

Is Place the Magic Bullet? Factors Related to Diet Quality and Cost in Low-income Women

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Abstract

A cross-sectional study was conducted examining factors associated with diet quality and cost among low-income California women. The researchers interviewed a convenience sample (n=117 adults) about their food shopping behaviors, food security, dietary intake, and food expenses. Based on three 24-hour diet recalls and food receipts, diet quality and cost were calculated. Groups with higher diet quality were more likely to have completed high school ($p < 0.03$) and less likely to be Supplemental Nutrition Assistance Program recipients ($p < 0.0001$). Greater access to stores with healthy foods and other neighborhood-level factors were not associated with diet quality or cost. Women with high quality diets were more likely to use the Nutrition Facts label ($p < 0.02$) and place more value on choosing nutritious foods ($p < 0.001$). Even where limited neighborhood access was not a factor, differences in diet quality and cost were still observed.

Keywords: low-income, women, diet quality, cost

Introduction

The relationships among income, food choices, and body weight are very complex (Jolliffe 2011; Mancino, Lin, and Ballenger 2004; Epstein and Saelens 2000; McLaren 2007). Low-income individuals are more likely than affluent audiences to choose low-quality diets that place them at risk for obesity and chronic disease (Mancino, Lin, and Ballenger 2004; Beydoun and Wang 2008; Wolongevicz et al. 2010). Understanding factors that influence food choices is of interest to policy makers and nutrition educators who work with low-income clients.

Behavioral economics is a useful framework to understand decisions related to food choice. (Mancino, Lin, and Ballenger 2004; Epstein and Saelens 2000). A key concept in behavioral economics is that the full price of food includes its monetary value, as well as travel and time costs involved in getting to stores and preparing food (Monsivais, Aggarwal, and Drewnowski 2012). People living in low-income neighborhoods and rural areas may have less access to supermarkets and healthy foods (Morland et al. 2002; Beaulac, Kristjansson, and Cummins 2009; Dean and Sharkey 2011; Jetter and Cassady 2006) . Greater distance from home to food stores is also negatively related to fruit and vegetable intakes in low-income households (Rose and Richards 2004; Dean and Sharkey 2011) . In the Lower Mississippi Delta, the high price of fruits and vegetables contributes to poor diet quality among low-income populations (Connell et al. 2012). Thus, food deserts and other place-related factors have become a focal point for public health interventions and advocacy efforts. Another factor that influences food choice is the individual's ability to buy or prepare food (Mancino, Lin, Ballenger 2004). As income increases, time also becomes more valuable and thus, people may rely more on convenience or prepared foods. Less time spent in food acquisition and preparation is associated with lower fruit and vegetable consumption (Barker et al. 2008) and poorer diet quality among low-income women (Lawrence et al. 2011).

Researchers have examined socioeconomic and psychosocial factors related to diet quality (Mancino, Lin, Ballenger 2004; Beydoun and Wang 2008; Wolongevicz et al. 2010; Lawrence et al. 2011; Barker et al. 2008). Previously, we reported that higher quality diets (less energy dense, less saturated fat, more vitamins A and C) are more expensive (Townsend et al. 2009). Yet some low-income women are able to eat a relatively higher quality diet at lower cost. Using other data collected in that same study, this current paper examines factors enabling these women to choose higher quality diets at lower cost. We hypothesized that women with higher quality, lower cost diets would be characterized by (1) greater access to stores with healthful food options; (2) less importance attached to convenience and taste; (3) more importance attached to nutritional value in food selection; and (4) greater use of meal planning and label reading skills.

Methods

Participants and recruitment

The findings to be discussed here are derived from a cross-sectional study that had the primary goal of determining the relationship between diet cost and diet quality in low-income women. A detailed description of the methods is provided elsewhere (Townsend et al. 2009; Aaron et al. 2013). The sample size for the primary study was selected to detect a significant correlation between actual food expenditures and diet cost based on prices attached to a food frequency instrument. A sample of 120 participants is needed to detect a correlation of 0.30 or above with 80 percent power at a 1 percent level of significance. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and approved by the Institutional Review Board of the University of California, Davis. Written informed consent was obtained from all subjects. Participants were compensated a total of \$75.

