 1 Conversion factors to translate Dietary Guidelines for Americans patterns to grams

Food group or subgroup	Conversion factor
	Grams/food pattern equivalent
Fruit	182
Vegetables	
Dark green	118
Red and orange	144
Beans and peas ¹	175
Starchy	134
Other	140
Grains	
Whole	51
Refined	36
Protein foods	
Red meat	31
Poultry	29
Eggs	50
Seafood/fish	29
Nuts and seeds	15
Soy	24
Beans and peas ¹	44
Dairy	149
Oils	1
Discretionary calories ²	na

¹Beans and peas are included as a vegetable subgroup in all of the eating patterns for the DGA; beans are also listed as a protein subgroup in the Healthy Vegetarian pattern.

²No conversion factor required because units provided in DGA (kcal) match EAT-Lancet; “na” means not applicable. DGA, Dietary Guidelines for Americans; EAT-Lancet, EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems.

food weights were summed to derive food subgroup weights and divided by the number of food pattern equivalents to create conversion factors. The conversion factors were multiplied by each of the DGA food groups and subgroups to derive the DGA patterns in gram amounts.

Dry weights of beans and peas in the EAT-Lancet pattern were converted to as-consumed amounts using conversion factors from the Food Intakes Converted to Retail Commodities Database (FICRCD) (13). Converting dry weights of whole grains to as-consumed amounts required a different process, because FICRCD did not include conversions to dry grains for some foods and also due to the extreme variability in as-consumed weights of grains (e.g. bread versus oatmeal). Using FPED, the weights of as-consumed food pattern equivalents were combined with the weights of grain per food pattern equivalent to develop conversion factors from dry to as-consumed for each food in the DGA whole grains group (14). A weighted average conversion factor (weighted by proportion of recommended servings) was then developed and applied to translate the EAT-Lancet whole grains subgroup from dry to as-consumed.

Finally, the EAT-Lancet pattern provides ranges in addition to single values for several of its recommendations to account for uncertainty and accommodate diverse eating patterns according to individual preferences and cultural contexts (1). The single values in the DGA patterns were compared with the ranges (when available) and single values provided by EAT-Lancet.

TABLE 2 Recommended eating patterns of EAT-Lancet and the Dietary Guidelines for Americans

Food group and subgroup	Recommended eating pattern (2500 kcal/person/d)			
	EAT-Lancet ¹	Healthy US Style	Healthy Mediterranean Style	Healthy Vegetarian
Fruit, grams	200 (100–300)	363	454	363
Vegetables, grams	350 (200–700)	402	402	402
Dark green	100	38	38	38
Red and orange	100	134	134	134
Starchy	50 (0–100)	125	125	125
Other	100	105	105	105
Grains, grams	494	371	371	397
Whole ²	494	218	218	244
Refined	0	153	153	153
Protein foods, grams	302	249	276	181
Meat, poultry, eggs ³	56	141	141	21
Red meat ⁴	14 (0–28)	71	71	0
Poultry	29 (0–58)	49	49	0
Eggs	13 (0–25)	21	21	21
Seafood/fish	28 (0–100)	41	67	0
Nuts, seeds, soy ³	75	11	11	50
Nuts and seeds ⁵	50 (25–100)	10	10	18
Soy	25 (0–50)	2	2	33
Beans and peas ²	143 (0–286)	56	56	109
Dairy, grams	250 (0–500)	446	372	446
Oils, grams	40 (20–80)	33	33	33
Discretionary calories, ⁶ kcal	216 (0–216)	365	315	390

¹ Adapted from EAT-Lancet (1); Range of recommended grams included when a range was provided by EAT-Lancet.

² Dry weights of these food subgroups in the EAT-Lancet pattern were converted to as-consumed using FPED and FICRCD (12, 13). The ratio of as-consumed to dry foods was 2.13 for grains and 2.86 for beans (mean of lentils, black beans, split peas).

