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A focused ethnographic study on the role of health and sustainability in food choice decisions

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ABSTRACT

In the United States, typical dietary patterns are not necessarily healthy and sustainable. In order to shift diets, we need to provide support to individuals in a way that reflects what matters most to them. In this study, we aimed to identify the considerations that are most important to individuals regarding food-related decisions, and to determine how those considerations relate to specific foods, with a focus on health and environmental sustainability. In a sequential mixed-methods design, we first conducted 27 semi-structured interviews with participants in California and Nebraska. These interviews included a free-listing activity, where we used a technical construct of salience, Smith's S Index, to identify the considerations that were most important to our participants. We followed up with 20 of those participants to complete a pile-sorting survey, where participants sorted and rated 42 food items for price, taste, health, convenience, familiarity, and environmental impact. Our findings showed that the most salient considerations cited by our participants were price, health, taste, and time. There was consensus for how participants rated the foods for price, taste, convenience, and familiarity. However, there was only weak consensus for how participants rated the foods for health impact, and no consensus for how participants rated the foods for environmental impact. There was also disagreement on how to sort new plant-based products intended to replace or substitute meat and other animal-based foods. These findings have implications for how to communicate about healthy and sustainable diets. They highlight conflicting considerations, disagreement in classification of new products, and limited consensus for perceived health and environmental impact of foods, which present challenges to the achievement of diets that are healthy and environmentally sustainable in the United States.

1. Introduction

Calls proposing the need for healthy diets from sustainable food systems are increasingly common (IPCC, 2019; Searchinger et al., 2018; Willett et al., 2019). Consumer demand is a key driver to the achievement of such diets (Macdiarmid et al., 2012; Searchinger et al., 2018). However, in North America and the United States, the current average consumption patterns exceed recommendations for foods such as red and processed meats and starchy vegetables, and are below recommendations for foods such as fish, fruits, vegetables, legumes, whole grains, and nuts (Dietary Guidelines Advisory Committee, 2020; Willett et al., 2019). Such diets are not aligned with healthy and sustainable dietary patterns, which are more plant-based. Although consumption of red and processed meats has decreased in the United States in the past decade (Neff et al., 2018), there are still major challenges to achieving healthy and sustainable diets.

Effective dietary recommendations require an understanding of what matters most to people when they make diet-related decisions and the tradeoffs they make related to those decisions. Consumer surveys from the United States and other high-income country settings show that price, quality, taste, and health are the most important considerations that influence food choice (Ranganathan et al., 2016; Rosenfeld & Tomiyama, 2020; Stoll-Kleemann & Schmidt, 2017). Cost and health are among the principal reasons that consumers reduced meat consumption

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in the United States (Neff et al., 2018). When individuals make decisions about the foods they consume, they consciously and unconsciously make mental calculations between these considerations (Sobal & Bisogni, 2009). Despite the complexity of consumer decision making, previous studies have primarily evaluated decision-making considerations identified by the researchers without soliciting participant input or evaluating how considerations relate to one another and to different types of foods.

Knowledge, attitudes, habits, and social norms influence how people think about and perceive different foods (Hardcastle et al., 2015; Monterrosa et al., 2020; Sobal & Bisogni, 2009). Mental models, or "ways of knowing," about food are largely cultural and social phenomenon (Godfray et al., 2018; Marteau 2017). These models relate to shared cognitions and feelings, social identities, and social situations (Bekker et al., 2017; Cheah et al., 2020). As such, efforts to achieve healthy and sustainable diets need to reflect individuals' shared values and perceptions, as these might differ from scientifically-driven classifications and priorities. This approach involves targeting nutrition recommendations and information in an 'emic' way that resonates with participants' views and experiences, and allowing for exploration and accounting of shared perceptions (Pelto et al., 1980; Tumilowicz et al., 2015).

Capturing mental models require tools that examine these constructs. These tools include ethnographic techniques such as free listing, which can be used to elicit relevant elements in a domain, and pile sorting, which can be used to assess categories and the relationships between items in a domain from the perspective of participants (Ares et al., 2015; Libertino et al., 2012). Such tools have been used in the field of nutrition to examine perceptions about foods (Corral-Terrazas et al., 2002; Hough & Ferraris, 2010; Kalra et al., 2018), food and packaging characteristics (Ares & Deliza, 2010), habits and meal patterns (Libertino et al., 2012; Rojas-Rivas et al., 2020; de Morais Sato etal., 2019), health (Ross et al., 2002), and nutrition information (Fox, Pelto, Bar, et al., 2018; Fox, Pelto, Rasmussen, et al., 2018). These tools have also been used to examine consumers' perceptions about sustainability (Barone et al., 2020) and to explore how consumers assessed healthfulness and environmental friendliness of protein products (Lazzarini et al., 2016). These methods help identify information about underlying perceptions and mental representations that might be difficult to obtain directly through an interview or survey (Barone et al., 2020; Doherty & Nelson, 2010) and capture similarities and differences between groups of people (Fox, Pelto, Rasmussen, et al., 2018; Guerrero et al., 2012). Such information can be used to improve the content and design of nutrition interventions, including those promoting healthy and sustainable diets, to better reflect the perspectives of target populations.

In this study, we aimed to explore the mental models involved in food decisions and identify challenges and opportunities involved in shifting towards healthy and sustainable diets. We were not interested in capturing consumption patterns themselves; rather, we aimed to identify both shared and disparate meanings that informed consumers' food-related perceptions and decisions, including those related to health and sustainability. We used focused ethnographic methods to examine the considerations that were most important to individuals about their food decisions. We add to recent literature examining the shared and perceived health and environmental impacts of specific foods (Lazzarini et al., 2016) by incorporating additional salient considerations of participants' food decisions (e.g., price, taste, etc.). We aimed to answer the following questions: What are the most salient considerations that influence food-related decisions? How are different foods classified, and how do those classifications and foods relate to participants' identified considerations, including those related to health and environmental sustainability?

2. Methods

2.1. Study design

In a sequential mixed methods design, we first conducted individual semi-structured interviews to contextualize individuals' eating decisions, with a particular focus on decisions about meat, other animal source foods, and plant-based proteins (e.g., Impossible™ burger, legumes, etc.). We were interested in capturing the tradeoffs that individuals considered with regard to their consumption practices. The interview included a free listing activity (Weller & Romney, 1988), where we used a technical construct of salience, Smith's Salience (S) Index, to identify the most important factors that individuals considered when deciding what foods to purchase and eat. The interviews were later followed by a pile sorting survey (Weller & Romney, 1988) to explore how people viewed the identified considerations in relation to specific foods and food groups, and whether these views were shared by participants.

2.2. Study participants

We purposively selected two geographic regions for this research: northern California and southeastern Nebraska. We selected these regions because they represented regions in the United States with high meat production and consumption (Guenther et al., 2005; USDA, 2018), and openness to discussions about climate change and mitigation strategies (Baldassare et al., 2018; Wilhite & Morrow, 2016). These regions also provided an opportunity to explore different social, economic, and political perspectives.

