HHS Public Access

Author manuscript

Prev Med. Author manuscript; available in PMC 2017 September 01.

Published in final edited form as:

Prev Med. 2016 September ; 90: 184–192. doi:10.1016/j.ypmed.2016.06.030.

Importance of taste, nutrition, cost and convenience in relation to diet quality: Evidence of nutrition resilience among US adults using National Health and Nutrition Examination Survey (NHANES) 2007–2010

Anju Aggarwal[*], **Colin D. Rehm**, **Pablo Monsivais**, and **Adam Drewnowski**

University of Washington, Dept. of Epidemiology & Center for Public Health Nutrition, 327 Raitt Hall, 98195 Seattle, WA, United States

Abstract

Concerns with taste, nutrition, cost, and convenience are said to be key influences on food choices. This study examined the importance of food-related attitudes in relation to diet quality using US national level data. Interactions by socioeconomic status (SES), gender and race/ethnicity were tested. Analyses of 8957 adults from National Health and Nutrition Examination Survey (NHANES 2007–2010) were conducted in 2014–15. Perceived importance of taste, nutrition, cost, and convenience in dietary choices were assessed using 4-point Likert scales. Education and family income-to-poverty ratio (FIPR) were SES indicators. Healthy Eating Index (HEI-2010), a measure of adherence to 2010 dietary guidelines, was the diet quality measure. Survey-weighted regressions examined associations between attitudes and HEI, and tested for interactions. Taste was rated as "very important" by 77.0% of the US adults, followed by nutrition (59.9%), cost (39.9%), and convenience (29.8%). However, it was the perceived importance of nutrition that most strongly predicted HEI (β: +8.0 HEI scores among "very important" vs. "not at all important"). By contrast, greater importance for taste and convenience had a weak inverse relation with HEI (β: −5.1 and −1.5 respectively), adjusting for SES. Significant interactions were observed by race/ethnicity, but not SES and gender. Those who prioritized nutrition during food shopping had higher-quality diets regardless of gender, education and income in the US. Certain racial/ethnic groups managed to eat healthy despite attaching importance to cost and convenience. This is the first evidence of nutrition resilience among US adults using national data, which has huge implications for nutrition interventions.

[*]Corresponding author: anjuagg@u.washington.edu (A. Aggarwal).

Transparency Document

The Transparency document associated with this article can be found, in online version.

Authors' contributions: AA was involved in study planning, implementation, and led data analyses, data interpretation, and manuscript writing. AD led the study and assisted in data interpretation and manuscript writing. CDR assisted in data analysis, interpretation of results, and manuscript writing. PM was involved in study planning, implementation, and assisted in data interpretation and manuscript writing. All of the authors read and approved the final manuscript.

Conflicts of interest: AD has received grants, honoraria, and consulting fees from numerous food, beverage, and ingredient companies and from other commercial and nonprofit entities with an interest in diet quality and nutrient density of foods. The University of Washington receives research funding from public and private sectors. AA, CDR, and PM have no conflicts of interest to declare.

Keywords

Food-related attitudes; Attitudes during food shopping; Importance of nutrition; Importance of taste; Importance of cost; Importance of convenience; Diet quality; NHANES; Nutrition resilience; HEI

1. Introduction

Taste, cost, convenience, and nutritional value are among the key influences on food choices. The most widely-cited evidence, from two decades ago, reported taste as the most important influence followed by cost (Glanz et al., 1998). Nutrition rated lower on the importance scale.

Food-related attitudes have been known to affect diet quality (Beydoun and Wang, 2008a, 2008b; Le et al., 2013; Acheampong and Haldeman, 2013; Traill et al., 2011; Turrell and Kavanagh, 2006; Gittelsohn et al., 2006). For example: In the US Continuing Survey of Food Intake by Individuals (CSFII 1994–96), perceived value of cost over nutrition was associated with lower quality diets and higher consumption of fats, added sugars and sodium, and vice a versa (Beydoun and Wang, 2008a). Those Finnish adults who rated healthfulness over price and convenience consumed more fruit and vegetables and less energy-dense foods (Konttinen et al., 2012). Similar associations between nutrition-related attitudes, food purchasing behaviors (Turrell and Kavanagh, 2006; Gittelsohn et al., 2006), and other diet quality measures were observed in small-scale studies in France (Le et al., 2013), the UK (Traill et al., 2011), Australia (Turrell and Kavanagh, 2006), Finland (Konttinen et al., 2012), and the US (Gittelsohn et al., 2006; Pelletier et al., 2013; Aggarwal et al., 2014).

Arguably, prioritizing healthy eating to the exclusion of any concerns with cost and convenience is a privilege of the more affluent (Darmon and Drewnowski, 2008). It is already well-established that diet quality follows a social gradient, improving with both education and incomes (Beydoun and Wang, 2008b; Le et al., 2013; Turrell and Kavanagh, 2006; Wardle et al., 2000; Wang and Chen, 2011; Miura and Turrell, 2014). However, one question that is worth exploring is whether positive food-related attitudes exist among lower socioeconomic groups and racial/ethnic minorities, and how does it improve diet quality despite their economic and physical accessibility constraints (Beydoun and Wang, 2008b; Acheampong and Haldeman, 2013; Aggarwal et al., 2014; Williams et al., 2010; Moser et al., 2005). The answer may have important implications for the targeting of nutrition education programs.

The purpose of the present study was: a) to examine the prevalence of the importance of taste, cost, convenience, and nutrition in the US population using a representative sample of US adults (NHANES 2007–10); b) to examine the role of key food-related attitudes as influencers of diet choices using Healthy Eating Index (HEI 2010) score; c) and to examine whether the associations between attitude measures and HEI-2010 persist among lower SES and racial/ethnic strata. To our knowledge, this is the first attempt to examine the impact of food-related attitudes on diet quality across different population subgroups in the US.

2. Methods

2.1. Study population

The National Health and Nutrition Examination Survey (2007–2008 and 2009–2010) was the primary data source (Centers for Disease Control and Prevention CDC, 2016a). National Center for Health Statistics (NCHS) provided IRB approvals (Centers for Disease Control and Prevention CDC, 2016b). NHANES data are publicly available on the NCHS website (Centers for Disease Control and Prevention CDC, 2016c) and are exempt from IRB review per University of Washington policies.

