Positive Attitude toward Healthy Eating Predicts Higher Diet Quality at All Cost Levels of Supermarkets

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ABSTRACT
Shopping at low-cost supermarkets has been associated with higher obesity rates. This study examined whether attitudes toward healthy eating are independently associated with diet quality among shoppers at low-cost, medium-cost, and high-cost supermarkets. Data on socioeconomic status (SES), attitudes toward healthy eating, and supermarket choice were collected using a telephone survey of a representative sample of adult residents of King County, WA. Dietary intake data were based on a food frequency questionnaire. Thirteen supermarket chains were stratified into three categories: low, medium, and high cost, based on a market basket of 100 commonly eaten foods. Diet-quality measures were energy density, mean adequacy ratio, and total servings of fruits and vegetables. The analytical sample consisted of 963 adults. Multivariable regressions with robust standard error examined relations between diet quality, supermarket type, attitudes, and SES. Shopping at higher-cost supermarkets was associated with higher-quality diets. These associations persisted after adjusting for SES, but were eliminated after taking attitudinal measures into account. Supermarket shoppers with positive attitudes toward healthy eating had equally higher-quality diets, even if they shopped at low-, medium-, or high-cost supermarkets, independent of SES and other covariates. These findings imply that shopping at low-cost supermarkets does not prevent consumers from having high-quality diets, as long as they attach importance to good nutrition. Promoting nutrition-education strategies among supermarkets, particularly those catering to low-income groups, can help to improve diet quality.
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THE SELECTION OF HIGH-QUALITY DIETS IS influenced by knowledge, attitudes, and the economics of food-choice behavior.[1-6] Positive food-related attitudes have been linked to better diets, as indexed by higher values of the Healthy Eating Index and by higher consumption of vegetables and fruit.[7] Diet quality has also been linked to the food environment.[8-13] Improved access to full-service supermarkets has been associated with better diets and with higher consumption of vegetables and fruit.[14,15] Ensuring equal access to supermarkets has thus recently become a focus of public health policy.[16,17]

However, a recent study found a threefold variation in obesity even among adults who primarily shopped at supermarkets. Lower-cost supermarkets, in particular, were linked to higher obesity rates.[18] Social class or unmeasured attitudinal factors were proposed to explain this phenomenon. The purpose of the present study was to examine whether there exists a gradient in diet quality among supermarket shoppers, and the extent to which the variability in food-related attitudes and socioeconomic status (SES) can explain this relation. We hypothesized that shopping at lower-cost supermarkets would be associated with lower diet quality and this relationship would be explained by SES and attitude toward healthy foods. The question was whether shoppers at lower-cost supermarkets achieve high-quality diets if they attach importance to good nutrition. The present study was unique in collecting individual-level data on actual food shopping destinations by supermarket chain brand, availability and prices of commonly consumed foods at each of these supermarkets, food-related attitudes, and sociodemographic characteristics, which allowed tests of these hypotheses.

METHODS

Participant Sample

Data were collected as part of the Seattle Obesity Study, using a stratified random sample of 2,001 adult residents of King County, WA, conducted in 2008-2009. Details on sampling and study procedures have been published previously.[18-20]

The Seattle Obesity Study combined telephone survey procedures, based on the Behavioral Risk Factor Surveillance System survey, with a mailed food frequency questionnaire (FFQ). A 20-minute telephone survey was used to collect data on food-shopping behaviors, names and locations of food stores frequented by respondents, food-related attitudes, and sociodemographic characteristics. Telephone survey respondents were asked to complete an additional dietary intake assessment. The majority (n=1,903 [95%]) agreed and FFQs were mailed to their home addresses. Completed FFQs (n=1,318) were checked for missing data and were sent to the Fred Hutchinson Cancer Research Center for processing. After removing respondents with outliers in calorie intakes (14 respondents with calorie intake <500 kcal/day and 9 respondents with >5,000 kcal/day) and respondents with missing data for key variables of interest (ie, income, education, and supermarket type), the final analytical sample consisted of 963 respondents. The sociodemographic profile of the total sample (2,001 respondents) was compared with the sample available for analyses (963 respondents). The analytical sample tended to have more white respondents (86% vs 80%) and more college-educated respondents (58% vs 54%). However, no significant differences were seen in other sociodemographic variables. The University of Washington Institutional Review Board approved study protocols and informed consent was obtained from study respondents.