We recruited a convenience sample of participants in the aforementioned regions via printed and online newspaper advertisements, online classified advertisements (Craigslist.org), and email invitations to university communities and extension associates. The advertisements and email flyers included a project-specific email address and telephone number to contact the study team; individuals used these contacts to indicate their interest in the study. The study team reached out to these individuals to screen eligibility and coordinate a time for the interview, if eligible. We included participants who were 18 years of age or older, spoke English, and lived in California or Nebraska; we excluded participants who lived outside of California or Nebraska and did not meet the eligibility criteria. After a first round of recruitment, we had a larger number of respondents from urban areas and, therefore, in subsequent recruitment efforts specifically targeted rural areas to ensure representation from rural communities. We recruited participants for the second stage of research from our initial participant sample: at the end of each interview, we asked participants if they would be interested in joining the pile sorting survey.

From August 2018 to February 2019, we recruited 27 participants for the semi-structured interviews. We estimated that we would need approximately 10–15 individuals in each region to reach theoretical saturation in the qualitative interviews and free lists (Fugard & Potts, 2015). We recruited 16 participants from California and 11 participants from Nebraska. All interview participants' names were replaced with pseudonyms. We estimated that we would need approximately 20 individuals to capture the normative patterns of our participants in the pile sorting survey (Weller & Romney, 1988). We enrolled 20 participants for the pile sorting survey from June to July 2019.

All participants provided consent before their enrollment in the study. We obtained oral consent for the semi-structured interviews, and electronic consent for participants of the pile sorting survey. Ethical approval was granted by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board in Baltimore, Maryland. We provided participants a $25 gift card to thank them for their participation at each stage of the study (i.e., the interview, the survey).

2.3. Data collection

2.3.1. Semi-structured interviews (including free listing)

To achieve our first aim related to identifying individuals' eating decisions and the factors that influence what they purchase and eat, we conducted individual semi-structured interviews. Three members of the study team (EF, CD, RM) conducted the interviews via telephone following a semi-structured interview guide. The interviews lasted 30–60 min. During each of the interviews, we asked the participants a series of open-ended questions about their eating patterns, the considerations they make when deciding what foods to include in their diet, how their diet has shifted over time, and where they get information about foods they should eat. We specifically probed about participants' perspectives on health and sustainability, their meat consumption and experiences with plant-based meat alternatives, and the tradeoffs they made with regard to their consumption practices. We audio recorded all interviews with participants and recorded notes during the interviews to facilitate data analysis.

The interview guide also included a free-listing activity to elicit a list of considerations that individuals thought about when deciding what foods to purchase and eat (e.g., price, health, taste, etc.). Free listing is an ethnographic technique used to define a set of related words and concepts, at the same level of contrast, that describe a subject matter of interest (Weller & Romney, 1988). We asked participants "When choosing what foods to buy and eat, what are all of the things that are considered?" and probed for additional considerations, including asking "Are any of these considerations moral or ethical considerations?" and following up to have participants explain what that phrase meant for them. We recorded the order that items were listed on the interview guide. We prompted participants to describe the meaning of each consideration and how they thought that consideration influenced food decisions and, specifically, decisions about consuming meat.

2.3.2. Pile sorting survey

We conducted an online pile-sorting survey to achieve our second aim of exploring the relationship between factors identified in the free-listing activity and specific foods and food groups. Pile sorting is an ethnographic technique used to provide insight into how people conceptually organize information and relationships between items (Weller & Romney, 1988). We used a web-based data acquisition tool, OptimalSort (Optimal Workshop Limited, 2019), to facilitate the remote sorting task. We provided the participants with a link to the online pile-sorting survey, which lasted 30–45 min. We asked the participants to sort 42 food items (Table 1). The food items represented commonly consumed foods that were discussed during the semi-structured interviews, including meat, other animal source foods, and plant-based proteins (e.g., Impossible™ burger, legumes, etc.). We also included novel products such as in-vitro meat, given on-going discussions about such products in the context of sustainable diets. In an open-sorting task, we first asked the participants to sort the foods into groups of foods that were similar to one another, using as many or as few piles as they wanted. The participants were asked to label the groups they created. Using the considerations generated from the free-listing activity and in a closed-sorting task (where we pre-identified the number and labels of the piles), we then asked participants to rate each food item on a four-to five-point scale (e.g., price: very expensive, somewhat expensive, somewhat inexpensive, very inexpensive). Participants were allowed to indicate "I don't know" for items with which they were less familiar. Participants rated for price, taste, convenience, familiarity, health impact, and environmental impact (Supplementary Material, Table S1).

Table 1
List of 42 food items that participants sorted during the pile sorting survey.

Bacon	Falafel	Instant ramen noodles	Refried beans
Baked ham	Fish sticks	Lentil soup	Rice
Bean tacos	Fried chicken	Lima beans	Roasted chicken
Beef hamburger	Grass-fed beef burger	Macaroni and cheese	Sausage
Black beans	Green salad	Mushroom-beef burger	Scrambled eggs
Bread	Grilled chicken	Nuts and seeds	Spaghetti
Cheese	Grilled salmon	Peanut butter	Steak
Chicken sandwich	Hard-boiled eggs	Pizza	Veggie burger
Chickpeas	Hot dogs	Plant-based milk	Yogurt
Cow's milk	Impossible™ burger	Portobello mushroom	
Deli meat	In-vitro meat burger	Quinoa	

2.4. Data analysis

2.4.1. Semi-structured interviews (including free listing)

All audio recordings were transcribed verbatim by a transcription service (Production Transcripts) and spot-checked for fidelity to the recordings by the first author. Using content analysis (Holsti, 1969), the research team (EF, CD) developed a preliminary codebook using the items identified in the free-listing exercise, as well as participants' explanations about their eating decisions and experiences. We used the codebook to complete line-by-line coding of the transcripts using NVivo version 11.4.3 (QSR, 2017). We reanalyzed the transcripts as new concepts emerged in an iterative process.

To analyze the results from the free-listing activity related to the considerations individuals make when deciding what foods to purchase and eat, we compiled all considerations following free-listing analysis procedures (Weller & Romney, 1988). We (EF, CD, SD) used the content from the interview transcripts to understand participants' meaning of the cited items and, when relevant, consolidated terminology (Supplementary Material, Table S2). If there were any duplicates in an individual participant's list, we used the first mention for the analysis. Using FLARES version 1.0 (Wencélius et al., 2017), we determined data saturation by identifying the point at which an additional participant added no new items to the list, and item salience by using Smith's Salience (S) Index to account for frequency and order of mention across participants. Smith's S Index is a technical construct used to analyze free-listing data calculated with the formula $S_j = \{\sum[(L_i - R_j + 1)/L_i]\}/N$ (where L_i represents the length of the list for informant i, R_j represents the rank of the message j in that list, and N represents the total number of participants) (Smith & Borgatti, 1997). Scores for Smith's S Index range from 0.0 to 1.0 (Borgatti & Halgin, 2013). Items with a low salience (closer to 0.0) represent items that were mentioned last in participants' lists and with low frequency, and those with a high salience (closer to 1.0) represent items that were mentioned first in participants' lists with a high frequency (Sutrop, 2001).

2.4.2. Pile sorting survey

To analyze the results of the pile-sorting survey and explore how foods related to one another, we first analyzed the open-sorting task (where participants sorted the foods into piles that made sense to them). The participants' responses were tabulated into a 42-by-42 food-item proximity matrix in which each cell in the matrix represented the proportion of people who grouped each message-pair together (Borgatti & Halgin, 2013; Kruskal & Wish, 1978). We used non-metric multidimensional scaling (MDS) to display the results using UCINET v6.614 (Borgatti et al., 2002). Food items closer together on the MDS plot were viewed as more similar and more often grouped together by participants, and food items at a greater distance from one another were viewed as dissimilar and not often grouped together. To determine the goodness-of-fit of the two-dimensional MDS plot to the proximity matrix, we determined that the Kruskal Stress test cutoff for 42-sorted food-items needed to be below 0.356 as noted by Sturrock and Rocha (2000). The clusters of food-items were determined using hierarchical

cluster analysis and the best-merge method for studies with fewer than 30 participants (Optimal Workshop Limited, 2019). The clusters were labeled using the common labels identified by participants in the survey.