For the present study, the sample was restricted to adults (age ≥ 20), who completed a valid 24-hour recall and responded to questions about food-related attitudes. 24-hour recall is the primary dietary data collection tool in NHANES. The final sample consisted of 8957 adults. The response rate for adults was ~74.4% for both the cycles. All analyses utilized survey weights to account for non-response and over-sampling, and the results are representative of the US adult population. Data analyses were conducted in 2014–15.

2.2. Socio demographic measures

NHANES database provides sociodemographic information, including age, gender and race/ethnicity. For analyses, the age variable was categorized into: 20–34, 35–49, 50–64, and ≥65 years. Race/ethnicity was coded in 5 categories: Non-Hispanic Whites, Non-Hispanic Blacks, Mexican Americans, other Hispanics, and other race. SES indicators were education and family income-to-poverty ratio (FIPR). Education was categorized in four groups: <high school, high school graduate or equivalent, some college and ≥college. FIPR is calculated based on federal poverty level and is adjusted for household size using the standard procedures by NHANES (USHHS Poverty guidelines, 2009; NHANES data documentation, 2011). Federal poverty level for a family of 2 in 2010 was $14,570. A family of 2 with an income of $29,140 would have a FIPR of 2.0. FIPR was categorized in four groups (<130%, 131–184%, 185–399% and ≥400%). Those with FIPR of <130% are generally eligible for the Supplemental Nutrition Assistance Program (SNAP) and Women Infants and Children (WIC) program, while those with a FIPR of 130–184% are generally eligible for WIC, but not SNAP.

2.3. Food-related attitude measures

The in-person Consumer Behavior Questionnaire and a Consumer Behavior Phone Follow-up Module were first added to NHANES in 2007–2008. Participants were asked about the key influences on food purchase behaviors. The question was: “When you buy food from a grocery store or supermarket, how important is *nutrition*?” Responses were obtained on 4-point Likert scale (very important, somewhat important, not too important, not at all important). Exactly the same question was repeated to collect data on *taste*, *price* and *ease of food preparation*. For analysis, responses were re-coded into 3 categories based on the distribution of data obtained (very important, somewhat important, not too important/not at all important).

2.4. Diet quality measures

The NHANES 24-h recall uses a multi-pass method, where respondents report the types and amounts of all food and beverages consumed in the preceding 24-h. The first NHANES recall is completed in-person at the Mobile Examination Center with a trained interviewer. The second one is completed over the telephone some days later. For the current study, data from the first 24-hour recall was used.

2.4.1. Healthy Eating Index (HEI 2010)—HEI-2010 is an energy-adjusted measure of conformance to the 2010 Dietary Guidelines for Americans (Guenther et al., 2014). Adequacy scores (with higher scores reflecting higher consumption) were total vegetables (5 points), greens and beans (5 points), total fruit (5 points), whole fruit (5 points), whole grains (10 points), dairy (10 points), total protein foods (5 points), seafood and plant proteins (5 points) and ratio of polyunsaturated and monounsaturated fatty acids to saturated fatty acids (10 points). Moderation scores (higher scores indicating lower consumption) included refined grains (10 points), sodium (10 points) and energy from solid fat, alcohol and added sugars (SoFAAS) (20 points). Energy from SoFAAS is a summary measure of "empty calories". The maximum HEI-2010 score is 100 points. One caution is that the HEI-2010 score, estimated using a single recall, does not capture the distribution of HEI-2010 scores in a population and may underestimate the population-level mean HEI-2010 score. Despite these limitations, the HEI-2010 score is viewed as a reliable measure of diet quality that can be used to identifying groups or segments of the population with healthier vs. less healthy diets.

2.5. Statistical analysis

Descriptive analyses evaluated the distribution of food-related attitudes by key socio-demographic indicators: age, gender, race/ethnicity, FIPR and education. All analyses employed survey weights. Wald tests served to compute overall p-values to test for heterogeneity. Linear regressions examined the bivariate associations of HEI-2010 score with key socio-demographic and the four attitude variables. A series of multivariable linear regression models examined the association between each attitudinal variable (independent variable) and HEI-2010 scores (the primary dependent variable). For each model, the "very important" group was treated as the reference group. Model 1 adjusted for age, gender and race/ethnicity. Model 2 added education, whereas Model 3 added FIPR. For persons aged 20–24 years, who may not have completed their education, a separate categorical variable indicating age 20–24 years was included, but no information regarding their education was included in the analysis. Kappa statistics and VIF were computed to check for collinearity across the four attitudinal variables. Additional regressions were conducted to test if the associations between attitude variables and HEI persist, after mutually adjusting for attitude variables.

A series of stratified regression analyses were conducted to examine if the observed associations between each attitude variable and HEI score were modified by gender, education, FIPR and race/ethnicity. These analyses were based on linear regression models with adjustment for age, race/ethnicity and gender, and a two-way interaction term between the attitude variable and each measure of SES. The significance of interactions between the

attitude and socio-demographic variables was evaluated using Wald test. All analyses of NHANES data were conducted using Stata 13.1 (College Station, TX).

3. Results

3.1. Food-related attitudes by socio-demographics

Table 1 shows that 77% of NHANES participants rated taste as “very important” when shopping for food. Nutrition was rated as very important by 59.9%, followed by cost (39.9%), and convenience (ease-of-preparation) (29.8%).

Taste universally emerged as an important consideration, with slight trends observed by gender, age and education. More likely to rate nutrition as very important were women (women 65.9%; men 52.9%); older adults (65+ years: 69%; 20–34 years: 52.8%); and lower income group (lowest: 66.6%; highest: 55.4%). Although women were more concerned about cost than were men (women 43.9%; men 35.2%), cost-related concerns by SES were far more striking. Lowest income NHANES participants attached much greater importance to cost than did the highest income, by a factor of 3 (60.2% vs. 21.7%). Groups with lower education were twice as likely to report food cost as being “very important” than were the most-educated groups (57.8% vs. 27.8%). Similarly, groups with the lowest income attached a premium to convenience (45.4% vs. 20.7%), as did groups with lowest education (48.7% vs. 20.6%). While groups with the lowest education also valued nutrition more, the trend was not nearly as steep (69.4% vs. 61.4%).