Variable Definitions

Socioeconomic and Demographic Measures. Demographic variables of interest were age, sex, and race/ethnicity. Six categories of education were recoded: "high school," "some college," and "≥college degree." Annual household income was categorized into: "<$50K," "≥$50 to <100K," and "≥$100K." Household size was a covariate during analyses. A five-category index of SES was also created to capture the combined effects of income and education.[21,22] The categories ranged from lower income and lower education (income <$50K and <college degree) to highest income and higher education (income ≥$100K and ≥college degree) (see Table 1 footnote).

Dietary-Intake Data and Diet-Quality Measures

Dietary data were collected using the General Select version of the Fred Hutchinson Cancer Research Center FFQ,[23] a modified version of the FFQ used previously in Women's Health Initiative studies.[24-26] Participants indicated, for the past year, the frequency of consumption of each food and beverage with portion size. Detailed methodology on analyses of FFQ dietary data have been published previously.[27] Analyses yielded dietary energy (kcal), weight of foods and beverages consumed, estimated daily intakes of >45 macro- and micronutrients, as well as food-based indices, such as fruit and vegetable intake, all at the individual level.

Diet-quality measures were energy density, mean adequacy ratio (MAR), and fruit and vegetable intakes.[6,7,19,27,28] Energy density is the ratio of total calorie intake to daily weight of foods and caloric beverages consumed (kcal/g). MAR is the average of the truncated Nutrient Adequacy Ratios for 11 key nutrients in the diet (ie, vitamin A, C, D, E, B-12, calcium, iron, magnesium, potassium, folate, and fiber). The truncated Nutrient Adequacy Ratio for each nutrient was defined as the daily nutrient intake divided by the age- and sex-specific dietary reference intake,[29] with a maximum value of 1 (so that intake of any nutrient that exceeds the daily reference intake cannot mask lower intakes of other nutrients).[30] Total servings of fruits and vegetables per day were the food-based index of diet quality.[31]

Identification of the Primary Supermarket Reported

During the telephone survey, Seattle Obesity Study respondents were asked "what is the name of the primary store where your household purchases most of the foods you eat?" Participants also reported the exact store location, frequency of shopping trips, the amount spent at this store per visit, and monthly household food expenditures. These questions were repeated for one secondary food store as well.

Self-reported data on primary food stores was used solely to identify the primary supermarket for each respondent. These stores accounted for approximately 70% of the household monthly food expenditure and were visited more often (at least two to three times per week). Of the primary stores reported in the present sample, 92% were supermarkets, which constituted the sample for the present analyses. Of these, 88% were the eight supermarkets with maximum penetration in the King County area.

Classification of Primary Supermarkets by Price

To collect data on availability and prices at 13 primary supermarkets reported by respondents, a market basket of 100 commonly consumed foods was developed. The detailed procedures for market-basket data collection have been published previously.[18,32,33] In brief, market-basket data were collected for eight primary supermarkets through in-person visits. Five additional supermarkets were reported by the remaining 12% of the sample, prices for which were collected through store websites and contact with store managers. Results showed that the availability of foods was close to 100% at each of these supermarkets; however, there was a considerable variation by price.[33] We used cluster analysis to stratify supermarkets by price. The low-cost strata consisted of five supermarkets with an average market-basket cost of $224, the medium-cost strata consisted of four supermarkets with an average cost of $305 (30% to 40% more expensive), and the high-cost strata consisted of remaining four supermarkets with an average market basket cost of $393 (70% more expensive). Prices were collected from January 2009 through April 2009, which coincided with the period of data collection from other study instruments.

Attitude toward Healthy Eating

Participants in the telephone survey were read the following statement: "It is important to me that the foods I usually eat are healthy _____" and were asked to respond on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." This question is analogous to the one used in the National Health and Nutrition Examination Survey's Flexible Consumer Behavior Module[34] and in many health studies. For analytical purposes, the variable was recoded based on the distribution of data obtained. Although most of the respondents either strongly agreed (61%) or somewhat agreed (34%) with the importance of eating healthy foods, a relatively small proportion chose the neutral (3%), somewhat