The study was conducted in 2006 in four California counties, comprising a mix of rural, suburban, and urban environments. Eligibility requirements included being (1) a female between 20-55 years; (2) low-income (\leq 185 percent of the federal poverty level); (3) the primary purchaser and preparer of food in the household; (4) reachable by phone with ability to understand and follow directions in English; (5) willing to collect food expenditure receipts for a two-week period; (6) willing to meet with research staff on a daily basis during data collection; (7) willing to provide written consent; and (8) in a household with at least one child. Exclusion criteria were (1) likely to move during study enrollment; (2) pregnant or breastfeeding within last 3 months; or (3) living in a shelter or rehabilitation center. Using convenience sampling, Cooperative Extension staff recruited participants at community centers, clinics, and social service agencies that were sites for U.S. Department of Agriculture (USDA) food assistance programs (e.g., Supplemental Nutrition Assistance Program, or SNAP). At the time of the study, none of the subjects had attended any Cooperative Extension-led nutrition education classes including those offered through Supplemental Nutrition Assistance Program Education (SNAP-Ed) or Expanded Food and Nutrition Education Program (EFNEP).

Procedures and measures

During individual interviews, participants self-reported household income for the previous month and other demographic characteristics (Townsend et al. 2009). The interview also included 55 items, with a 5-response Likert scale, to collect data on (1) self-reported decision-making related to food shopping; (2) participant-perceived attributes of neighborhood stores and restaurants; and (3) food preparation equipment and practices. For most items, responses were strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, or strongly disagree. Some items included the following responses: usually/always, often, sometimes, rarely,

or never. For the 15 variables relevant to the hypotheses and presented in this paper, a factor analysis was performed to examine construct validity of the instrument (unpublished data). Fair to good internal consistency (Cronbach's alpha coefficients of 0.56 to 0.70) of related constructs, including convenience, nutrition motivation, store attributes, and cooking practices, was evident. To understand the household economic context that may influence diet quality, the interviewers administered the 18-item USDA food security supplement, creating a scale where 0= most secure and 18= least food secure (Economic Research Service 2009).

Dietary intake

UCCE research staff, who completed a two-day training, interviewed participants on three non-consecutive days, including at least one weekend day, to recall dietary intakes from the previous day, using the USDA 5-pass method (Conway, Ingwersen, and Moshfegh 2004) . Interviews included questions about food eaten away from home, recipes, and free foods received. Raw data from recalls were entered into USDA's Nutrition Education Evaluation and Reporting System software version 5 (USDA 2012). The nutrient composition database contained a list of about 7,000 foods, derived from the USDA Nutrient Data Laboratory. Using data from the three recalls, an average Healthy Eating Index (HEI) was calculated for each participant (Guenther, Reedy, and Krebs-Smith 2008) . More detail on the diet recall methods used in this study are published elsewhere (Aaron et al. 2013).

Diet cost

Participants were asked to save all food expenditure receipts in a wearable pouch for a two-week period. The researchers felt that a longer period might result in poorer compliance. "Cost" referred to the food's value in dollars as purchased with SNAP benefits card, vouchers from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), or cash. The estimate included cost of all foods prepared and eaten at or away from home, purchased from carryout places, consumed at restaurants, donated to household, or acquired from emergency food assistance sites. To control for potential underreporting bias, calculations with diet cost were repeated, adjusting for an energy intake of 2000 kcal. A detailed description of the methods to calculate diet cost, based on 24-hour diet recalls, is available elsewhere (Aaron et al. 2013).