3.2. Food-related attitudes and HEI-2010

HEI-2010 scores were significantly associated with key socio-demographics (age, sex, education and incomes) and food-related attitudes (Appendix 1). HEI scores were higher by 6.48 points across extreme income categories ($\beta = 6.48$, $p < 0.05$), and >8-point difference across education categories ($\beta = 8.65$, $p < 0.05$). HEI scores were also linked to all four attitudinal variables, with the strongest gradient observed with nutrition variable. The perceived nutrition importance was associated with significantly lower HEI ($\beta = -5.36$ among “somewhat important” and −9.99 among “not too important/not at all” categories, $p < 0.001$ for each, as compared to “very important” reference category). By contrast, an inverse relation was observed between importance of taste and HEI. Those who did not attach importance to taste had higher HEI scores ($\beta = +1.67$ among “somewhat important”, and +3.99 among “not too important/not at all” categories). Similar inverse association was observed by attitudes toward cost and convenience.

Multivariate analyses, reported in Table 2, showed the strongest positive association with the nutrition variable. There was a significant increase in HEI-2010 scores among those who perceived nutrition as very important. Conversely, the mean HEI scores were lower by 4.87 (95% CI: −5.79, −3.95) among those who perceived nutrition as somewhat important, and by 9.48 (95% CI: −11.64, −7.33) among those who rated it as not too important/not at all important, as compared to “very important” as the reference category, adjusting for demographics (Model 1). The associations remained strong and significant even after adjusting for education (Model 2) and FIPR (Model 3). By contrast, taste and convenience

variables showed inverse and relatively weaker associations with HEI-2010. As compared to those who attached importance to taste, the mean HEI scores were higher by +1.50 points (95% CI: 0.19, 2.82) among “somewhat important” group, and by +5.1 points among “not too important/not at all” group (95% CI: 1.74, 8.59) (Model 3). The corresponding numbers for the convenience variable were +1.11 and +1.57 respectively. The observed associations between cost and HEI attenuated and were no longer statistically significant after taking socioeconomic variables into account.

While the four attitude variables were correlated with each other, kappa statistics and VIF (variance inflation factor) values confirmed that these were not collinear. Additional multivariable analysis confirmed that the observed associations between attitude variables and HEI persisted after mutually adjusting for all the attitude variables (Appendix 2). The observed difference in HEI scores by nutrition importance variable remained very similar in the adjusted model (with very important category as the reference, β: −5.05; 95% CI: −6.0, −4.1 for somewhat important, and β: −8.39; 95% CI: −10.82, −5.96 for not at all important categories) (Appendix 2). The gradient in HEI did not change much by other attitude variables.

3.3. Food-related attitudes and HEI-2010: Interactions by gender, SES and race/ethnicity

Additional multivariable regression analyses were conducted to examine if the observed associations were modified by gender, race/ethnicity, education and FIPR.

The observed HEI gradient by nutrition importance had no differential impact by gender, education and FIPR (overall p for interaction >0.05 for each) (Table 3). For example: among men and women, the mean HEI gradient was very similar (−8.78 and −7.73 respectively; p for interaction: 0.490). No significant interaction was observed (p: 0.490). Similar results were obtained by education. Among lower educated groups (<high school), – the mean gradient in HEI scores was −3.5 units (among those who rated nutrition as “somewhat important”) and −3.3 units (among “not at all important”) as compared to the “very important” category. The corresponding gradient among college graduates was −6.0 and −7.0 units. While the observed gradient was stronger for higher educated groups; the p-value for the interaction term did not reach statistical significance (p 0.084). By FIPR, the nutrition differential was −7.2 points between “very important” and “not too important/not at all” categories among the lowest FIPR category (<130%). The corresponding nutrition differential among the highest FIPR category was −11.12 points. However, the interaction did not reach statistical significance (p: 0.390).

A significant interaction was observed by race/ethnicity (p for overall interaction: 0.002). Lower nutrition importance was associated with significantly lower HEI scores only among non-Hispanic Blacks and Whites (HEI scores were −8.63 and −9.76 units lower respectively) (Table 3). No such associations were observed among Mexican Americans or other Hispanics.

Fig. 1 summarizes the results from interaction analyses, which tested if the observed association between each attitude variable and HEI persisted equally at all levels of education, FIPR and race/ethnicity. For most of the models, there was no significant

interaction (indicated by p for interaction >0.05). The only exceptions were nutrition variable by race/ethnicity, importance of cost by race/ethnicity, and importance of convenience by education and race/ethnicity (overall p for interaction <0.05 for each). None of these attitude variables showed significant interaction by gender.

4. Discussion

The present study of food-related attitudes in the US, with focus on lower socioeconomic groups and certain racial/ethnicities brings a unique perspective to the existing literature.

The first ever examination of attitudinal data from NHANES revealed that taste and nutrition tend to be most valued attributes among US adults during food shopping (self-rated as very important by 77% and 59.9% of the US adults respectively). This is somewhat consistent with the existing literature where taste emerged as the most important determinant of food choice, followed by cost and nutrition (International Food Information Council Foundation, 2012; Hebden et al., 2015; Glanz et al., 1998).

Second, the present study advanced it further and examined each of these attitudinal variables in relation to adherence to 2010 dietary guidelines. It was the importance of nutrition that was most strongly associated with HEI-2010 scores. Interestingly, nutrition importance was even a more important factor influencing HEI than either income or education. People who attached high importance to nutrition during food shopping had HEI scores that were 8.0 points higher than those who did not. By contrast, attaching high importance to taste reduced HEI by 5.0 points. Cost and convenience had a smaller and negative impact on diet quality. These findings are consistent with past small scale studies that linked food-related attitudes with diet quality (Aggarwal et al., 2014; Ball et al., 2006; Monsivais et al., 2014; Beydoun and Wang, 2008a, 2008b).

Third, for the first time in the existing literature, the prevalence and importance of these food-related attributes was studied among vulnerable segments of the population. Interestingly, prioritizing nutrition during food shopping was not just confined to upper social class. Attaching importance to nutrition was associated with significantly higher quality diets among both men and women, regardless of education and FIPR. Similarly, attaching importance to taste and cost were prevalent across all SES and racial/ethnic groups, and did not show differential associations with HEI scores regardless. These results indicate there is no interaction.