³ DGA recommendations are at these subcategory levels of resolution. Subcategories were further disaggregated using the Technical Tables for the 2015 USDA Food Patterns (10) to map to EAT-Lancet categories.

⁴ Includes the EAT-Lancet categories of beef and lamb, and pork.

⁵ Includes the EAT-Lancet categories of tree nuts and peanuts.

⁶ In the DGA, this category is "limit on calories for other uses." It includes the EAT-Lancet categories of palm oil, lard or tallow, and added sugars.

DGA, Dietary Guidelines for Americans; EAT-Lancet, EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems; FICRCD, Food Intakes Converted to Retail Commodities Database; FPED, Food Patterns Equivalents Database.

Results

Food groups and subgroups whose values in the DGA patterns were within the ranges recommended by EAT-Lancet were total vegetables, poultry, eggs, seafood, soy, beans and peas, dairy, and unsaturated oils (Table 2). EAT-Lancet did not publish gram ranges for grains or non-starchy vegetable subcategories. EAT-Lancet recommended more total grains (25–33%) than the DGA patterns. Only whole grains were recommended in the EAT-Lancet pattern, resulting in more than double (2.3 times) the amount of whole grains recommended than the HUS and MED patterns. The recommendations for nonstarchy vegetables and other vegetables were similar between the EAT-Lancet pattern and all DGA patterns. Compared with the EAT-Lancet pattern, the DGA patterns included 25% less red and orange vegetables and 163% more dark green vegetables.

Food groups and subgroups whose values in the DGA patterns were outside of the ranges recommended by EAT-Lancet were fruit, starchy vegetables, red meat, nuts and seeds, and discretionary calories. For fruit, EAT-Lancet recommended 45% (for HUS and VEG) to 56% (for MED) less than the DGA. The starchy vegetable recommendation provided by EAT-Lancet was 60% lower than all patterns in the DGA.

EAT-Lancet included a greater quantity of protein foods than all 3 DGA patterns, but with a starkly different distribution by subcategory. Almost half of the protein foods (47%) included in the EAT-Lancet pattern were beans and peas. EAT-Lancet recommended 80% less red meat than the HUS and MED patterns, but more than the VEG pattern (14 g versus 0 g). The VEG pattern had the lowest animal-based protein foods recommendation (21 g), followed by EAT-Lancet (84 g), HUS (182 g), and the MED pattern (209 g). The animal protein food amounts included in the VEG pattern were within the ranges provided by EAT-Lancet, the latter of which had a lower bound of zero grams for all animal-based foods. The MED pattern had the highest animal protein foods recommendation because it included the same amount of all protein foods as the HUS pattern, plus a higher seafood recommendation. For nuts, seeds, and soy, the EAT-Lancet and VEG patterns recommended similar amounts of soy (25 and 33 g), but EAT-Lancet included 2.8 times the amount of nuts and seeds.

Finally, EAT-Lancet recommended 31–45% lower intake of solid fats and added sugars, or discretionary calories, on a kcal basis compared to the DGA patterns. The subcategories included in EAT-Lancet are palm oil, lard or tallow, and added sugars, whereas the DGA category included all discretionary allowances, such as for solid fats, added sugars, and alcohol.

Discussion

The recommended eating patterns of the DGA and EAT-Lancet align and diverge in several ways. The differences between the patterns in part reflect different approaches to developing dietary guidance. There are 2 broad (and competing) approaches to improving diet quality that are considered when developing dietary recommendations. The “small changes” approach (15–17) recognizes that even moderate dietary shifts can lead to positive health outcomes (18), so individuals should strive to make incremental dietary improvements that can be more easily adopted and sustained, rather than making more extensive changes all at once (15–17). The other broad approach recognizes that current diet patterns have remained far below optimal, despite decades of dietary guidance, and represent an urgent public health problem. For example, 0.5 million deaths per year are attributable to poor diet in the USA, which now represents the leading cause of death (19). Thus, this transformational approach recommends more immediate, extensive changes to diet patterns. Although diet transformation could be argued solely on the basis of health, the contribution of diets to ecological crises, such as climate change, that require rapid, large-scale mitigation efforts provides additional justification for this approach (1).