Statistical analyses

Data were analyzed using SAS (SAS Version 9.2 for Windows, SAS Institute Inc., Cary, NC, 2010). Descriptive statistics included frequencies for categorical variables and medians for non-normally distributed continuous variables. To form four comparison groups, the sample was split at the median values for the HEI (52.6) and diet cost per day (\$6.81) variables, thus yielding the 2 X 2 classification scheme. To examine differences in socioeconomic, store/restaurant access,

and food shopping and preparation variables, chi-square was used for the categorical variables and Kruskal-Wallis test for the continuous variables due to non-normal distribution. Significance level was $p < 0.05$.

Results

Among the sample recruited ($n=121$), four women did not complete all procedures. Median age was 34.5 years (range 18-54); 32 percent had completed high school or higher (vocational school); and 35 percent were married. Almost half (48 percent) were receiving benefits from WIC; 41.9 percent were SNAP recipients; and 18 percent were on Temporary Assistance for Needy Families (TANF). Less than 10 percent (11 women) participated in all three programs (WIC, SNAP, and TANF), and none received only TANF. When asked about race/ethnicity, 36.8 percent reported being white (non-Latino); 33.0 percent, Latino; 11 percent, black (non-Latino); 9.4 percent, Asian or Pacific Islander; and 9.5 percent other. The final sample ($n= 117$) was divided into the following four groups: (1) low quality/high cost, $n=30$; (2) low quality/low cost, $n=29$; (3) high quality/high cost, $n=28$; and (4) high quality/low cost, $n=30$. No differences were observed when unadjusted or energy-adjusted diet cost was used to form the groups. Thus, only the unadjusted diet costs are shown in the tables.

The four groups differed for housing costs, education, and program participation (Table 1). The groups with higher diet quality were more likely to have completed high school and were less likely to be SNAP or TANF recipients.

Table 1. Socioeconomic characteristics by cost per person and quality of diet ($n=117$)

Variable Median ¹ or % (n) ²	High Quality and Low Cost $n=30$	High Quality and High Cost $n=28$	Low Quality and Low Cost $n= 29$	Low Quality and High Cost $n= 30$	P-value
HEI ¹	63.0 (54.2-85.1)	61.0 (52.7-85.5)	45.3 (30.9-52.5)	43.8 (29.3-51.0)	0.0001
Diet cost (\$/day) ¹	\$4.88 (2.07-6.43)	\$8.21 (6.81-14.15)	\$4.97 (2.69-6.81)	\$8.71 (6.88-13.64)	0.0001
Per capita income (\$/mo.) ¹	\$372 (93-1125)	\$325 (100-750)	\$263 (85-931)	\$273 (136-600)	0.15
Total housing	\$1036	\$697	\$750	\$700	0.02

costs (\$/mo.) ¹	(0-2000)	(0-2000)	(200-2125)	(0-1777)	
Food Insecurity scale ¹	3.0 (0-16)	1.0 (0-16)	2.0 (0-12)	4.5 (0-13)	0.07
Completed high school ² (n=116)	46.7% (14) (n=30)	44.4% (12) (n=27)	24.1% (7) (n=29)	16.7% (5) (n=30)	0.03
SNAP ²	13.3% (4)	25% (7)	51.7% (15)	76.7% (23)	0.0001
WIC ²	36.7% (11)	46.4% (13)	58.6% (17)	53.3% (16)	0.36
TANF ²	0 (0)	21.4% (6)	20.7% (6)	30% (9)	0.02
Both WIC and SNAP	3.6% (1)	17.9% (5)	35.7% (10)	42.9% (12)	0.004

¹ Median (range), Kruskal-Wallis test

² Response, % (n), is “yes”, chi-square test; SNAP is the Supplemental Nutrition Assistance Program; WIC is the Special Supplemental Nutrition Program for Women, Infants and Children; TANF is Temporary Assistance to Needy Families (welfare)

Greater access to stores with healthy foods and other neighborhood-level factors were not associated with diet quality and food cost (hypothesis 1, Table 2). The group characterized by lower quality and higher cost reported eating out more often than did the other groups. However, one participant reported eating out daily. When this potential outlier was removed, the relationship between eating out to diet quality and cost was only marginal ($p=0.06$). Although there were no differences in perceived importance of convenience and taste, both high diet quality groups attached more importance to “healthy” and “nutritious” foods, compared to the low diet quality groups (hypotheses 2 and 3, Table 3). More frequent use of the Nutrition Facts label, but not menu planning, was related to higher diet quality (hypothesis 4, Table 3).