On the other hand, the perceived importance of nutrition, cost and convenience did show significant interactions by race/ethnicity. Among non-Hispanic Whites and Blacks, those who attached importance to nutrition had higher quality diets, adjusting for SES. In contrast, Mexican-Americans and Hispanics were the resilient groups, and consumed higher quality diets regardless. These racial/ethnic groups also consumed higher quality diets despite attaching importance to cost and convenience during food shopping. These findings resonate with past studies reflecting that some ethnic dietary patterns may hold the key to achieving healthier diets within SES constraints in the US (Wang and Chen, 2011; Moser et al., 2005; Monsivais et al., 2013), and have significant implication for further research.

One common assumption, in the exiting literature, is that positive food-related attitudes tend to exist among higher social strata, which may in turn explain better diets and health among them (Beydoun and Wang, 2008a; Le et al., 2013; Turrell and Kavanagh, 2006; Konttinen et al., 2012; Miura and Turrell, 2014). However, the present data suggest that setting a priority on nutrition is not class-dependent. Lower socioeconomic groups also prioritize nutrition during food shopping, and are able to achieve diets comparable in quality to those of higher SES groups.

Having said that, it is also evident that the wide prevalence of positive food-related attitudes among US adults does not translate into positive eating behaviors equally across vulnerable segments of the population. This could be attributed to SES-driven barriers at the individual level such as higher food prices, limited availability or access to healthy foods, lack of cooking skills or cooking time constraints, which may outweigh positive attitudes, making it difficult to eat healthy. Similar concerns were raised among African Americans and Hispanics who had lower quality diets despite positive attitudes toward healthy eating (Acheampong and Haldeman, 2013).

Nonetheless, these findings imply that: a) prioritizing nutrition during food shopping, regardless of income or education level or racial/ethnic category, might help to overcome psychosocial or environmental challenges to healthy eating; b) it is possible to eat healthy despite prioritizing cost and convenience during food shopping, even after taking SES into account. While this concept is very well known in the literature from developing countries, this is the first evidence of the existence of *nutrition resilience* in relation to diets and health among US adults. In other words, there are certain people from lower social class, and minority groups who have positive food-related attitudes and are able to achieve higher quality diets, despite their economic or environmental constraints – termed as "*nutrition resilience*". Identifying those unique behaviors or practices of resilient sub-groups in the US might be another strategy to improve diets and health among vulnerable segments of the US population. These findings lead the existing knowledge and research in a novel direction.

The present study had several strengths. First, this is one of the first studies to examine the importance of food-related attributes using a representative national level data. The survey weighted analyses allowed us to generalize findings for the entire US adult population. Second, this study makes novel contribution to the existing literature by linking food-related attributes with the federal measure of diet quality, across all categories of SES and race/ethnicity in the US.

There were limitations. First, the cross-sectional nature of the analyses limits our ability to draw any causal associations between food-related attributes and diet quality. Second, study findings are based on self-rated importance of food-related attributes, assuming that the perceived importance translates into behaviors. However, this is the most widely used method to collect and analyze attitudinal data in the existing literature. Having additional data on actual household food purchases would have served as a more proximal measure of food selection behaviors.

5. Conclusion

The present study provides the first evidence of the importance of food-related attitudes on diet quality using US national level data, and its significance among vulnerable segments of the population. Prioritizing nutrition during food shopping may be one of the ways to achieve higher quality diets, regardless of income, or education constraints. Further, certain racial/ethnic groups manage to consume higher quality diets despite attaching importance to cost and convenience. These findings open the door to novel and valuable research on the concept of nutrition resilience in the US. Nutrition education interventions that target food-related beliefs and attitudes can leverage this concept as another strategy to tackle the issue of socioeconomic and racial disparities in diets and health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding support: This project was funded by NIH grant R01DK076608. PM was supported by the Centre for Diet and Activity Research, a UKCRC Public Health Research Centre of Excellence.

References

Acheampong I, Haldeman L. Are nutrition knowledge, attitudes, and beliefs associated with obesity among low-income Hispanic and African American women caretakers? J Obes. 2013; 2013:123901. [PubMed: 23819044]

Aggarwal A, Monsivais P, Cook AJ, Drewnowski A. Positive attitude toward healthy eating predicts higher diet quality at all cost levels of supermarkets. J Acad Nutr Diet. 2014; 114:266–272. [PubMed: 23916974]

Ball K, Crawford D, Mishra G. Socio-economic inequalities in women's fruit and vegetable intakes: a multilevel study of individual, social and environmental mediators. Public Health Nutr. 2006; 9:623–630. [PubMed: 16923294]

Beydoun MA, Wang Y. Do nutrition knowledge and beliefs modify the association of socio-economic factors and diet quality among US adults? Prev Med. 2008a; 46:145–153. [PubMed: 17698186]

Beydoun MA, Wang Y. How do socio-economic status, perceived economic barriers and nutritional benefits affect quality of dietary intake among US adults? Eur J Clin Nutr. 2008b; 62:303–313. [PubMed: 17342164]

Centers for Disease Control and Prevention (CDC). About the National Health and Nutrition Examination Survey (NHANES). National Center for Health Statistics (NCHS); 2016a. Available from http://www.cdc.gov/nchs/nhanes/about_nhanes.htm [Accessed January 4]

Centers for Disease Control and Prevention (CDC). NCHS Research Ethics Review Board (ERB) Approval. National Center for Health Statistics (NCHS); 2016b. Available from http://www.cdc.gov/nchs/nhanes/irba98.htm [Accessed January 4]

Centers for Disease Control and Prevention (CDC). NHANES 2009–2010. National Center for Health Statistics (NCHS); 2016c. Available from: http://wwwn.cdc.gov/nchs/nhanes/search/nhanes09_10.aspx [Accessed January 4]

Darmon N, Drewnowski A. Does social class predict diet quality? Am J Clin Nutr. 2008; 87:1107–1117. [PubMed: 18469226]

Gittelsohn J, Anliker JA, Sharma S, Vastine AE, Caballero B, Ethelbah B. Psychosocial determinants of food purchasing and preparation in American Indian households. J Nutr Educ Behav. 2006; 38:163–168. [PubMed: 16731451]

Glanz K, Basil M, Maibach E, Goldberg J, Snyder D. Why Americans eat what they do: taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. J Am Diet Assoc. 1998; 98:1118–1126. [PubMed: 9787717]