To identify whether the considerations people make about what foods to buy and eat were shared among participants and related to specific foods and food groupings, we analyzed the closed-sorting task (where participants sorted the foods into the pre-defined rating categories). To determine the rating dimensions, we used the most salient considerations listed by the participants in the free-listing activity, identified by the natural break in a scree plot of the considerations listed from most to least salient (Supplementary Material, Fig. S1), as well as considerations related to the environment given our interest in healthy and environmentally sustainable diets (Weller & Romney, 1988).

We conducted consensus and property-fitting (PROFIT) analyses of the rating data using UCINET v6.614 (Borgatti et al., 2002). The consensus analysis assessed whether there was agreement (or not) across participants for how they rated certain food items for different considerations (Weller & Romney, 1988). Consensus was determined when the first eigenvalue in a principal components analysis of the rating data across participants explained most of the variance in the sample (Garro, 1986). We used a ratio between the first and second eigenvalues of >3.0:1 for consensus, 2.0 to 2.9:1 for weak consensus, and <2.0:1 for no consensus (Caulkins, 2004; Romney et al., 1987). We used PROFIT analysis to determine whether the rated free-listing considerations that had consensus could be used to understand the axes of the MDS plot. We computed this by calculating the vector coordinates of the aggregated rating data, and assessing the fit of the vector to the MDS plot coordinates; R-squared values > 0.9 with corresponding $p < 0.01$ indicated a strong fit of the vector to the MDS plot (Borgatti et al., 2002).

3. Results

3.1. Participant characteristics

Twenty-seven participants were recruited for the semi-structured interview and free-listing activity. Participants' ages ranged from 21 to 70 years, with an average of 48 (SD ± 13.5) years. The majority of participants were female, White (non-Hispanic), urban residents, and college-educated (Supplementary Material, Table S3). As determined by nonparametric statistical tests (Fisher's exact test and Kruskal-Wallis H test), there were no statistically significant differences in the sociodemographic characteristics between the participants from California and the participants from Nebraska.

3.2. What are the most salient considerations that influence food-related decisions?

With regard to our first aim to identify what influenced the foods participants purchase and eat, participants collectively identified 21 considerations (Table 2). Each participant listed a mean of 8.1 considerations (range: 3–15 considerations). All of the 21 considerations were listed by 6 participants; the remaining 21 participants added no further items to the list. We found no differences in the lists generated by the different sociodemographic characteristics or regional locations as determined by respondent-by-respondent proximity matrices for the different sociodemographic characteristic categories.

Among the most salient items cited by our participants were price, health, taste and preference, and time (Table 2). These had a major influence on the foods people selected for themselves, as well as for their families. As described by one participant,

> I get home and I have three nieces that are starving. So you have to find something very fast to cook them so that they're not screaming. But you also want it to be good for them, healthy for them. So, if I can do a recipe with a few ingredients, and it turns out that (a) the family likes it, (b) I've got all the ingredients, and (c) it takes less than 30 minutes to cook, I'm good to go; I'm going to cook that. (Mia, 58 years)

Despite health being ranked second based on it being listed frequently and early in the free-listing activity (Table 2), participants often discussed price, taste, and time as being more impactful considerations. As one participant explained, "I don't think any of us would eat something that we think is healthy, but we don't like the taste of it" (Amy, 43 years). The cost of a healthy diet and healthy foods was also viewed as a major barrier to consuming healthy foods. Healthy foods were viewed as "a little bit pricier" (Wendy, 37 years) and "expensive when you're on the go" (Donna, 46 years), and price strongly influenced selection of foods, including those that were "not so great in nutrition … just because it keeps food in the cupboards" (Wendy, 37 years).

We specifically probed for moral and ethical considerations during

Table 2
Considerations influencing what foods to purchase and eat from free-listing activity of 21 participants.

Cited Considerations	Meaning[a]	Frequency	Smith's S Index
Price	Sales and coupons, price/cost of foods, affordability of foods, food budget	25	0.7437
Health	"Balanced diet", caloric content, food and food content related to health (e.g., cholesterol, sugar, salt), dieting, weight maintenance	22	0.6337
Taste and preferences	Flavor of food, preferred brands because of taste, visual appeal of foods, smells of food, texture of foods, food that other friends and families prefer	19	0.4974
Time	Time to prepare or procure food, purchase of fast food related to aspects of convenience	15	0.4105
Quality	Brands preferred because of perceived quality, freshness of foods related to perceived quality, perceived nutrient composition, food processing	13	0.2859
Animal welfare	Animal treatment, animal slaughter	19	0.1967
Familiarity	Comfort cooking or purchasing because have experience with food in past, including childhood	7	0.1824
Value	How much a food or food purchase "carries through" or lasts, how filling food makes you feel	7	0.1669
Availability	Physical availability (store or home), seasonality	7	0.0942
Environment	Environmental considerations: greenhouse gas emissions, runoff, land, odors, pesticides	6	0.0809
Perishability	How quickly food will go bad, packaging dates, how long a food can last (e.g., canned, frozen)	2	0.0471
Variety	Not eating the same thing every day	3	0.0462
Novelty	Trying new foods	2	0.0434
Packaging	Packaging size or type, packaging that increases desire to purchase foods	2	0.0378
Religion	Religious reasons for consuming a food (or not)	6	0.0324
Labor	Labor considerations of food, fair trade	5	0.0321
Versatility	Ingredient/food that can be used for many things	1	0.0278
Access	Transportation, distance to store or food source from home or work	1	0.0228
Skills	Skills needed to prepare foods	1	0.0216
Local economy	Food grown locally or regionally	3	0.0208
Food safety	Food safety considerations	1	0.0135

[a] Meaning based on descriptions of participants during the semi-structured interviews.

the free-listing activity, which elicited considerations related to animal welfare, religious restrictions on eating certain foods, supporting the local economy ("buying local"), fair labor, and environmental concerns. Only 6 (22%) of our participants mentioned considerations that they thought were moral or ethical prior to the probe. Participants described not knowing how to operationalize ethical concerns because "it's hard to tell from reading a label" (Tony, 30 years) and "we aren't able to know where our meat comes from or how it was raised or anything like that" (Frank, 68 years) when at the grocery store. When discussing animal welfare, one participant indicated that it was difficult to operationalize,

> I don't know enough about it [animal welfare] that I could exercise any real effective shopping choices, I don't think, to help or hinder that. So at least consciously, I don't really think there's a lot of ethical considerations going into my food choices. (Carl, 46 years)

Ethical considerations were often overshadowed by more salient considerations (such as price, taste, health, and time). Participants explained that, "Oftentimes, convenience and price end up outweighing any kind of ethical considerations I might have" (Omar, 30 years), and "Affordability is the biggest concern … you're taking away from the environment, but you're able to afford to even eat … it's important to also have an affordable substitute" (Donna, 46 years). Considerations about ethical concerns were seen as coming from a place of privilege. As one participant stated, "I think though, honestly, that people that can consider those things are usually the people that can—from a monetary perspective—they can afford to think about those things" (Carl, 46 years). Even among the subset of participants who cared deeply about ethical concerns related to food choice (e.g., animal welfare, fair trade), challenges related to price and convenience were cited as reasons participants were not able to act according to those concerns. These tradeoffs were noted by one participant, who said,

