*Research Article*

# Lay Perceptions of Healthy Eating Styles and Their Health Impacts

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## ABSTRACT

**Objective:** This study examined perceptions of healthy eating styles among US respondents to determine whether eating styles are defined as a distinct set of people's healthy eating beliefs and how different aspects of eating styles are perceived to affect health.

**Design:** In-person pile sort activities were used to identify key dimensions of healthy eating beliefs, and online surveys were used to confirm these dimensions and examine perceived health benefits of healthy eating styles.

**Participants:** The pile-sorting activity recruited 48 US participants in the Phoenix metropolitan area via social media and snowball sampling. Online surveys recruited US participants via Amazon Mechanical Turk (survey 1, n = 70; survey 2, n = 283).

**Analysis:** The researchers used an exploratory visualizing technique (multidimensional scaling) to analyze pile sort data; Property Filling (PROFIT) analysis was used to analyze online survey 1; paired sample *t* test and repeated-measures ANOVA were used to analyze online survey 2.

**Results:** Eating styles are a distinct set of beliefs within lay models of healthful diets ($P < .001$) viewed as important for a number of health outcomes, including weight management.

**Conclusions and Implications:** In addition to educating the public about choosing healthy food characteristics, health and nutrition professionals may need to address people's beliefs regarding healthy eating styles to identify gaps and misconceptions. Future research is needed to examine the relationships between such beliefs and corresponding behaviors, as well as whether these behaviors result in any health benefits.


**Key Words:** eating styles, healthy eating perception, lay beliefs, mindful eating, food characteristics, chronic disease prevention (*J Nutr Educ Behav*. 2018;■■:■■–■■.)

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## INTRODUCTION

Perceived healthiness is a key factor shaping eating preferences.[1,2] People's views can differ in their interpretations of what a healthful diet is[3] and numerous studies have examined people's theories of what counts as healthy eating.[4,5] Such lay theories are so sufficiently important for policy that the US Food and Drug Administration requested public comments on definitions of healthiness in food labels to develop guidelines reflecting both current science and public concerns on the topic.[6]

Most work on understanding lay perceptions of dietary healthiness provides detailed information on what people think is good to eat rather than how one should eat it.[5] Yet eating is a patterned activity embedded in context, resulting in various ways of eating.[7] The current study refers to these 2 domains of beliefs as food characteristics (what to eat) and eating styles (how to eat it). The few studies that examined public views of eating styles suggested that such beliefs are an important part of people's mental models of healthy eating.[8] For example, Bisogni and colleagues[4] reviewed a number of qualitative studies in North America, Europe, and Australia and noted several such beliefs, including the importance of regular meals, having balance, and practicing moderation in one's diet. In addition, pacing of eating (eg, eat slowly), proper food intake patterns (eg, always having breakfast), and social and emotional considerations (eg not eating to alleviate negative emotion) are important eating norms for Americans.[9] Although people conceptualize healthy eating in terms of both eating styles and food characteristics, it is not known whether people classify these as different kinds of beliefs within their models of health-

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ful diets. In addition, for eating styles, it is not known in which ways they are perceived to affect health. Some work suggests that certain eating styles (eg, eating late at night) are popularly believed to cause weight gain, but such discussions were based on examining health-focused websites.[10] The current study thus addressed (1) whether beliefs about eating styles are viewed as a distinct set of healthy eating beliefs, and (2) how different aspects of eating styles are perceived to affect health.

## METHODS

### Overall Study Design

To address these research questions, the study involved 3 rounds of data collection: an in-person pile sort activity (n = 48) and 2 online surveys (survey 1, n = 70; and survey 2, n = 283). For the pile sort activity, 48 participants were recruited to identify dimensions of healthy eating beliefs. Online survey 1 was used to validate these dimensions with a simple online questionnaire. Online survey 2 examined how individuals perceive the health importance of different aspects of eating styles.