Guenther PM, Kirkpatrick SI, Reedy J, et al. The Healthy Eating Index-2010 is a valid and reliable measure of diet quality according to the 2010 Dietary Guidelines for Americans. J Nutr. 2014; 144:399–407. [PubMed: 24453128]

Hebden L, Chan HN, Louie JC, Rangan A, Allman-Farinelli M. You are what you choose to eat: factors influencing young adults' food selection behaviour. J Hum Nutr Diet. 2015; 28(4):401–408. [PubMed: 25891415]

International Food Information Council Foundation. [Accessed May 29, 2015] Food & health survey: consumer attitudes toward food safety. Nutr Health. 2012. Available from: http://www.foodinsight.org/articles/2012-food-and-health-survey

Konttinen H, Sarlio-Lahteenkorva S, Silventoinen K, Mannisto S, Haukkala A. Socio-economic disparities in the consumption of vegetables, fruit and energy-dense foods: the role of motive priorities. Public Health Nutr. 2012:1–10. [PubMed: 23294865]

Le J, Dallongeville J, Wagner A, et al. Attitudes toward healthy eating: a mediator of the educational level-diet relationship. Eur J Clin Nutr. 2013; 67:808–814. [PubMed: 23801096]

Miura K, Turrell G. Contribution of psychosocial factors to the association between socioeconomic position and takeaway food consumption. PLoS One. 2014; 9:e108799. [PubMed: 25268899]

Monsivais P, Rehm CD, Drewnowski A. The DASH diet and diet costs among ethnic and racial groups in the United States. JAMA Intern Med. 2013; 173:1922–1924. [PubMed: 23999924]

Monsivais P, Aggarwal A, Drewnowski A. Time spent on home food preparation and indicators of healthy eating. Am J Prev Med. 2014; 47:796–802. [PubMed: 25245799]

Moser RP, Green V, Weber D, Doyle C. Psychosocial correlates of fruit and vegetable consumption among African American men. J Nutr Educ Behav. 2005; 37:306–314. [PubMed: 16242062]

[Accessed May 28, 2015] NHANES data documentation. NHANES 2009–2010. 2011. Available from: http://wwwn.cdc.gov/Nchs/Nhanes/2009-2010/DEMO_F.htm

Pelletier JE, Laska MN, Neumark-Sztainer D, Story M. Positive attitudes toward organic, local, and sustainable foods are associated with higher dietary quality among young adults. J Acad Nutr Diet. 2013; 113:127–132. [PubMed: 23260729]

Traill W, Chambers S, Butler L. Attitudinal and demographic determinants of diet quality and implications for policy targetin. J Hum Nutr Diet. 2011; 25:87–94. [PubMed: 22077492]

Turrell G, Kavanagh AM. Socio-economic pathways to diet: modelling the association between socio-economic position and food purchasing behaviour. Public Health Nutr. 2006; 9:375–383. [PubMed: 16684390]

USHHS Poverty guidelines. [Accessed May 28, 2015] US Federal Poverty Measures. 2009. Available from: https://aspe.hhs.gov/2009-hhs-poverty-guidelines

Wang Y, Chen X. How much of racial/ethnic disparities in dietary intakes, exercise, and weight status can be explained by nutrition- and health-related psychosocial factors and socioeconomic status among US adults? J Am Diet Assoc. 2011; 111:1904–1911. [PubMed: 22117667]

Wardle J, Parmenter K, Waller J. Nutrition knowledge and food intake. Appetite. 2000; 34:269–275. [PubMed: 10888290]

Williams L, Ball K, Crawford D. Why do some socioeconomically disadvantaged women eat better than others? An investigation of the personal, social and environmental correlates of fruit and vegetable consumption. Appetite. 2010; 55:441–446. [PubMed: 20728488]

Appendix 1. Bivariate association of HEI-2010 scores by key socio-demographic variables and food-related attitudes among US adults: NHANES 2007–10

	β (SE)	p-Value
Mean	49.1 (0.45)	
Age group		
20–34	ref	
35–49	1.76 (0.61)	0.008
50–64	6.17 (0.88)	<0.001
≥65	8.13 (0.51)	<0.001
Gender		
Female	ref	
Male	−2.33 (0.44)	<0.001
Race/ethnicity		
Non-Hispanic White	ref	
Non-Hispanic Black	−4.34 (0.80)	<0.001
Mexican American	−1.17 (0.74)	0.127
Other Hispanic	−0.46 (0.93)	0.619
Other race	1.38 (0.89)	0.131
Family income		
<130%	ref	
131–184%	1.96 (0.86)	0.030
185–399%	3.21 (0.50)	<0.001
≥400%	6.48 (0.60)	<0.001
Education		
<High school	ref	
High school	1.18 (0.67)	0.089
Some college	3.37 (0.57)	<0.001
≥College	8.65 (0.72)	<0.001
Perceived importance of taste		
Very important	ref	
Somewhat important	1.67 (0.57)	0.006
Not at all important	3.99 (1.75)	0.030
Perceived importance of nutrition		
Very important	ref	
Somewhat important	−5.36 (0.38)	<0.001
Not at all important	−9.99 (1.00)	<0.001
Perceived importance of cost		
Very important	ref	
Somewhat important	2.49 (0.40)	<0.001
Not at all important	2.83 (0.61)	<0.001
Perceived importance of convenience		

	β (SE)	p-Value
Very important	ref	
Somewhat important	1.98 (0.41)	<0.001
Not at all important	2.31 (0.58)	<0.001

Appendix 2. Multivariable associations of HEI-2010 scores with self-rated importance of taste, nutrition, cost, and convenience, after mutually adjusting for four attitude variables and other covariates. NHANES 2007–2010

	Model 1 (n = 8236)			Model 2 (n = 8193)		
	β	95% CI	p-Value	β	95% CI	p-Value
Taste						
Very important	ref			ref		
Somewhat important	1.64	0.54, 2.74	**0.005**	1.77	0.56, 2.99	**0.006**
Not too important/not at all important	3.84	0.81, 6.88	**0.015**	4.07	0.95, 7.19	**0.012**
Nutrition						
Very important	ref			ref		
Somewhat important	−5.03	−5.93, −4.13	<**0.001**	−5.05	−6.00, −4.10	<**0.001**
Not too important/not at all important	−8.54	−10.81, −6.27	<**0.001**	−8.39	−10.82, −5.96	<**0.001**
Cost						
Very important				ref		
Somewhat important	1.61	0.71, 2.51	**0.001**	1.21	0.24, 2.18	**0.016**
Not too important/not at all important	1.69	0.32, 3.06	**0.017**	1.19	−0.26, 2.65	0.103
Convenience						
Very important	ref			ref		
Somewhat important	1.17	0.34, 2.00	**0.007**	1.06	0.19, 1.94	**0.018**
Not too important/not at all important	1.24	0.03, 2.46	**0.045**	1.19	0.01, 2.37	**0.048**

Model 1. Adjusted for age group, race/ethnicity, gender and education. Education variable includes separate category for those age 20–24.