> I think it's almost shameful how animals have been raised for food and still are probably, but I know some people are changing on that. And yes, foods cost more, but it's bad for the environment. I can imagine it's bad for the people working at these places because they feel it. They know what's going on inside, and, you know, it's just not right … I buy cage-free eggs and I buy organic when I can. So you know, it's the price factor for me … When I'm feeling good, I'll buy the better stuff, and if I'm feeling poor that day, then I say, well, I just can't do it today. (Kimberly, 64 years)

Given the focus on healthy and sustainable diets, we were also interested in understanding how these considerations related to perceptions about different types of meat products. As with more general food choices, health was particularly salient for the selection of different types of meat, and often outweighed other considerations, such as environment. As one participant shared, "I believe there's a lot of people who feel that it [consuming less meat] is both the healthy and environmental thing to do. But, for myself, I'd say right now it's more health" (Jason, 55 years). Many participants described selecting poultry, fish, and vegetarian options because they were viewed as "lean" and "healthy" compared to meats such as beef, which was viewed as "more fattening" (Amanda, 55 years). Participants often described health considerations for meat in terms of different nutrients, namely protein, fat, vitamins, and minerals. They also described eating meat in terms of feelings of satisfaction. One participant explained that when she consumed vegetarian meals, "Mentally I don't feel as satisfied, but physically I feel okay … I'm so used to eating meat, that it feels like I'm missing out on something" (Donna, 46 years).

Price of meat was also a major determinant; one participant explained that the price of "meat has gone up so much … So it [what I purchase] is depending what's on sale" (Carrie, 45 years). Although poultry was described as being cheaper and beef as more expensive, price was more often associated with different cuts of meat. Participants explained that they "do a lot more of the ground hamburger, some of the microwave things like chicken nuggets and things like that, not a lot of the higher-end prices of meat, not steaks and that type of thing" (Jeanne, 48 years). Participants explained that identifying suitable substitutes and alternatives, including recommendations for different types of meat, needed to account for affordability.

3.3. How are different foods classified?

To achieve our second aim to explore the relationship between salient considerations that influenced food-decisions and how those related to specific foods, we needed to first determine how participants classified different foods. We achieved this through the open-sorting task. On average, participants created an average of 5.7 (SD ± 3.9) groups. The 2-dimensional MDS plot had a good fit to the proximity data with a stress value of 0.168 (cutoff = Kruskal stress test <0.356) (Fig. 1), and there was limited variability in how participants sorted (Supplementary Material, Table S4). With the use of hierarchical cluster analysis (Supplementary Material, Fig. S2), we identified 12 clusters. We used the explanations provided by participants to label the cluster groupings. The 6 main clusters aligned with food groups: meats and fish, eggs, dairy, grains, plant proteins, and other vegetables. There were 6 food items that did not correspond to any of these aforementioned groupings, and which were characterized as their own groups: macaroni and cheese, pizza, plant-based milk, instant ramen noodles, Impossible™ burger, and in-vitro meat burger.

Notably, in our study, products intended to serve as alternatives to meat and animal-based products, such as the Impossible™ burger, in-vitro meat burger, and plant-based milk, fell into their own categories. Based on our observations of how participants grouped these foods, there are two reasons for this in our study. First, approximately half of our participants grouped these food items on their own and classified them as dissimilar to other foods that the participants were asked to sort. For the other half of our participants, there was lack of agreement about how to classify these food items, with some participants grouping these foods in one category (e.g., meat or dairy), and other participants grouping them in a different category (e.g., plant proteins). These grouping patterns resulted in these foods falling between groupings on the MDS map (Fig. 1). Although some participants grouped and labeled these products as plant-based substitutes during the open-sorting exercise, others labeled them as "not whole food", "weird", "won't eat", "waste of time", etc. As such, for some of our participants, these foods are not aligned with existing preferences and classifications that they have for foods.

When asked about plant-based meat alternatives during the semi-structured interviews (e.g., Impossible™ meats, Beyond Burger™, in-vitro meat), participants explained that some of these products seemed overly processed and like poor imitations of meat. Some participants expressed strong distaste for them. One participant explained,

> I call them "fake products." They're just like something that they try to make look like something, right, and I'm thinking, well, even if it's supposed to be so-called healthy, it's highly processed, so what's really the point, right? (Christina, 55 years)

Many participants described not knowing how to think about some of these food products as they were "futuristic" and raised concerns and fears about "issues down the road" (Mia, 58 years). Although some participants had tried plant-based meat alternatives and found them to appeal to their taste preferences, they were not viewed as replacements or equivalents, per se. As one participant explained, "I've had it, and it is delicious, but is it a complete substitute for regular beef for me? No … It tastes good enough, but has it made me completely stop eating meat? No, it hasn't" (Mary, 35 years). Some participants regarded these foods negatively in terms of taste and texture. For instance,

> I don't know why they try to make a meat patty look like a meat patty, but it just didn't taste or look very good. And then all the stuff