The difference between these approaches are implicitly reflected in some key differences between the EAT-Lancet and DGA patterns. For example, the health benefits of whole grains compared with refined grains are well-established, and include a reduced risk of incident cardiovascular disease, cancer, diabetes, and a wide range of intermediary conditions (20). Approximately 85% of Americans consume ≥ 4 servings per day of refined grains, whereas only 30% of Americans consume ≥ 1 serving per day of whole grains (21). Clearly, a nutritionally perfect consumption amount of refined grains would be zero, which is reflected in the EAT-Lancet pattern (1). In contrast, the DGA patterns recognize that Americans are far from achieving the optimal daily intake of whole grains, and therefore recommend that “at least half” of grain intake should be whole (9). Similar differences in food-based recommendations between EAT-Lancet and DGA can also be observed for protein foods (animal-based versus plant-based), dairy, and discretionary calories like saturated fats and added sugars. These differences bring to the forefront the delicate issue of providing health-based nutrition recommendations that are at once practical and achievable.

Although several differences between the EAT-Lancet and DGA patterns may have implications for environmental sustainability, differences in the levels of animal-based foods are particularly salient. The EAT-Lancet and DGA Healthy Vegetarian pattern emphasize plant-based sources of protein, with low consumption of animal-based foods. Healthy diets that rely primarily on plant-based foods generally have lower environmental burdens when compared with average US consumption, though variation exists depending on how the alternative pattern is operationalized (3, 22–26). Comparing just the DGA patterns, the Healthy Vegetarian pattern has lower impacts than the Healthy US-Style and Healthy Mediterranean patterns in multiple domains (e.g. water quality, climate, land), largely due to differences in protein foods (7). Whether the EAT-Lancet pattern has environmental benefits or costs relative to the DGA’s Healthy Vegetarian pattern requires further research. In a recent study, modeled future shifts to a vegetarian diet in the USA resulted in lower greenhouse gas emissions and similar land, water, nitrogen, and phosphorus use compared to the EAT-Lancet pattern

(3). Further study is needed to understand the relative environmental performances of the EAT-Lancet and DGA patterns.

The EAT-Lancet global reference diet was intended to provide a broad framework for dietary guidance, and therefore includes point estimates and ranges to account for heterogeneous conditions across countries (1). The point estimates and ranges are helpful to compare against other established patterns, as we do. At the same time, dietary recommendations should consider cultural context (27), and perhaps be tailored to age, sex, and activity level (9). Since the EAT-Lancet pattern lacks these nuances by design, it may be challenging to adapt the pattern to country-specific conditions. If a country wanted to use EAT-Lancet as a starting point, the pathway to establishing a balanced recommended pattern that includes deviations from the point estimates EAT-Lancet provides is not clear. For example, if a country wanted to shift from the point estimates for red meat and poultry to the top ends of those ranges, what compensatory changes would need to be made to ensure a nutritionally balanced and environmentally sustainable pattern? Further research is needed to examine the alignment and divergence of EAT-Lancet with country-specific recommendations beyond the USA and to examine the range of healthy diets that could be achieved while staying within the EAT-Lancet ranges.

This research provides the nutrition community with an empirical starting point to debate and study the relative merits of the EAT-Lancet and DGA patterns. Additionally, we have highlighted a key tension to be addressed in sustainable nutrition policy: to what extent should dietary guidance reflect practicality when large-scale change is required to address urgent health and sustainability issues? To further complicate matters, truly sustainable nutrition will require integration of economic and social outcomes, in addition to outcomes related to human health and the environment. Recent estimates of the affordability of the EAT-Lancet diet globally (28) and the relative costs of current US diets and DGA patterns (29) are important advances in this area. These works point to some of the structural factors that impede adoption of recommended diets, particularly for low-income and other marginalized populations. Continued interdisciplinary collaboration is needed to develop dietary guidance and other policies that promote sustainable nutrition for all.