Model 2. Adjusted for age group, race/ethnicity, gender, education and family income-to-poverty ratio.

Bold data indicates significant p-value < 0.05.

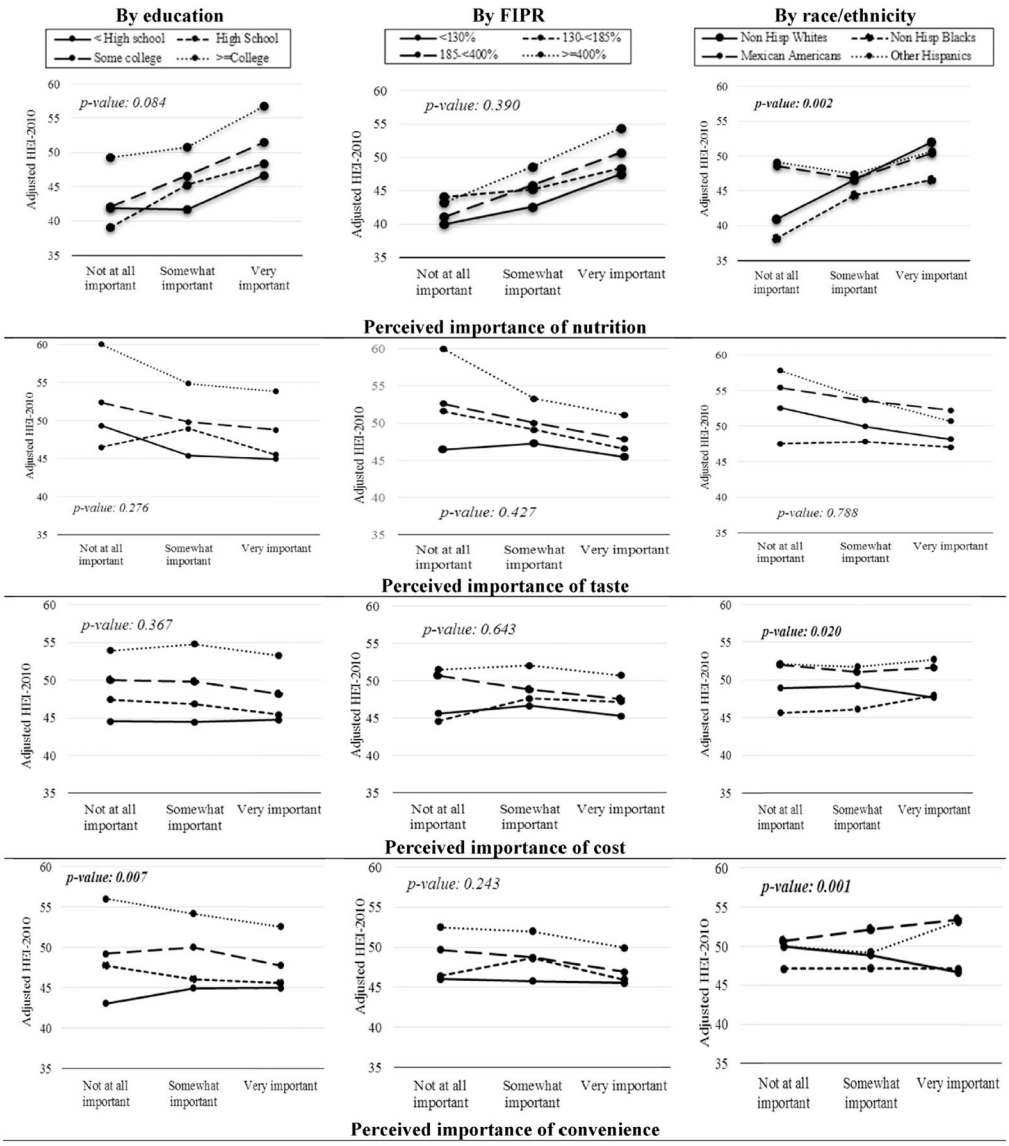

Fig. 1.

Adjusted mean HEI-2010 scores by perceived importance of nutrition, taste, cost and convenience: results from interaction analyses by education, FIPR and race/ethnicity.

Table 1

The self-rated importance of taste, nutrition, cost, and convenience, by socio-demographics among US adults, NHANES 2007–2010. Values are percentages and standard errors (in parentheses).