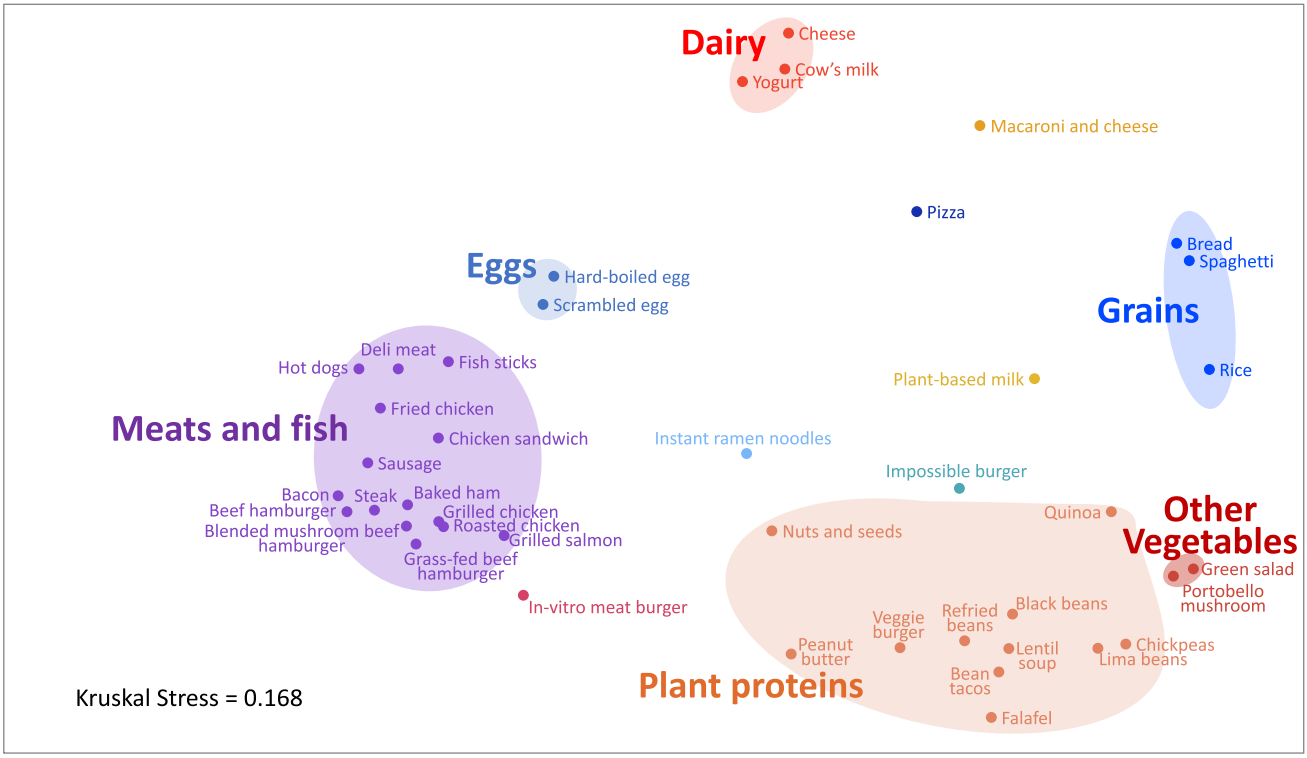

Fig. 1. Multi-dimensional scaling (MDS) map and clusters of participants' pile sorts of 42 food items.
The figure represents the MDS map of the sorted 42 items from the 20 participants. It represents how our participants conceptualized or cognitively organized the different foods they were asked to sort. The Kruskal stress test indicates that this two-dimensional MDS map is a good fit for the data, as it is less than the cutoff of 0.356. The distance between the food items indicates how closely the food items relate to one another—the greater the distance between food items indicates that they are less similar to one another; the shorter the distance between food items indicates that they are more similar to one another. For instance, hard-boiled egg and scrambled egg are closely related to one another. They are conceptualized as being more similar to deli meat than they are to falafel. We used hierarchical cluster analysis and participants' explanations of their groupings to label the clusters of foods. Individual food items that were not part of the labeled clusters (e.g., Impossible™ burger) meant that the food item was not cognitively similar to any of the other groupings (e.g., grouped on its own across participants), or that there was lack of agreement between participants (e.g., one set of participants grouped it into one category and another set of participants grouped it into a different category).

> that's made with tofu, to try to make phony meat, also don't taste very good. So those are things that are very unappealing I guess … mostly because of taste and texture. I think it's more the texture that really gets me. (Amanda, 55 years)

Overall, there were mixed sentiments about these foods and lack of agreement about how to classify them among the participants we interviewed.

3.4. How do foods and food classifications relate to participants' identified considerations?

We evaluated the closed-sorting (rating) task to achieve our second aim to explore the relationship between salient considerations that influenced food-decisions and how those related to specific foods. The average ratings for price, taste, convenience, familiarity, health, and environment for each food item are included in the Supplementary Materials, Table S5. Based on the findings of the consensus analysis, participants shared consensus for how they rated foods for price, taste, convenience, and familiarity (Table 3). There was weak consensus for how participants rated foods for their health impact and no consensus for how participants rated foods for their environmental impact (Table 3). This means that, among our participants, there was not a shared view on how foods were characterized for their health and environmental impact. Rather, there was more than one way (or mental model) to explain how people connected the 42 food items in our study to health and the environment.

Table 3
Consensus analysis for how participants rated the 42 food items for price, taste, convenience, health, and environmental impact.

Rated Dimension	Eigenvalues[a]	Ratio between factors	Conclusion
Price	1st = 5.083 2nd = 1.476	3.444	Consensus
Taste	1st = 4.253 2nd = 1.324	3.211	Consensus
Convenience	1st = 6.150 2nd = 1.433	4.290	Consensus
Familiarity	1st = 10.466 2nd = 1.071	9.773	Consensus
Health	1st = 4.239 2nd = 1.517	2.794	Weak consensus
Environment	1st = 3.392 2nd = 2.595	1.307	No consensus

[a] Consensus was determined when the first eigenvalue in a principal components analysis explained most of the variance in the sample (Garro, 1986). We used a ratio between the first and second eigenvalues of >3.0:1 for consensus, 2.0 to 2.9:1 for weak consensus, and <2.0:1 for no consensus (Caulkins, 2004).

Data from our qualitative interviews support the idea that people have different ways of understanding health and the environment, and the relationship of these considerations to different foods. Participants themselves even understood that there were various ways of understanding these considerations. As one participant noted,

> I feel like I have a pretty standard view on what healthy is. That people envision vegetables and fruits, I don't know, I might be a little bit stricter. But I think whether people live by it or not, I feel like I have a pretty standard view of healthy. I think people think meat is really healthy and I disagree with that. So that might be a big difference. (Omar, 30 years)

Views on the healthiness of different meats were particularly varied among our participants. Whereas some participants viewed meat, and particularly beef, as unhealthy, others did not. Participants noted that "I don't consider beef unhealthy; I mean that's one of our staples" (Fred, 65 years), and "Look at steak. Maybe it's the protein in it … But when I eat a piece of steak, I feel really good. And it's like I feel better" (Cathy, 57 years). Views on what was considered an environmental impact also varied. For instance, when discussing the environment, participants described organic foods, pesticides, pollution (including odors), runoff, greenhouse gas emissions, and water quality. We found that participants often described very different ideas when discussing the same topic (e.g., environmental sustainability or health).

In the property fitting (PROFIT) analysis, we sought to determine whether the ratings for the salient considerations aligned with how participants classified different foods and whether the ratings could explain the dimensions of the MDS map (Fig. 1). Unfortunately, all considerations for which there was consensus (price, taste, convenience, familiarity, and health) had a poor fit to the MDS map (R^2 values: Price = 0.019, Taste = 0.038, Convenience = 0.127, Familiarity = 0.108, Health = 0.041). As such, there was no identified relationship between how people grouped foods and their ratings of those foods for price, taste, convenience, familiarity, and health. In large part, this could be because our participants sorted foods into food groups and did not necessarily classify or group them by their free-listing considerations.

4. Discussion

In order to support the adoption of sustainable and healthy diets, it is essential to understand what drives food decisions and whether such diets align with individuals' values. In our study, we found that trade-offs between different food choice considerations, particularly those related to price, outweighed other considerations for our participants, including those pertaining to the environment and other ethical considerations. We also found that participants did not share an understanding about the relationship between specific foods and their health and environmental impacts. Additionally, participants did not share an understanding about how to classify all foods, such as plant-based alternatives for meat and animal-source foods, that are often considered relevant to healthy and sustainable diets. Together, these findings indicate that although participants agreed on some of the considerations that informed diet (e.g., price, taste, convenience) and how those considerations relate to particular types of foods, they did not fully agree on the two considerations most relevant for healthy and sustainable diets (i.e., health and environment).

Understanding how people view and conceptualize the world, including their perceptions on healthy and sustainability, can inform the promotion of healthy and environmentally sustainable diets. In particular, if multiple mental models and representations exist for how health and sustainability are perceived and operationalized, counseling and health promotion efforts should be sensitive to those differences and recognize that not all individuals share the same understanding.