### Recruitment

*Pile sort activity.* Recruitment was completed in the Phoenix metropolitan area via social media and snowball sampling through undergraduate research assistants at Arizona State University (ASU) assigned to the project (n = 7). Short study descriptions were posted on Facebook, Twitter, and Instagram with the primary investigator's contact information. In addition, assistants recruited classmates at ASU from a variety of departments: anthropology, geography, law, and business administration. Finally, assistants asked participants to share study information with a friend or family member who was not a current student at ASU. Exclusion criteria were not having been born in the US, not being a US citizen, and being aged ≤18 years. Each participant was presented with the study information letter. Reading the letter and agreeing to the pile sort activity constituted informed consent. At the end of the activity, participants filled out a short demographic survey collecting information on age, gender, education level, student status, and employment. Each participant received a $5 gift card for participation.

*Online surveys.* Online survey participants were recruited via Amazon's Mechanical Turk website (https://www.mturk.com; MTurk, Seattle, WA),[11] a crowdsourcing system in which surveys and tasks are given to anonymous participants or workers for a completion fee ($0.35 for survey 1 and $0.45 for survey 2). MTurk respondents have been shown to be more diverse than typical US college-based samples, and MTurk data have been shown to have scale reliabilities comparable to data collected with traditional recruitment methods.[11] Study instructions informed participants that completing the survey constituted consent to participate. Online surveys also collected demographic information as well as education level. The online surveys included an attention test (a multiple choice question that, in its description, instructs participants to skip it if they are paying attention). If participants failed to pass it (by answering the question anyway), their surveys were excluded from analysis. Finally, any surveys completed in <3 minutes were excluded from analysis, because such completion time was deemed unrealistically short. Table 1 presents sample characteristics for both the pile sort activity and online surveys.

**Table 1.** Sample Demographics From 3 Stages of Data Collection

| Variable | Pile Sort Activity | Online Survey 1 | Online Survey 2 |
|---|---|---|---|
| n | 48 | 70 | 283 |
| Age, y (mean [SD]) | 29.3 (14) | 34.7 (11.8) | 35.8 (11.5) |
| Females | 52% | 55% | 55% |
| Body mass index, kg/m$^2$ (mean [SD]) | 24.6 (5.3) | 26 (10.7) | 26.7 (7.3) |
| College degree or higher | 50% | 58% | 58% |
| Try to lose weight | 29% | 49% | 50% |

Note: Data collection tested (1) whether eating styles were viewed as a distinct set of healthy eating beliefs, and (2) how different aspects of eating styles were perceived to affect health.
Participants for the pile sorting activities were recruited in Phoenix, AZ. Participants for online surveys 1 and 2 were recruited via Amazon Mechanical Turk.

### Instrument Development

*Pile sort activity.* The in-person pile sorting activity used 42 statements about eating (printed on cards) derived from past interviews on healthy eating interpretations[12] and other studies[9,13] with the goal of reflecting variation in beliefs. These statements mentioned different aspects of food characteristics (eg, it is important to eat foods low in fat; it is important to eat foods that are whole and not processed) as well as eating styles (eg, it is important to avoid eating late in the day; it is important not to be distracted when eating). Respondents were instructed to group the cards in as many mutually exclusive piles as they wished so that statements that were similar to each other were in the same pile and those less similar were in different piles.[14] These similarities and differences were later mapped in a 2-dimensional space (using multidimensional scaling [MDS]) to examine the average judged similarity between different healthy eating beliefs. The sample size (n = 48) was well above n = 15, which is considered the minimum number for this method of qualitative research.[15]

*Online survey 1.* To assess the meaning of MDS-derived dimensions, online survey participants (n = 70) were

recruited via MTurk. The goal of the survey was to assess whether dimensions identified with the explorative MDS procedure aligned with people's perceptions of food and eating style dimensions. Online participants were asked to read the 42 statements that were used in the pile sort activity and rate to which degree they thought each statement represented (1) eating styles, (2) food characteristics, and (3) sound advice about healthy eating (5-point Likert scales from 1 = not at all to 5 = a great deal). Specific questions asked were: (1) *For each statement, to what degree do they focus on how food is eaten? (eg, one's patterns and habits of eating)*; (2) *For each statement, to what degree do they focus on the characteristics of the foods one might eat? (eg, anything related to the food products themselves)*; (3) *For each statement, to what degree do they represent sound healthy eating advice? Here, we ask about your personal opinion: what* you *think is good advice*. The separate group of respondents needed to verify dimensions observed from pile sort data could be as small as n = 24,[16] which made the current sample of n = 70 sufficiently large for this study.