		Taste			Nutrition			Cost (price)			Ease-of-preparation (convenience)		
		Very	Somewhat	Not too/not at all	Very	Somewhat	Not too/not at all	Very	Somewhat	Not too/not at all	Very	Somewhat	Not too/not at all
	n	(n = 6953)	(n = 1746)	(n = 258)	(n = 5952)	(n = 2640)	(n = 365)	(n = 4351)	(n = 3652)	(n = 954)	(n = 3472)	(n = 3620)	(n = 1865)
Total	8957	77.0 (1.0)	20.8 (1.0)	2.0 (0.2)	59.9 (1.0)	35.7 (0.8)	4.3 (0.2)	39.9 (0.9)	48.8 (1.0)	11.2 (0.5)	29.8 (0.8)	47.1 (0.9)	23.0 (0.5)
Gender													
Male	4153	74.1 (0.8)	23.4 (0.9)	2.4 (0. 2)	52.9 (1.4)	39.9 (1.2)	7.0 (0.5)	35.2 (1.1)	50.8 (1.2)	13.8 (0.7)	27.2 (1.3)	47.4 (1.2)	25.2 (0.9)
Female	4804	79.6 (1.0)	18.7 (1.0)	1.6 (0.2)	65.9 (1.0)	32.1 (0.9)	1.9 (0.2)	43.9 (1.0)	47.0 (1.2)	8.9 (0.7)	32.1 (0.8)	46.8 (1.0)	21.0 (0.8)
p-value			<0.001			<0.001			<0.001			<0.001	
Age group													
20–34	2140	72.9 (1.7)	24.7 (1.6)	2.3 (0.3)	52.8 (1.7)	42.4 (1.6)	4.6 (0.5)	38.0 (1.5)	51.0 (1.6)	10.9 (0.7)	28.0 (1.8)	48.4 (1.7)	23.5 (0.9)
35–49	2400	78.0 (1.1)	20.5 (1.1)	1.3 (0.2)	59.4 (1.4)	36.4 (1.3)	4.0 (0.6)	44.4 (1.6)	45.4 (1.2)	10.1 (1.1)	31.1 (1.5)	45.7 (1.7)	23.0 (1.4)
50–64	2345	79.5 (1.3)	18.7 (1.3)	1.6 (0.3)	62.0 (1.8)	33.6 (1.6)	4.3 (0.5)	37.4 (1.4)	51.1 (1.6)	11.4 (0.9)	29.1 (1.4)	48.1 (1.8)	22.7 (1.0)
≥65	2072	77.9 (1.4)	18.6 (1.2)	3.4 (0.5)	69.0 (1.1)	26.8 (1.1)	4.1 (0.4)	38.9 (1.5)	47.6 (1.2)	13.4 (0.9)	31.7 (1.3)	45.7 (1.3)	22.4 (1.2)
p-value			<0.001			0.005			0.005			0.579	
Race/ethnicity													
Non-Hispanic White	4423	76.7 (0.9)	21.8 (0.9)	1.4 (0.2)	54.8 (1.1)	40.6 (0.9)	4.6 (0.4)	33.8 (1.2)	54.5 (1.2)	11.7 (0.6)	22.8 (0.8)	53.3 (1.0)	23.9 (0.7)
Non-Hispanic Black	1736	81.2 (1.0)	15.6 (0.9)	3.0 (0.4)	69.4 (1.4)	27.2 (1.3)	3.4 (0.6)	59.1 (1.7)	33.1 (1.4)	7.8 (0.8)	45.3 (1.6)	35.5 (1.4)	19.2 (0.9)
Mexican American	1526	79.6 (1.3)	16.6 (1.2)	3.6 (0.5)	78.2 (1.0)	18.1 (1.0)	3.7 (0.7)	56.0 (1.9)	31.6 (1.3)	12.4 (1.1)	53.7 (2.1)	27.5 (1.6)	18.7 (1.5)
Other Hispanic	930	77.4 (1.6)	17.8 (1.1)	4.7 (1.0)	79.4 (1.9)	18.8 (2.0)	1.8 (0.7)	55.6 (2.7)	31.8 (1.9)	12.6 (1.4)	55.9 (3.1)	26.4 (2.0)	17.7 (2.2)
Other race	342	68.9 (4.5)	27.3 (4.6)	3.6 (1.6)	65.4 (2.8)	29.2 (2.9)	5.4 (1.7)	44.4 (4.3)	46.4 (4)	9.2 (1.9)	33.2 (4.3)	36.4 (3.4)	30.4 (4.4)
p-value			<0.001			<0.001			<0.001			<0.001	
Family income													
<130%	2533	77.6 (1.0)	18.9 (1.0)	3.4 (0.4)	66.6 (1.6)	28.5 (1.2)	4.8 (0.7)	60.2 (1.6)	32.6 (1.3)	7.1 (0.7)	45.4 (1.8)	32.5 (1.4)	21.9 (1.2)
131–184%	1098	75.1 (1.9)	21.5 (1.7)	3.3 (0.6)	63.0 (2.5)	32.3 (2.2)	4.5 (1.2)	56.0 (1.9)	36.9 (1.8)	7.0 (1.0)	37.6 (2.0)	40.2 (2.9)	22.1 (2.2)
185–399%	2425	75.7 (0.8)	22.6 (0.9)	1.6 (0.2)	57.2 (1.6)	38.5 (1.4)	4.1 (0.4)	42.0 (1.9)	48.3 (1.8)	9.6 (0.7)	26.0 (1.3)	51.2 (1.4)	22.7 (1.2)
N400%	2142	77.6 (1.0)	21.1 (0.9)	1.2 (0.3)	55.4 (1.2)	40.2 (1.2)	4.2 (0.4)	21.7 (1.1)	61.9 (1.5)	16.2 (1.0)	20.7 (0.9)	55.0 (1.5)	24.1 (1.2)

		Taste			Nutrition			Cost (price)			Ease-of-preparation (convenience)		
		Very	Somewhat	Not too/not at all	Very	Somewhat	Not too/not at all	Very	Somewhat	Not too/not at all	Very	Somewhat	Not too/not at all
	n	(n = 6953)	(n = 1746)	(n = 258)	(n = 5952)	(n = 2640)	(n = 365)	(n = 4351)	(n = 3652)	(n = 954)	(n = 3472)	(n = 3620)	(n = 1865)
p-value			<0.001			<0.001			<0.001			<0.001	
Education													
<High school	2389	82.1 (1.1)	14.5 (0.9)	3.2 (0.5)	69.4 (1.6)	25.7 (1.6)	4.8 (0.5)	57.8 (1.6)	32.7 (1.5)	9.4 (0.9)	48.7 (1.9)	33.3 (1.8)	17.9 (1.1)
High school	2137	80.1 (1.3)	18.2 (1.3)	1.6 (0.2)	54.7 (1.5)	38.9 (1.2)	6.3 (0.7)	44.2 (1.3)	47.0 (1.4)	8.7 (0.7)	31.6 (1.7)	45.9 (1.8)	22.4 (1.3)
Some college	2525	78.9 (1.0)	19.7 (1.1)	1.3 (0.2)	57.1 (1.7)	38.3 (1.6)	4.5 (0.6)	37.3 (1.4)	50.8 (1.8)	11.7 (0.8)	25.8 (1.3)	49.2 (1.4)	24.8 (1.1)
NCollege	1898	72.7 (1.6)	25.5 (1.5)	1.6 (0.3)	61.4 (1.1)	36.5 (1.3)	2.0 (0.3)	27.8 (1.2)	58.2 (1.2)	13.9 (0.9)	20.6 (1.2)	54.6 (1.7)	24.6 (1.2)
p-value			<0.001			<0.001			<0.001			<0.001	

Table 2

Multivariable associations of HEI-2010 scores with self-rated importance of taste, nutrition, cost, and convenience, adjusting for socio-demographics. NHANES 2007–2010.