Table 2: Store characteristics and eating away from home by cost per person and quality of diet (n=117)¹

Variable % (n) ¹ or median ²	High Quality and	High Quality and	Low Quality and	Low Quality and	P-value
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	Low Cost n=30	High Cost n=28	Low Cost n= 29	High Cost n= 30	
Store has wide choice ¹ (n=116)	73.3% (22) (n=30)	78.6% (22) (n=28)	71.4% (20) (n=28)	70% (21) (n=30)	0.89
Store sells desired foods ¹	66.7% (20)	57.1% (16)	62.1% (18)	60% (18)	0.89
Store sells healthy foods ¹	50% (15)	57.1% (16)	51.7% (15)	60% (18)	0.85
Store sells affordable foods ¹	36.7% (11)	46.4% (13)	27.6% (8)	60% (18)	0.07
Store easy to reach ¹	56.7% (17)	42.9% (12)	44.8% (13)	63.3% (19)	0.34
Store is supermarket or grocery ¹ (n=116)	100% (30) (n=30)	100% (28) (n=28)	93.1% (27) (n=29)	100% (29) (n=29)	0.41
Take car to store ¹	96.7% (29)	92.9% (26)	89.7 % (26)	90% (27)	0.22
# Times ate out last mo. ²	3.0 (0-20)	3.0 (0-15)	3.0 (0-10)	4.0 (1-30)	0.05

¹ Response, % (n), is “yes” or “strongly agree”; chi-square test

² Median (range), Kruskal-Wallis test

Table 3: Food shopping practices¹ and attitudes² by cost per person and quality of diet(n=117)

Variable % (n)	High Quality and Low Cost n=30	High Quality and High Cost n=28	Low Quality and Low Cost n=29	Low Quality and High Cost n=30	P-value
Plan meals ¹	50% (15)	57.1% (16)	41.4% (12)	53.3% (16)	0.66

Use Nutrition Facts ¹	60% (18)	75% (21)	37.9% (11)	41.4% (12)	0.02
Important that foods are healthy ²	80.0% (24)	71.4% (20)	37.9% (11)	40% (12)	0.0008
Important that foods are nutritious ²	83.3% (25)	67.9% (19)	37.9% (11)	43.3% (13)	0.0009
Important that foods take little time to prepare ²	50% (15)	46.4% (13)	34.5% (10)	50% (15)	0.59
Important that foods fill me up ²	70.0% (21)	78.6% (22)	55.2% (16)	76.7% (23)	0.20
Important that foods taste good ²	86.7% (26)	96.4% (27)	93.1% (27)	96.7% (29)	0.38

¹ Responses for practices are 1="Often or usually" or 0="Sometimes, rarely or never", chi-square test

² Responses for attitudes are 1="Strongly agree" or 0="Somewhat agree, neither agree nor disagree, somewhat disagree, or strongly disagree"

Discussion

In this convenience sample of low-income women, some managed to eat higher quality diets at a lower cost. Those with higher quality diets were more likely to have finished high school, use the Nutrition Facts label, and place more value on choosing nutritious foods. Along with taste and convenience, greater access to stores with healthy foods and other neighborhood-level factors were not associated with diet quality and food cost. In addition, lower quality diets were associated with SNAP and TANF, but not WIC, participation although all the women were low-income.