*Online survey 2*. To address how different aspects of eating styles are perceived to affect health, another online survey was conducted via MTurk (n = 283). Respondents read 26 statements derived from the original list of 42. The final list of 26 included statements that participants in survey 1 had highly rated as clearly either an eating style or a food characteristic (but not both). Statements with which pile sort participants strongly disagreed were also eliminated from the original 42, because participants' open-ended answers[17] indicated that those statements did not make sense to them. Thirteen statements represented the food characteristics category of beliefs scoring high on the food characteristic attribute in survey 1. Another 13 statements represented the eating styles category of beliefs scoring high on the eating styles attribute in survey 1. Participants were then asked to indicate whether they thought each statement was important for specific health outcomes: having a healthy weight, preventing chronic health problems, feeling energetic, and having good digestion. Alternatively, the respondent could choose the exclusive *not important for health at all* outcome. This list of health outcomes was derived from previous work[4] on healthy eating beliefs. Respondents could select as many relevant outcomes as applied to each statement. The sample size was chosen to have a 95% confidence level with a 6% margin of error on proportion endorsing each statement.

## Data Analysis

*Pile sort activity*. To map statements in relation to each other based on how people sorted them into similar piles, the researchers used MDS, a visualization technique for representing the overall perceived similarity and difference between statements in a 2-dimensional space.[18] The MDS was applied to a statement-by-statement similarity matrix that averages the number of times a pair of items was placed in the same pile across all respondents. For 42 items, a stress statistic < 0.35 is considered a good fit,[19] meaning that 2 dimensions are adequate for portraying the complex relationships accurately among a set of items.

*Online survey 1*. The validity of the MDS-derived dimensions was assessed by using a property fitting technique, PROFIT,[20] which compares the MDS-derived dimensions (pile sort activity) with rater assessments (online survey 1) of how each of the 42 statements represents (1) eating styles, (2) food characteristics, and (3) sound advice about healthy eating (5-point Likert scales from 1 = not at all to 5 = a great deal). To compare the independently obtained attribute ratings with MDS dimensions, PROFIT analysis fits a multiple regression using each statement's coordinates on the MDS map (result of the pile sort activity in the Figure) as an independent variable, and the attribute ratings (from online survey 1) as a dependent variable. PROFIT runs a separate regression for each of the 3 attributes (eating styles, food characteristics, and sound advice) and provides 2 key outputs for each: a multivariate coefficient ($R^2$) statistic and direction cosines (the 3 arrows in the Figure). The $R^2$ statistic demonstrates how strongly MDS coordinates predict attribute ratings from online survey 1, whereas the cosines show along which direction an attribute increases. According to Kruskal and Wish,[17] judgments that have high correlations with MDS dimensions ($R^2$ of >.9) or those significant beyond the .01 level are considered reliable in interpreting the MDS structure. PROFIT analysis was performed in UCINET 6 for Windows (version 6.625; Borgatti S, Everett M, Freeman L; Columbia, SC; 2016).

*Online survey 2*. The percentage of statements about eating styles endorsed as important for each of 5 outcomes was calculated (weight, prevention, energy, digestion, and not important). As a point of comparison, these percentages were compared with the percentage of statements about food characteristics endorsed as important for these health outcomes (Table 2). Analysis then focused on statements pertaining to the distinct aspects of healthy eating styles, which were grouped into 3 subgroups or themes: pattern of food intake (5 statements; Cronbach $\alpha = .8$), time of intake (4 statements; Cronbach $\alpha = .8$), and mindfulness during intake (4 statements; Cronbach $\alpha = .7$). The 3 themes were derived from prior healthy eating surveys with online US participants using exploratory factor analysis.[21] The pattern of food intake theme included the following statements: eat breakfast, do not skip meals, eat small meals often, eat 3 main meals, and do not snack between meals. Time of intake included: do not eat before bedtime, do not eat late in the day, have set times for meals, and do not snack in the evenings. Statements in the mindfulness theme included: do not rush when eating, chew food slowly, be relaxed/in a good mood, and do not be distracted while eating. Table 2 summarizes the average proportion of statements endorsed as important in terms of the 5 health outcomes. Paired-sample *t* tests assessed whether individuals differed in the proportion of eating style and food characteristic statements they endorsed as influencing each of the 5 health outcomes (mean endorsement