Acknowledgments

The authors’ contributions were as follows—NTB and ZC: designed the research and wrote the manuscript; NTB: conducted the research, analyzed the data, and has primary responsibility for the final content; and both authors: read and approved the final manuscript.

References

1. Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, Garnett T, Tilman D, DeClerck F, Wood A, et al. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet North Am Ed* 2019;393:447–92.
2. Springmann M, Clark M, Mason-D’Croz D, Wiebe K, Bodirsky BL, Lassaletta L, Vries W de, Vermeulen SJ, Herrero M, Carlson KM, et al. Options for keeping the food system within environmental limits. *Nature* 2018;562: 519–25.
3. Springmann M, Wiebe K, Mason-D’Croz D, Sulser TB, Rayner M, Scarborough P. Health and nutritional aspects of sustainable diet strategies

- and their association with environmental impacts: a global modelling analysis with country-level detail. *The Lancet Planetary Health* 2018;2:e451–61.
4. Fischer CG, Garnett T. Plates, pyramids and planets: developments in National Healthy and Sustainable Dietary Guidelines: a state of play assessment. Food and Agriculture Organization of the United Nations and The Food Climate Research Network at The University of Oxford. 2016, p. 80.
 5. 2015 Dietary Guidelines Advisory Committee. Scientific report of the 2015 Dietary Guidelines Advisory Committee. 2015.
 6. Vilsack T, Burwell S. 2015 Dietary Guidelines: giving you the tools you need to make healthy choices [Internet]. US Department of Agriculture Blog Archive 2015 [cited 2018 May 17]. Available from: <https://www.usda.gov/media/blog/2015/10/6/2015-dietary-guidelines-giving-you-tools-you-need-make-healthy-choices>.
 7. Blackstone NT, El-Abbadi NH, McCabe MS, Griffin TS, Nelson ME. Linking sustainability to the healthy eating patterns of the Dietary Guidelines for Americans: a modelling study. *The Lancet Planetary Health* 2018;2:e344–52.
 8. Mekonnen MM, Fulton J. The effect of diet changes and food loss reduction in reducing the water footprint of an average American. *Water Int* 2018;43:860–70.
 9. U.S. Department of Health and Human Services, U.S. Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 2015. Report No.: 8th edition.
 10. Technical Tables for the 2015 USDA Food Patterns: item clusters, percent of consumption, and representative foods for USDA food pattern food groups and subgroups. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion [Internet]. 2015 [cited 2018 Apr 10]. Available from: <https://www.fns.usda.gov/usda-food-patterns>.
 11. Food and Nutrient Database for Dietary Studies (FNDDS) 5.0. U.S. Department of Agriculture, Agricultural Research Service [Internet]. 2012 [cited 31 Dec 2019]. Available from: <https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/fndds/>.
 12. Food Patterns Equivalents Database 2007–2008. U.S. Department of Agriculture, Agricultural Research Service [Internet]. 2013 [cited 27 Oct 2017]. Available from: <https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/fped-overview/>.
 13. Food Intakes Converted to Retail Commodities Database 2007–2008. U.S. Department of Agriculture, Agricultural Research Service [Internet]. 2013 [cited 31 Dec 2019]. Available from: <https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/ficrcd-overview/>.