4.1. Competing considerations that inform food choice

Oftentimes, "scientific" classifications and priorities do not align with participants' own views, values, and experiences, so it is important to understand people's perspectives and the meanings they ascribe to different ideas, considerations, and foods. Similar to other studies (Ranganathan et al., 2016; Rosenfeld & Tomiyama, 2020; Stoll-Kleemann & Schmidt, 2017), affordability, quality, taste, and health were key considerations of food decisions among our participants. We also found that time and convenience were relevant. Most participants cited considerations such as environmental impact, animal welfare, labor, only after they were elicited by a probe about ethical and moral considerations; however, all of these considerations were less salient. These findings align with other studies, in which price and health were viewed as more influential than social responsibility, environmental sustainability, or other ethical concerns (Allès et al., 2017; Ghvanidze et al., 2017; Hoek et al., 2017; Lindeman & Väänänen, 2000). These findings have implications for how to frame recommendations about healthy and sustainable diets. Focusing on more salient considerations, e.g., health and price, may be more relevant to consumers than framing dietary changes around less salient considerations, e.g., sustainability.

Importantly, we found that the ability to act on certain considerations, including those related to environmental impact, were heavily influenced by considerations such as price. Our participants perceived that healthy and sustainable diets were expensive, and many perceived that only certain consumers (i.e., those who were affluent) were able to adhere to such dietary practices. Quantitative data does show that the cost of healthy and sustainable diets is greater than typical and nutritionally adequate diets (Barosh et al., 2014; Hirvonen et al., 2020). This is often framed as an issue for low-income countries (Hirvonen et al., 2020), however, it is also important to think about inequities, economic disparities and social issues faced by individuals in high-income countries, as well. Even among our participants who deeply valued sustainability, animal welfare, etc., affordability was perceived as a major consideration and tradeoff. Although there are likely some opportunities to show alignment between health, environment, and economics in public health communications, it is also likely that social issues such as price and affordability need to be addressed at the same time.

4.2. Lack of consensus about healthy and environmentally sustainable foods

We found that two or more mental models exist to explain how people connect food items to environment and to health. From our research, we show that there was weak or no consensus between participants' ratings of foods for environment and health characteristics. This aligns with other studies in the United States and other settings that indicates confusion and low awareness about the relationship between environmental sustainability, health, and diets (International Food Information Council, 2019; Lea & Worsley, 2008). However, this is different from other settings, such as in Switzerland, where participants were able to evaluate products based on health and environmental considerations (Lazzarini et al., 2016). Drawing from the literature, there are numerous reasons why we might expect our participants to have multiple ways of thinking about healthfulness and environmental consequences of food. It could be related to numerous and varying criteria to measure health and environmental impacts (Barone et al., 2020; Lazzarini et al., 2016), poor access to knowledge and information, and varying and conflicting information about food and diet (Davis, forthcoming). This is an area for future research that has implications for consumers' understanding of healthy and sustainable diets and the framing of messaging related to healthy and sustainable diets for consumers.

4.3. Perceptions about novel plant-based foods

As different and new foods continue to be developed and introduced to our food systems, we also need to think about how they are conceptualized. Many of our participants expressed uncertainty and skepticism about the health impacts of new products intended to support healthy and sustainable diets. This includes plant-based alternative proteins (e.g., Impossible™ meats, Beyond Burger™, etc.). The concerns raised by

our participants align with research from other settings which highlights that many of these plant-based alternatives are highly processed and high in sodium, sugar, saturated fats, and preservatives (Neff et al., 2018), and that this is of concern to consumers (Siegrist & Hartmann, 2020). Our findings suggest that consumers have a nuanced view of these novel food products and that these products may face challenges in acceptance and adoption by consumers more generally.

Our participants also had trouble classifying novel plant-based alternative proteins intended to substitute meat. These foods did not align with our participants' shared understanding of how people view and classify foods, compared to for instance, veggie burgers which were classified with plant proteins. Other research shows that classifications about cultured meat and meat substitutes are not always clear, and depend on how open-minded individuals are with what they classify as meat versus not meat (in terms of origin, similar expected physical properties and contents, etc.) (Bekker et al., 2017). These findings have implications for dietary guidelines (i.e., where these foods fit, how they are framed) and communication about whether and how such products fit into a healthy diet. It also has implications for the need for additional research on the different types of consumers groups and the best way(s) to communicate with them about healthy and sustainable diet, particularly in the context of new technologies applied to foods.

4.4. Limitations

Though our research provides an emic perspective of cultural patterns and of how individuals think about their diets, including health and sustainability, it is not without limitations. First, though we found our recruitment practices to be a viable and inexpensive way to recruit participants, our sample is not representative. Our sample represented individuals who wanted to talk with us about their food choice decisions. Our respondents also differed in age, race, and educational status compared to the populations from which we recruited. Prior research indicates that Craigslist respondents tend to be younger (Head et al., 2015), but we did not find this to be the case among our study participants, who tended to be older (which may also reflect the multiple methods we used for recruitment). Altogether, the generalizability of our findings is limited and should be viewed with caution. Future research can reach a more diverse subset of participants to more explicitly explore the multiple mental models that may exist in understanding healthy and sustainable diets.

Second, we elicited participants' perceptions and self-reported experiences. Our findings reflect our participants' conscious considerations, and not the unconscious decisions informed by habits, emotions, and environments (Godfray et al., 2018; Marteau 2017). We also did not measure what our participants actually do or what foods they purchased. We expect that this may also result in self-reporting bias. For instance, health was listed high on the list of considerations, but that might not actually reflect practice given known research about over-reporting of health considerations and diet (Beechy et al., 2012; Macdiarmid & Blundell, 1998). We also expect that considerations such as animal welfare, labor rights, etc. Are also overestimated in our study, as we elicited participants to share their perspectives about moral and ethical considerations related to food choice. Despite these limitations, our study and approach provide relevant information to capture underlying (and latent) views about diets, and specifically consumers' perceptions about healthy and sustainable diets.

5. Conclusions

In the context of calls to transform food systems for the sake of both human and planetary health (Willett et al., 2019), we must focus on people's lived experiences, perceptions, and values to support the shift toward healthy and sustainable diets. Our findings represent only a snapshot of a specific population, but they highlight the importance of communication that reflects consumers' realities. Communication should include consideration for the multidimensional factors relevant to individuals' food choice decisions (e.g., importance of price, taste and convenience) and, given that we found limited consensus on two key dimensions of healthy and sustainable diets (i.e., health and environmental impact), awareness of the multiple ways in which people understand these issues. In addition to a greater focus on nutrition and dietary communication, education, awareness raising and policy interventions that address barriers to healthy, sustainable diets are also needed. The significance and inherent challenges of behavior change should not be underestimated, as change is not easy, particularly given the many considerations and trade-offs that surround food choice decisions.

Ethical statement

Ethical approval was granted by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board in Baltimore, Maryland (IRB No. 0008443).

Author contributions

ELF, CD, SD, RM and JF were involved in the conception and design of the research; ELF, CD and RM were involved in the acquisition of the data; ELF, CD and SD were responsible for the analysis and interpretation of the data; ELF, CD and SD wrote the paper and had primary responsibility for the final content; and RM and JF were involved in providing detailed comments and revising the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2021.105319.

References

Allès, B., Péneau, S., Kesse-Guyot, E., Baudry, J., Hercberg, S., & Méjean, C. (2017). Food choice motives including sustainability during purchasing are associated with a healthy dietary pattern in French adults. *Nutrition Journal, 16*, 58. https://doi.org/10.1186/s12937-017-0279-9

Ares, G., de Saldamando, L., Giménez, A., Claret, A., Cunha, L. M., Guerrero, L., … Deliza, R. (2015). Consumers' associations with wellbeing in a food-related context: A cross-cultural study. *Food Quality and Preference, 40*, 304–315. https://doi.org/10.1016/j.foodqual.2014.06.001

Ares, G., & Deliza, R. (2010). Identifying important package features of milk desserts using free listing and word association. *Food Quality and Preference, 21*, 621–628. https://doi.org/10.1016/j.foodqual.2010.03.010

Baldassare, M., Bonner, D., Dykman, A., & Lopes, L. (2018). *Californians and the environment. PPIC statewide survey*. San Francisco, CA: Public Policy Institute of California.