value is reported in Table 2 as proportions). To assess whether endorsement of health outcomes differed by the 3 statement subgroups (themes) within the eating styles category, the researchers performed a repeated-measures ANOVA. Paired-sample *t* tests were used to assess pairwise differences in endorsements among 3 kinds of eating styles. The researchers employed $P = .005$ as the cutoff for statistical significance and Cohen δ as a measure of effect size to distinguish among small (<0.2), medium (0.2–0.5), and large effect sizes (>0.8).[22]

This work was approved by the Arizona State University Institutional Review Board as an exempt study. Implied consent was obtained by participating in study activities after reading the information letter.

## RESULTS

### Sample Characteristics

Table 1 contains sample characteristics for the 3 studies. For the pile sort activity, 50% of respondents were current undergraduate students. For online survey 1, 3 participants were dropped owing to unrealistically fast completion times (<3 minutes). For online survey 2, analysis included 283 responses (out of 300), because 17 respondents failed the attention check. Data were available for all 48 pile sort participants.

*Are eating styles viewed as a distinct set of healthy eating beliefs?*. The MDS visual representation of the pile sort results (Figure) shows a distinction between statements about eating styles and statements about food characteristics along the horizontal axis: statements to the left of the vertical axis represent food characteristics whereas those to the right are examples of eating styles. The vertical axis appears to represent endorsement as sound healthy eating advice. Thus, statements above the horizontal axis represent what respondents viewed as sound healthy eating advice whereas statements below the horizontal axis are perceived to be poor healthy eating advice. Thus, the 2 dimensions appear to reflect (1) the degree to which a statement represents people's perceptions of sound healthy eating advice (which increases along the vertical axis), and (2) the degree to which a statement focuses on how one should eat vs what one