Our study reported an HEI of 43.8 to 45.3 for the women in low-diet-quality groups, among whom SNAP participation was high (> 50%). This estimate is essentially the same as the HEI of 44.4 for SNAP participants, reported by the National Health and Nutrition Examination Survey (NHANES) 1998-2008 study (Leung et al. 2012). In that study, SNAP participation, compared to nonparticipation, was associated with lower diet quality scores for some components of the HEI-2005, though the effect of SNAP on diet quality was no longer significant after controlling for

potential confounders. In our study, the small sample size precluded a multivariate analysis to determine if confounders might explain the relationship between SNAP and diet quality. The median daily diet cost for the high-quality, low-cost group in our study was \$4.88, a value slightly higher than the 2006 Thrifty Food Plan (TFP) diet cost for females ages 20-50 years (weekly: \$30.70 or daily: \$4.38) (USDA 2006). According to a report based on the Current Population Survey (CPS) conducted in 2006, the median daily per person food expenditure for a household (<130 percent federal poverty level) was \$4.28 (Nord, Andrews, and Carlson 2007). Thus, our sample reports a close but slightly higher diet cost, compared to either the 2006 TFP or CPS household expenditure reports. This may be due to higher cost of living in California compared to other states or to our methodology that estimated diet cost using 24-hour recalls and food receipts.

The finding that neighborhood factors were not related to diet quality runs counter to what some researchers have reported previously (Morland et al. 2002; Beaulac, Kristjansson, and Cummins 2009; Dean and Sharkey 2011; Jetter and Cassady 2006). These studies have explored neighborhood factors in different ways, often using geocoding, market basket store surveys, or distance to stores, all of which are considered objective measures of access. In our study, the use of participants' perceptions of store attributes, which is a subjective measure of access, may explain these results. Interestingly, a study that included both objective and subjective measures of access found that perceived access to stores is more strongly related to fruit and vegetable intake than is actual measured distance to stores (Caspi et al. 2012). Another possible explanation is lack of diversity in our sample. Had our sample included a more diverse sample of non-English speaking, immigrant, or other isolated population subgroups, a relationship between neighborhood factors and diet quality and cost might have been observed. In our sample, most women (> 90 percent) had access by car to stores, and almost everyone listed a grocery store or supermarket as their primary food store. However, two larger studies in diverse settings (Pennsylvania and UK) reported similar findings to ours, specifically that distance to primary food stores or lack of access to a car is not associated with fruit and vegetable consumption (Fuller, Cummins, and Matthews 2013; Dibsall et al. 2003).

Having more education and reading nutrition labels were both related to higher quality diets, similar to the observations in other studies (Mancino, Lin, Ballenger 2004; Cahill et al. 2010; Bhargava 2004). While per capita household income (monthly income divided by total household members) did not vary across the four groups, the higher quality, lower-cost diet group reported the highest housing costs, least use of SNAP, and no TANF support. Thus, there may be economic pressures, beyond what was captured in our rough estimate of income, that motivated this group to choose a lower cost diet. These economic factors, coupled with greater interest in nutrition and food-related skills (use of the food label), may account for the differences in these low-income women who chose the higher-quality, lower-cost diet compared to others who did not.

Strengths of the study were use of actual diet costs, calculated from food receipts and three non-consecutive dietary recalls, and the 2005 Healthy Eating Index as a measure of diet quality.

Limitations include small sample size and a convenience sampling method, which preclude generalizing the findings to the broader low-income population. Attitudes, income, and perception of neighborhood access were self-reported.

Some women in this study were able to eat higher quality, lower cost diets despite financial constraints. Only half of these women received WIC and/or SNAP food assistance. Neighborhood access to stores appeared not to be a factor in this sample. Our findings suggest that community interventions focused on food access issues may still need to include nutrition education to improve diet quality in low-income audiences. Emphasis should be placed on motivating low-income women to make healthy food choices, as well as building skills in label reading and food preparation.

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