Barone, B., Rodrigues, H., Nogueira, R. M., de Queiroz Guimarães, K. R. L., & Behrens, J. H. (2020). What about sustainability? Understanding consumers' conceptual representations through free word association. *International Journal of Consumer Studies, 44*, 44–52. https://doi.org/10.1111/ijcs.12543

Barosh, L., Friel, S., Engelhardt, K., & Chan, L. (2014). The cost of a healthy and sustainable diet – who can afford it? *Australian & New Zealand Journal of Public Health, 38*, 7–12. https://doi.org/10.1111/1753-6405.12158

Beechy, L., Galpern, J., Petrone, A., & Das, S. K. (2012). Assessment tools in obesity - psychological measures, diet, activity, and body composition. *Physiology & Behavior, 107*, 154–171. https://doi.org/10.1016/j.physbeh.2012.04.013

Bekker, G. A., Tobi, H., & Fischer, A. R. H. (2017). Meet meat: An explorative study on meat and cultured meat as seen by Chinese, Ethiopians and Dutch. *Appetite, 114*, 82–92. https://doi.org/10.1016/j.appet.2017.03.009

Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). In *Ucinet for windows: Software for social network analysis*. Harvard, MA: Analytic Technologies, 6.6.

Borgatti, S. P., & Halgin, D. S. (2013). Elicitation techniques for cultural domain analysis. In J. J. Schensul, & M. D. LeCompte (Eds.), *Specialized ethnographic methods: A mixed methods approach* (Vol. 4). Lanham: AltaMira Press.

Caulkins, D. D. (2004). Identifying culture as a threshold of shared knowledge: A consensus analysis method. *International Journal of Cross Cultural Management, 4*, 317–333. https://doi.org/10.1177/1470595804047813

Cheah, I., Sadat Shimul, A., Liang, J., & Phau, I. (2020). Drivers and barriers toward reducing meat consumption. *Appetite, 149*, Article 104636. https://doi.org/10.1016/j.appet.2020.104636

Corral-Terrazas, M., Martinez, H., Flores-Huerta, S., Duque, L. M., Turnbull, B., & Levario-Carrillo, M. (2002). [Beliefs and knowledge of a group of doctors about the nutritional management of the child with acute diarrhea]. *Salud Publica Mex, 44*, 303–314.

de Morais Sato, P., Lourenço, B. H., Silva, J., & Scagliusi, F. B. (2019). Food categorizations among low-income women living in three different urban contexts: The pile sorting method. *Appetite, 136*, 173–183. https://doi.org/10.1016/j.appet.2019.01.022

Dietary Guidelines Advisory Committee. (2020). *Scientific report of the 2020 dietary guidelines advisory commitee: Advisory report to the secretary of agriculture and the secretary of health and human services*. Washington, DC: U.S. Department of Agriculture, Agricultural Research Service.

Doherty, S., & Nelson, R. (2010). Using projective techniques to tap into consumers' feelings, perceptions and attitudes: Getting an honest opinion. *International Journal of Consumer Studies, 34*, 400–404. https://doi.org/10.1111/j.1470-6431.2010.00880.x

Fox, E. L., Pelto, G. H., Bar, H., Rasmussen, K. M., Young, S. L., Debrosse, M. G., … Pelletier, D. L. (2018). Capturing changes in HIV-infected breastfeeding mothers' cognitive processes from before delivery to 5 Months postpartum: An application of the pile-sorting technique in Haiti. *Current Developments in Nutrition, 2*, nzy017. https://doi.org/10.1093/cdn/nzy017

Fox, E. L., Pelto, G. H., Rasmussen, K. M., Debrosse, M. G., Rouzier, V. A., Pape, J. W., & Pelletier, D. L. (2018). Who knows what: An exploration of the infant feeding message environment and intracultural differences in Port-au-Prince, Haiti. *Maternal and Child Nutrition, 14*, Article e12537. https://doi.org/10.1111/mcn.12537

Fugard, A. J. B., & Potts, H. W. W. (2015). Supporting thinking on sample sizes for thematic analyses: A quantitative tool. *International Journal of Social Research Methodology, 18*, 669–684. https://doi.org/10.1080/13645579.2015.1005453

Garro, L. (1986). Intracultural variation in folk medical knowledge: A comparison between curers and noncurers. *American Anthropologist, 88*, 351–370. https://doi.org/10.1525/aa.1986.88.2.02a00040

Ghvanidze, S., Velikova, N., Dodd, T., & Oldewage-Theron, W. (2017). A discrete choice experiment of the impact of consumers' environmental values, ethical concerns, and health consciousness on food choices: A cross-cultural analysis. *British Food Journal, 119*, 863–881. https://doi.org/10.1108/BFJ-07-2016-0342

Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., … Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science, 361*, Article eaam5324. https://doi.org/10.1126/science.aam5324

Guenther, P. M., Jensen, H. H., Batres-Marquez, S. P., & Chen, C. F. (2005). Sociodemographic, knowledge, and attitudinal factors related to meat consumption in the United States. *Journal of the American Dietetic Association, 105*, 1266–1274. https://doi.org/10.1016/j.jada.2005.05.014

Guerrero, L., Claret, A., Verbeke, W., Vanhonacker, F., Enderli, G., Sulmont-Rossé, C., … Guàrdia, M. D. (2012). Cross-cultural conceptualization of the words Traditional and Innovation in a food context by means of sorting task and hedonic evaluation. *Food Quality and Preference, 25*, 69–78. https://doi.org/10.1016/j.foodqual.2012.01.008

Hardcastle, S. J., Thøgersen-Ntoumani, C., & Chatzisarantis, N. L. (2015). Food choice and nutrition: A social psychological perspective. *Nutrients, 7*, 8712–8715. https://doi.org/10.3390/nu7105424

Head, B. F., Dean, E., Flanigan, T., Swicegood, J., & Keating, M. D. (2015). Advertising for cognitive interviews: A comparison of facebook, craigslist, and snowball recruiting. *Social Science Computer Review, 34*, 360–377. https://doi.org/10.1177/0894439315578240

Hirvonen, K., Bai, Y., Headey, D., & Masters, W. A. (2020). Affordability of the EAT–Lancet reference diet: A global analysis. *Lancet Global Health, 8*, e59–e66.

Hoek, A. C., Pearson, D., James, S. W., Lawrence, M. A., & Friel, S. (2017). Shrinking the food-print: A qualitative study into consumer perceptions, experiences and attitudes towards healthy and environmentally friendly food behaviours. *Appetite, 108*, 117–131. https://doi.org/10.1016/j.appet.2016.09.030

Holsti, O. (1969). *Content analysis for the social sciences and humanities*. Reading, MA: Addison-Wesley.

Hough, G., & Ferraris, D. (2010). Free listing: A method to gain initial insight of a food category. *Food Quality and Preference, 21*, 295–301. https://doi.org/10.1016/j.foodqual.2009.04.001

International Food Information Council. (2019). *Food and health survey*. Washington, DC: International Food information Council Foundation.