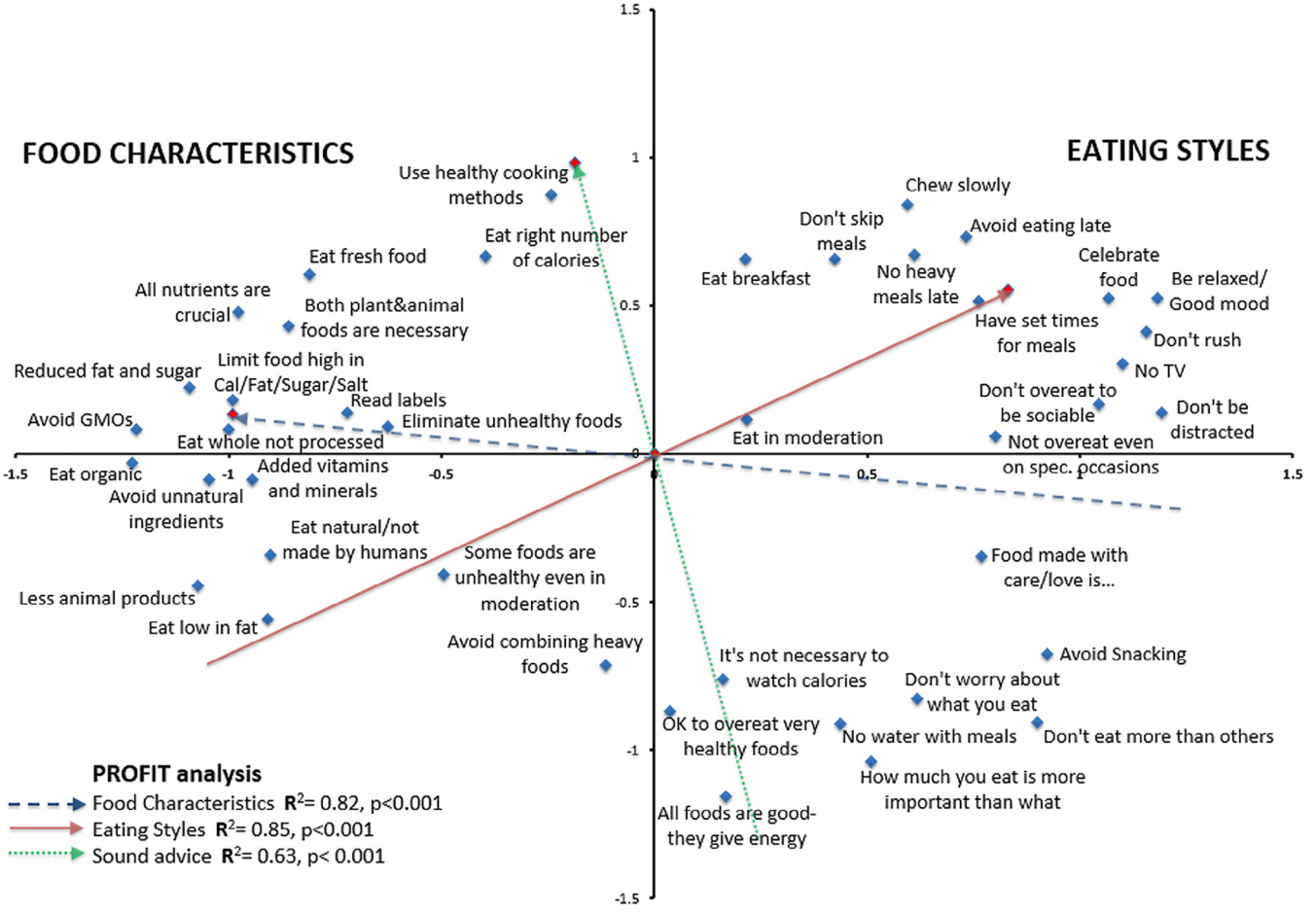


**Figure.** Nonmetric multidimensional scaling (MDS) representation of the similarities and distances among the 42 statements on healthy eating. The stress statistic measures MDS goodness-of-fit. Property Filling (PROFIT) analysis used multiple regression to confirm MDS dimensions. Statements to the left of the vertical axis represent beliefs about healthy food characteristics, whereas statements to the right of the vertical axis represent beliefs about healthy eating styles. Statements above the horizontal axis represent beliefs considered to be sound healthy eating advice, whereas statements below the horizontal axis were those considered to be less sound by participants. $R^2$ indicates multivariate coefficient.

should eat (which increases along the horizontal axis). The 2-dimensional MDS solution was a good fit with the low stress level of .16.[19]

The 3 arrows on the 2-dimensional MDS map are results of the PROFIT analysis (online survey 1). The first arrow or vector, which represents online participants' rating (n = 70) of the statement as pertaining to food characteristics, begins on the right side of the MDS map (Figure) with statements least focused on specifics of the foods, and ends on the far left of the MDS with statements strongly focused on what one eats ($R^2 = .82$; $P < .001$). The second vector (which represents online participants' rating of statement as pertaining to eating styles) begins in the lower left corner of the MDS map (Figure) with statements least representing how one eats foods and ends in the top right of the map with statements most focused on styles of eating ($R^2 = .85$; $P < .001$). Finally, the sound advice vector begins with the least sound healthy eating advice at the bottom of the MDS (Figure) and statements judged to be the best advice on the top ($R^2 = .63$; $P < .001$). Importantly, in this sample the ratings of eating styles were strongly and negatively correlated with the ratings of food characteristics ($R^2 = .52$; $P < .001$). PROFIT analysis demonstrated reliable fit to the MDS structure; these analyses validated respondents' differentiation between statements based on (1) food characteristics and (2) eating styles.