 14. Bowman SA, Clemens JC, Friday JE, Thoeig RC, Shimizu M, Barrows BR, Moshfegh AJ. Food Patterns Equivalents Database 2007–08: Methodology and User Guide. U.S. Department of Agriculture, Agricultural Research Service [Internet]. 2013 [cited 2019 Sep 10]. Available from: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/fped/FPED_0708.pdf.
 15. Damschroder LJ, Lutes LD, Kirsh S, Kim HM, Gillon L, Holleman RG, Goodrich DE, Lowery JC, Richardson CR. Small-changes obesity treatment among veterans: 12-month outcomes. *Am J Prev Med* 2014;47:541–53.
 16. Lutes LD, DiNatale E, Goodrich DE, Ronis DL, Gillon L, Kirsh S, Richardson CR, Damschroder LJ. A randomized trial of a small changes approach for weight loss in veterans: design, rationale, and baseline characteristics of the ASPIRE-VA trial. *Contemporary Clinical Trials* 2013;34:161–72.
 17. Hills AP, Byrne NM, Lindstrom R, Hill JO. “Small changes” to diet and physical activity behaviors for weight management. *Obes Facts* 2013;6:228–38.
 18. Sotos-Prieto M, Bhupathiraju SN, Mattei J, Fung TT, Li Y, Pan A, Willett WC, Rimm EB, Hu FB. Association of changes in diet quality with total and cause-specific mortality. *N Engl J Med* 2017;377:143–53.
 19. Wang DD, Li Y, Afshin A, Springmann M, Mozaffarian D, Stampfer MJ, Hu FB, Murray CJL, Willett WC. Global improvement in dietary quality could lead to substantial reduction in premature death. *J Nutr* 2019;149:1065–74.
 20. Aune D, Keum N, Giovannucci E, Fadnes LT, Boffetta P, Greenwood DC, Tonstad S, Vatten LJ, Riboli E, Norat T. Whole grain consumption and risk of cardiovascular disease, cancer, and all cause and cause specific mortality: systematic review and dose-response meta-analysis of prospective studies. *BMJ* 2016;353:i2716.
 21. Rehm CD, Peñalvo JL, Afshin A, Mozaffarian D. Dietary intake among US adults, 1999–2012. *JAMA* 2016;315:2542–53.
 22. Nelson ME, Hamm MW, Hu FB, Abrams SA, Griffin TS. Alignment of healthy dietary patterns and environmental sustainability: a systematic review. *Adv Nutr* 2016;7:1005–25.
 23. Kim BF, Santo RE, Scatterday AP, Fry JP, Synk CM, Cebon SR, Mekonnen MM, Hoekstra AY, de Pee S, Bloem MW, et al. Country-specific dietary shifts to mitigate climate and water crises. *Global Environ Change* 2019;101926.
 24. Heller MC, Keoleian GA. Greenhouse gas emission estimates of U.S. dietary choices and food loss. *J Ind Ecol* 2015;19:391–401.
 25. Hitaj C, Rehkamp S, Canning P, Peters CJ. Greenhouse gas emissions in the United States food system: current and healthy diet scenarios. *Environ Sci Technol* 2019;53:5493–503.
 26. Peters CJ, Picardy J, Darrouzet-Nardi AF, Wilkins JL, Griffin TS, Fick GW. Carrying capacity of U.S. agricultural land: ten diet scenarios. *Elem Sci Anth* 2016;4: p.000116.
 27. World Health Organization, Food and Agriculture Organization of the United Nations. Preparation and Use of Food-Based Dietary Guidelines [Internet]. Geneva (Switzerland); 1996[cited 2019 Oct 1]. Available from: <http://www.fao.org/3/x0243e/x0243e00.htm>
 28. Hirvonen K, Bai Y, Headey D, Masters WA. Affordability of the EAT-Lancet reference diet: a global analysis. *The Lancet Global Health* 2020;8:e59–66.
 29. Fulgoni VI, Drewnowski A. An economic gap between the recommended healthy food patterns and existing diets of minority groups in the US National Health and Nutrition Examination Survey 2013–14. *Front Nutr* [Internet] 2019;6:37 [cited 2020 Jan 1]. Available from: <https://www.frontiersin.org/articles/10.3389/fnut.2019.00037/full?report=reader>.