	Model 1 (n = 8957)			Model 2 (n = 8236)			Model 3 (n = 8193)		
	β	**95% CI**	**p-Value**	**β**	**95% CI**	**p-Value**	**β**	**95% CI**	**p-Value**
Taste									
Very important	ref			ref			ref		
Somewhat important	2.09	0.96, 3.23	**0.001**	1.41	0.19, 2.62	**0.024**	1.50	0.19, 2.82	**0.026**
Not too important/not at all important	3.91	0.55, 7.27	**0.024**	5.02	1.73, 8.32	**0.004**	5.17	1.74, 8.59	**0.004**
Nutrition									
Very important	ref		ref	ref			ref		
Somewhat important	−4.87	−5.79, −3.95	<**0.001**	−4.79	−5.78, −3.80	<**0.001**	−4.81	−5.72, −3.90	<**0.001**
Not too important/not at all important	−9.48	−11.6, −7.33	<**0.001**	−8.24	−10.4, −6.01	<**0.001**	−8.07	−10.3, −5.80	<**0.001**
Cost									
Very important	ref		ref				ref		
Somewhat important	2.48	1.58, 3.38	<**0.001**	1.17	0.39, 1.95	**0.004**	1.00	0.08, 1.92	**0.033**
Not too important/not at all important	2.75	1.51, 3.99	<**0.001**	1.39	−0.01, 2.79	0.051	0.98	−0.26, 2.24	0.119
Convenience									
Very important	ref		ref	ref			ref		
Somewhat important	2.20	1.28, 3.12	<**0.001**	1.28	0.48, 2.08	**0.002**	1.11	0.18, 2.03	**0.020**
Not too important/not at all important	2.57	1.36, 3.78	<**0.001**	1.59	0.40, 2.77	**0.010**	1.57	0.47, 2.67	**0.006**

Model 1. Adjusted for age group, race/ethnicity and gender.

Model 2. Adjusted for age group, race/ethnicity, gender and education. Education variable includes separate category for those age 20–24.

Model 3. Adjusted for age group, race/ethnicity, gender, education and family income-to-poverty ratio.

Bold data indicates significant p-value < 0.05.

Table 3

Multivariable associations of HEI-2010 scores with self-rated importance of nutrition, stratified by gender, education, income and race/ethnicity, adjusting for covariates.

	Gender[a]				
	Female		**Male**		
	β (95% CI)		**β (95% CI)**		**p-value for overall interaction**
Adjusted HEI-2010 score Mean (SE)	50.1 (0.60)		47.7 (0.43)		
Perceived importance of nutrition					
Very important	ref		ref		0.490
Somewhat important	−5.19 (−6.35, −4.03)		−4.39 (−5.52, −3.33)		
Not too important/not at all important	−8.78 (−12.0, −5.61)		−7.73 (−10.6, −4.85)		
	Education[b]				p-value for overall interaction
	<High school	High school	Some college	College graduates	
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	
Adjusted HEI-2010 score Mean (SE)	44.9 (43.3, 46.4)	46.7 (45.5, 47.8)	49.3 (48.3, 50.2)	54.7 (53.7, 55.6)	
Perceived importance of nutrition					
Very important	ref	ref	ref	ref	0.084
Somewhat important	−3.53 (−5.47, −1.59) **	−2.71 (−4.35, −1.08) **	−5.48 (−6.95, −4.02) ***	−6.07 (−7.56, −4.57) ***	
Not too important/not at all important	−3.38 (−8.23, 1.47)	−7.63 (−9.79, −5.47) ***	−10.18 (−13.8, −6.56) ***	−7.09 (−15.0, 0.83)	
	FIPR[b]				p-value for overall interaction
	<130%	131–184%	185–399%	≥400%	
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	
Adjusted HEI-2010 score Mean (SE)	45.6 (44.2, 46.9)	47.1 (45.0, 49.1)	48.4 (47.3, 49.4)	51.7 (50.9, 52.4)	
Perceived importance of nutrition					
Very important	ref	ref	ref	ref	0.390
Somewhat important	−4.77 (−6.39, −3.15) ***	−3.13 (−6.51, 0.23)	−4.81 (−6.74, −2.87) ***	−5.90 (−7.55, −4.25) ***	

	Gender[a]				
	Female		**Male**		
	β (95% CI)		**β (95% CI)**		**p-value for overall interaction**
Not too important/not at all important	−7.22 (−10.15, −4.29) ***	−4.20 (−12.38, 3.97)	−9.34 (−12.08, −6.94) ***	−11.12 (−16.76, −5.48) ***	
	Race/ethnicity[c]				p-value for overall interaction
	Non-Hispanic Whites	Non-Hispanic Blacks	Mexican Americans	Other Hispanics	
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	
Adjusted HEI-2010 score Mean (SE)	48.9 (47.6, 50.1)	48.0 (46.9, 49.0)	53.3 (52.3, 54.2)	52.6 (50.7, 54.4)	
Perceived importance of nutrition					
Very important	ref	ref	ref	ref	**0.002**
Somewhat important	−5.10 (−6.47, −3.73) ***	−2.38 (−3.93, −0.83) **	−4.10 (−6.58, −1.63) **	−2.96 (−6.87, 0.94) *	
Not too important/not at all important	−8.63 (−11.58, −5.68) ***	−9.76 (−13.72, −5.81) ***	−0.79 (−5.22, 3.64)	−5.87 (−15.39, 3.65)	

FIPR is family income-to-poverty ratio.

Bold data indicates significant p-value < 0.05.

[a]Adjusted for age, race/ethnicity, income and education.

[b]Adjusted for age, gender and race/ethnicity.

[c]Adjusted for age, gender, income and education. Data for the other/mixed race group is not shown due to small numbers.

*<0.05.

**< 0.005.

***< 0.002.