*How do people judge the importance of styles of healthy eating for health?.* In online survey 2 (Table 2), participants endorsed the following outcomes significantly more for food characteristics statements than for eating styles statements: weight management (food characteristics: mean = 0.58, SD = 0.26; eating styles: mean = 0.45, SD = 0.25; $t[282] = 8.8$, $P < .001$, Cohen $\delta = .52$) and preventing disease (food characteristics: mean = 0.57, SD = 0.26; eating styles: mean = 0.18, SD = 0.22; $t[282] = 22.4$, $P < .001$, Cohen $\delta = 1.56$). Respondents endorsed good digestion significantly more for eating styles statements (food characteristics: mean = 0.31, SD = 0.26; eating styles: mean = 0.43, SD = 0.24; $t[282] = -7.8$, $P < .001$, Cohen $\delta = .47$). Finally, participants viewed statements on eating styles as significantly less important for health overall (food characteristics: mean = 0.17, SD = 0.19; eating characteristics: mean = 0.24, SD = 0.22; $P < .001$, Cohen $\delta = .34$).

*How are different aspects of eating styles perceived to affect health?.* Table 2 also shows the proportion of statements in each of the 3 eating style themes (pattern of intake, time of intake, and mindfulness) that were endorsed as important for the 5 health outcomes. Statements from the 3 themes were not rated equally on affecting weight ($F_{2,564} = 107.1$; $P < .001$), prevention ($F_{2,564} = 22.7$; $P < .001$), digestion ($F_{2,564} = 60.2$; $P < .001$), energy ($F_{2,564} = 258.5$; $P < .001$), and not being important for health ($F_{2,564} = 17.1$; $P < .001$). Pattern of intake statements included: eat breakfast, do not skip meals, eat small meals often, eat 3 main meals, and do not snack between meals. Weight management (55%) and feeling energetic (49%) were the top 2 important health outcomes reported for these aspects of eating styles (Table 2). Pattern of intake was also viewed as significantly more important for preventing disease than both the time of eating (pattern: mean = 0.24, SD = 0.28; time: mean =0.17, SD = 0.26; $t[282] = 5.4$, $P < .001$) and mindfulness (mindful: mean = 0.15, SD = 0.25); $t[282] = 6$, $P < .001$). Time of intake included: do not eat before bedtime, do not eat late in the day, have set times for meals, and do not snack in the evenings. These statements were endorsed most for weight management (55%) and, to a lesser extent, for good digestion (40%). Statements in the mindfulness theme included: do not rush when eating, chew food slowly, be relaxed/in a good mood, and do not be distracted while eating.

**Table 2.** Proportion of Statements That Online Participants Endorsed as Important for Various Health Outcomes Within the 2 Major Categories and 3 Eating Styles Themes

| Groups of Statements | Weight | Digestion | Energy | Prevention | Not Important |
|---|---|---|---|---|---|
| Food characteristics (%) | 58.5* | 31.4* | 28.5 | 57.5* | 17.2* |
| Eating styles (%) | 45.3 | 43.1 | 25.8 | 18.6 | 24.3 |
| Pattern of intake theme | 54.7* | 33.0* | 48.7* | 24.2* | 18.7* |
| Time of intake theme | 55.1 | 40.4 | 16.9 | 16.6 | 24.3 |
| Mindfulness theme | 26.3 | 55.9 | 11.9 | 15.1 | 30 |

*$P \leq .005$.

Note: n = 283. The 2 major food categories were food characteristics and eating styles. Pattern of intake theme statements included: eat breakfast, do not skip meals, eat small meals often, eat 3 main meals, and do not snack between meals. Statements comprising the time of intake theme were: do not eat before bedtime, do not eat late in the day, have set times for meals, and do not snack in the evenings. Statements comprising the mindfulness theme were: do not rush when eating, chew food slowly, be relaxed/in a good mood, and do not be distracted while eating.

Differences between mean endorsement of food characteristics and eating styles were tested with a paired sample *t* test. Any difference between mean endorsement of the 3 kinds of eating style statements was tested with repeated-measures ANOVA.