IPCC. (2019). Summary for policymakers. In *Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable lab management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. Geneva, Switzerland: Intergovernmental Panel on Climate Change.

Kalra, N., Pelto, G., Tawiah, C., Zobrist, S., Milani, P., Manu, G., … Parker, M. (2018). Patterns of cultural consensus and intracultural diversity in Ghanaian complementary feeding practices. *Maternal and Child Nutrition, 14*, Article e12445. https://doi.org/10.1111/mcn.12445

Kruskal, J. B., & Wish, M. (1978). Multidimensional scaling. In E. Uslaner (Ed.), *Quantitative applications in the social sciences, Series 11*. Beverly Hills and London: SAGE Publications.

Lazzarini, G. A., Zimmermann, J., Visschers, V. H. M., & Siegrist, M. (2016). Does environmental friendliness equal healthiness? Swiss consumers' perception of protein products. *Appetite, 105*, 663–673. https://doi.org/10.1016/j.appet.2016.06.038

Lea, E., & Worsley, A. (2008). Australian consumers' food-related environmental beliefs and behaviours. *Appetite, 50*, 207–214. https://doi.org/10.1016/j.appet.2005.07.012

Libertino, L., Ferraris, D., López Osornio, M. M., & Hough, G. (2012). Analysis of data from a free-listing study of menus by different income-level populations. *Food Quality and Preference, 24*, 269–275. https://doi.org/10.1016/j.foodqual.2011.11.003

Lindeman, M., & Väänänen, M. (2000). Measurement of ethical food choice motives. *Appetite, 34*, 55–59. https://doi.org/10.1006/appe.1999.0293

Macdiarmid, J., & Blundell, J. (1998). Assessing dietary intake: Who, what and why of under-reporting. *Nutrition Research Reviews, 11*, 231–253. https://doi.org/10.1079/NRR19980017

Macdiarmid, J. I., Kyle, J., Horgan, G. W., Loe, J., Fyfe, C., Johnstone, A., & McNeill, G. (2012). Sustainable diets for the future: Can we contribute to reducing greenhouse gas emissions by eating a healthy diet? *American Journal of Clinical Nutrition, 96*, 632–639. https://doi.org/10.3945/ajcn.112.038729

Marteau, T. M. (2017). Towards environmentally sustainable human behaviour: Targeting non-conscious and conscious processes for effective and acceptable policies. *Philos Trans R Soc A, 375*. https://doi.org/10.1098/rsta.2016.0371, 20160371.

Monterrosa, E. C., Frongillo, E. A., Drewnowski, A., de Pee, S., & Vandevijvere, S. (2020). Sociocultural influences on food choices and implications for sustainable healthy diets. *Food and Nutrition Bulletin, 41*, 59S–73S. https://doi.org/10.1177/0379572120975874

Neff, R. A., Edwards, D., Palmer, A., Ramsing, R., Righter, A., & Wolfson, J. (2018). Reducing meat consumption in the USA: A nationally representative survey of attitudes and behaviours. *Public Health Nutrition, 21*, 1835–1844. https://doi.org/10.1017/S1368980017004190

Optimal Workshop Limited. (2019). In *OptimalSort*. Wellington, New Zealand: Optimal Workshop Limited.

Pelto, G. H., Jerome, N. W., & Kandel, R. F. (1980). Chapter 2: Methodological issues in nutritional anthropology. In N. W. Jerome, R. F. Kandel, & G. H. Pelto (Eds.), *Nutritional anthropology: Contemporary approaches to diet and culture* (pp. 1–6). New York: Redgrave Publishing Company.

QSR. (2017). In *NVivo qualitative data analysis software, Version 11. In (Version* (11 ed.). QSR International Pty Ltd.

Ranganathan, J., Vennard, D., Waite, R., Dumas, P., Lipinski, B., Searchinger, T., & GLOBAL AGRI-WRR Model Authors. (2016). *Shifting diets for a sustainable food future. . Working paper, installment 11 of Creating a sustainable food future*. Washington, DC: World Resources Institute.

Rojas-Rivas, E., Rendón-Domínguez, A., Felipe-Salinas, J. A., & Cuffia, F. (2020). What is gastronomy? An exploratory study of social representation of gastronomy and Mexican cuisine among experts and consumers using a qualitative approach. *Food Quality and Preference, 83*, Article 103930. https://doi.org/10.1016/j.foodqual.2020.103930

Romney, A. K., Batchelder, W. H., & Weller, S. C. (1987). Recent applications of cultural consensus theory. *American Behavioral Scientist, 31*, 163–177. https://doi.org/10.1177/000276487031002003

Rosenfeld, D. L., & Tomiyama, A. J. (2020). Taste and health concerns trump anticipated stigma as barriers to vegetarianism. *Appetite, 144*, 104469. https://doi.org/10.1016/j.appet.2019.104469

Ross, J. L., Laston, S. L., Pelto, P. J., & Muna, L. (2002). Exploring explanatory models of women's reproductive health in rural Bangladesh. *Culture, Health and Sexuality, 4*, 173–190. https://doi.org/10.1080/13691050110096189

Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018). *Creating a sustainable food future: Synthesis report*. Washington, DC: World Resources Institute.

Siegrist, M., & Hartmann, C. (2020). Consumer acceptance of novel food technologies. *Nature Food, 1*, 343–350. https://doi.org/10.1038/s43016-020-0094-x

Smith, J. J., & Borgatti, S. P. (1997). Salience counts—and so does accuracy: Correcting and updating a measure for free-list-item salience. *Journal of Linguistic Anthropology, 7*, 208–209. https://doi.org/10.1525/jlin.1997.7.2.208

Sobal, J., & Bisogni, C. A. (2009). Constructing food choice decisions. *Annals of Behavioral Medicine, 38*, s37–s46. https://doi.org/10.1007/s12160-009-9124-5

Stoll-Kleemann, S., & Schmidt, U. J. (2017). Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: A review of

influence factors. *Regional Environmental Change, 17*, 1261–1277. https://doi.org/10.1007/s10113-016-1057-5

Sturrock, K., & Rocha, J. (2000). A multidimensional scaling stress evaluation table. *Field Methods, 12*, 49–60. https://doi.org/10.1177/1525822X0001200104

Sutrop, U. (2001). List task and a cognitive salience index. *Field Methods, 13*, 263–276. https://doi.org/10.1177/1525822X0101300303

Tumilowicz, A., Neufeld, L. M., & Pelto, G. H. (2015). Using ethnography in implementation research to improve nutrition interventions in populations. *Maternal and Child Nutrition, 11*(Suppl 3), 55–72. https://doi.org/10.1111/mcn.12246

USDA. (2018). *Meat animals production, disposition, and income. 2017 summary*. Washington, DC: United States Department of Agriculture, National Agricultural Statistics Service.

Weller, S. C., & Romney, A. K. (1988). *Systematic data collection. Qualitative research methods* (Vol. 10). Newbury Park and London: Sage.

Wencélius, J., Garine, E., & Raimond, C. (2017). *FLARES v1.0*.

Wilhite, D. A., & Morrow, K. (2016). *The implications of climate change for Nebraska: Summary report of sector-based roundtable discussions*. Lincoln, NE: School of Natural Resources, University of Nebraska.

Willett, W., Rockstrom, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., … Murray, C. J. L. (2019). Food in the anthropocene: The EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet, 393*, 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4