Having good digestion received the highest endorsement for this theme (56%). Finally, mindfulness was viewed as significantly less important for weight management than both the time of eating (mindful: mean = 0.26, SD = 0.31; time: mean = 0.55, SD = 0.36; $t[282] = -11.9$, $P < .001$, Cohen $\delta = .86$) and pattern of intake (pattern: mean = 0.55, SD = 0.32); $t[282] = -12.2$, $P < .001$, Cohen $\delta = .92$). It was also viewed as significantly more unimportant for overall health than both the time of eating (mindful: mean = 0.3, SD = 0.31; time: mean = 0.24, SD = 0.32; $t[282] = 2.65$, $P = .008$, Cohen $\delta = .2$) and pattern of intake (pattern: mean = 0.19, SD = 0.24); $t[282] = 5.54$, $P < .001$, Cohen $\delta = .4$).

## DISCUSSION

This study demonstrates that respondents perceive eating styles (or how one should eat) as distinct from food characteristics (what one should eat) when considering healthy eating. Whereas previous work showed that people's understanding of healthy eating includes both aspects of food characteristics and eating styles,[9] the current work confirmed the distinction between the 2 sets of beliefs.

In terms of overall importance for health, statements related to eating styles were viewed as significantly less important than those related to food characteristics; this result was anticipated because food characteristics are the primary focus of the Dietary Guidelines for Americans[23] and nutrition research.[24] Participants viewed healthy eating styles as particularly less important for preventing disease. Because much of nutrition research examines the association of specific foods and nutrients with chronic disease risk (cancer, diabetes, and cardiovascular disease),[24] aspects of eating styles might appear to be less salient for disease prevention in comparison. However, nutrition work is currently focusing more on the health implications of behaviors related to eating styles, providing preliminary evidence for their importance in human disease development.[25-27] Because such research receives much public attention, beliefs about healthy eating styles might also become highly salient in people's mental models of healthy eating. Specifically, there has been an increase in human research on the timing of food intake and markers of disease risk such as glucose tolerance[28,29]; thus it is possible that people's endorsement of the disease prevention outcome may increase for this eating style theme.

Past work suggests that some beliefs related to eating styles are popularly considered to influence weight management, such as having a regular eating schedule and avoiding eating late at night.[10] Results of the current study confirmed that respondents perceived managing weight to be an important health outcome of eating styles. The link between styles of food consumption and weight was previously explored; some authors[30] proposed that changing public beliefs about how (not just what) one should eat might be crucial in addressing the obesity epidemic (eg, decreasing the acceptance of snacking and promoting the importance of the traditional 3-meal pattern of food intake). Because people already hold beliefs about how eating styles affect their health, it is important to examine this category of beliefs in relation to existing nutrition work, identify gaps and misconceptions, and improve people's understanding about the topic. Based on current findings, at least 2 themes of beliefs about eating styles might merit attention: time of eating and mindfulness during food consumption. Although this sample of respondents placed low importance on time of intake for disease prevention, other work provided support for the notion that the time at which one eats can influence both weight and disease risk by reducing glucose tolerance and increasing blood pressure.[29] In terms of behaviors related to the mindfulness eating style theme, distractions during eating can increase food intake by up to 60%[31] or even as high as 75%[32]; this suggests that mindfulness can have important implications for weight control yet not be perceived as important by the public.

The study had important limitations. The results may not be generalizable to the US population because the sample was limited to highly educated online participants and Phoenix area residents selected via convenience sampling.

## IMPLICATIONS FOR RESEARCH AND PRACTICE

The current findings can be instrumental in building successful nutrition education strategies and public health interventions by highlighting the need for targeting beliefs about eating styles and food characteristics. Because there is evidence for health implications of various eating styles, informing patients and correcting their misconceptions about the ways in which food is best consumed can be important elements of health promotion and obesity prevention efforts.

More research is needed to understand how perceptions of healthy eating styles differ among respondents of diverse racial and socioeconomic backgrounds as well as greater age range. Future work also needs to explore healthiness perceptions of other elements of eating styles, such as the importance of social situations (eg, when eating with family and friends), because lay models of healthy eating may include aspects other than patterns, time, and mindfulness that were examined here. Another important research direction is to examine lay rationale behind beliefs about healthy eating styles and understand why people think ways of eating influence health. Finally, it is necessary to study whether beliefs about the importance of healthy eating styles translate into behaviors, and whether such behaviors result in health benefits (eg, improved quality of life, healthy body mass index).

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## CONFLICT OF INTEREST

The authors have not stated any conflicts of interest.