Introduction

Numerous social, economic, educational, and cultural factors may influence the types of foods people consume. Few studies have examined the possible influence of neighborhood socioeconomic status (SES) on dietary behaviors. A recent study in Scotland identified significant differences across neighborhoods in the consumption of foods which remain after controlling for individual level variables, including income and occupational class. Another recent study investigated neighborhood differences in dietary behaviors, systematically within a large cohort using multilevel models and controlling for individual level factors. This study found consistent differences in food intake across neighborhoods. The literature contains stronger evidence supporting how neighborhood socioeconomic status predicts physical activity levels. Residents of low socioeconomic status neighborhoods have been shown to use recreational facilities less than those in higher socioeconomic status neighborhoods. Residents of neighborhoods where a high percentage of the population is college educated have been found to be more likely to walk than those in less educated neighborhoods. Residents of low socioeconomic status neighborhoods may have limited ability to control their physical activity due to inaccessible environments. This evidence suggests more in-depth research into potential neighborhood level determinants of diet is warranted.

After establishing the important role of socioeconomic status in shaping diet, we must next look for the causal mechanisms within this relationship. The potential impact of neighborhood socioeconomic status on individual dietary behaviors may be mediated by various components of neighborhood context, including neighborhood tenure, food store quality, food store convenience, and perceived neighborhood size. In today's society, cost and availability of low fat foods, or fruits and vegetables may vary by neighborhood. The availability of healthy (low fat and high fiber) products (as assessed by shelf space occupied in community stores) has been shown to be significantly related to the consumption of healthful foods by people living in a particular area. A lower prevalence of large supermarkets and a higher prevalence of smaller independently owned grocery stores was identified in both low-wealth and predominately Black neighborhoods. In addition, a greater proportion of households without access to private transportation exist in these neighborhoods. Thus, the impact of neighborhood socioeconomic status on individual dietary behaviors may be mediated by the context of one's neighborhood. However, little evidence exists to demonstrate that aspects of neighborhood context meditate the relationship between neighborhood socioeconomic status and individual dietary behaviors.

Sample

The subjects were 749 individuals from fifty-three religious organizations (ROs) who participated in the baseline and follow-up examinations of the Eating for Healthy Life (EHL) Study. EHL was a prospective cohort study investigating the efficacy of a multi-component intervention package for dietary change. The project was conducted by the Fred Hutchinson Cancer Research Center in Seattle, Washington. The RO's were identified for recruitment using a list provided by the Church Council of Greater Seattle. Eligible RO's met the following criteria: 1) ZIP code within a one-hour drive from FHCRC; 2) a telephone number listed on the Church Council list or obtainable through directory assistance or the Church Council directory; and 3) between 100 and 2,000 adult active members, with a minimum of 100 English-speaking adults. The participants were a cohort (n=35 for each RO) of randomly selected individuals whose names were on their RO's membership list. The study population was restricted to families' primary food preparers, at least eighteen years of age, who had attended their respective religious organizations at least twelve times in the year prior to being surveyed.



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Analysis Plan

A series of regression analyses were conducted using the Statistical Package for Social Sciences (SPSS) Version 10.0 to test our hypotheses that: 1) individuals living in neighborhoods with higher socioeconomic status consume less fat and more fiber than individuals living in neighborhoods with lower socioeconomic status, and 2) the relationship between neighborhood socioeconomic status and individual dietary behaviors is mediated by neighborhood context.

The mediational relationship depicted in the conceptual model proposed was tested using methods described by Baron and Kenny (1986). This approach outlined the following regression equations be estimated in the order listed:

Step 1) The independent variables must predict the mediating variables,

- Step 2) The independent variables must predict the dependent variables, and
- Step 3) The independent variables and the mediating variables must predict the dependent variables.

The first step involved testing socioeconomic status as a predictor of neighborhood context. Four different models were tested to determine if the socioeconomic status variables predict any of the four neighborhood context measures. These four tests were conducted by logistic regression, since each of the dependent variables is dichotomous.

The second step involved testing socioeconomic status as a predictor of individual dietary behaviors. Two different models were tested to determine if socioeconomic status predicts individual dietary behaviors as measured by fat and fiber summary scores. One test was executed for the fat scale summary score outcome. The second test was executed for the fiber scale summary score outcome. These two tests were conducted by linear regression. When constructing these two models, the measures of socioeconomic status used as independent variables were determined on the basis of the results of the first step of analyses.

The third step involved testing socioeconomic status and neighborhood context together as predictors of individual dietary behaviors. Two different models were tested to determine if socioeconomic status and neighborhood context predicts individual dietary behaviors as measured by fat and fiber scale summary scores. One test was executed for the fat scale summary score outcome. Another test was executed for the fiber scale summary score outcome. These two tests were conducted as linear regression. The SES variables were entered as the first block of independent variables tested, then the neighborhood context variables were entered as the second block of independent variables tested. When constructing this model, the measures of socioeconomic status and the measures of neighborhood context used as independent variables were determined on the basis of the results of the first step of analyses.

Results

Socioeconomic Status as a Predictor of Step 1. **Neighborhood Context**

SES ¹	Neighborhood Tenure Food Store Qualit OR (95%CI) OR (95%CI)		Food Store Convenience OR (95%CI)	Neighborhood Size OR (95%Cl)			
NEIGHBORHOOD LEVEL SES							
Median neighborhood income	1.30 (0.89 , 1.89)	**1.39 (0.98 , 1.97)	1.10 (0.77 , 1.57)	1.02 (0.72 , 1.43)			
% of neighborhood employed	1.00 (0.97 , 1.04)	1.01 (0.98 , 1.05)	1.00 (0.96 , 1.04)	1.00 (0.97 , 1.04)			
% of neighborhood with bachelor's degree or higher	1.00 (0.99 , 1.02)	1.01 (0.99 , 1.02)	1.00 (0.99 , 1.02)	*1.02 (1.01 , 1.03)			
INDIVIDUAL LEVEL SES							
Race/ethnicity	1.16 (0.65 , 2.06)	1.16 (0.67 , 2.01)	1.35 (0.75 , 2.44)	0.70 (0.40 , 1.20)			
Highest education level completed (h.s. grad or $< =$ referent)							
Some college	0.84 (0.49 , 1.42)	1.17 (0.72 , 1.88)	1.37 (0.84 , 2.24)	1.30 (0.81 , 2.07)			
College graduate	0.81 (0.47 , 1.39)	1.03 (0.64 , 1.67)	1.12 (0.69 , 1.82)	1.35 (0.84 , 2.18)			
Graduate or professional school	0.66 (0.37 , 1.16)	0.91 (0.54 , 1.51)	0.71 (0.43 , 1.20)	1.37 (0.82 , 2.29)			
Employed	0.91 (0.60 , 1.37)	0.89 (0.61 , 1.31)	1.02 (0.69 , 1.52)	1.37 (0.93 , 2.02)			
Overall significance	χ²=132 P<0.001	χ ² =34 P<0.001	χ ² =13 P=0.279	χ²=37 P<0.001			

* p<0.05, ** p<0.10 1 Controlling for age, gender, and marital status

Socioeconomic Status as a Predictor of Step 2. **Fat and Fiber Behaviors**

	Fat Bel	naviors	Fiber Behaviors		
SES ¹	Beta	SE	Beta	SE	
Median neighborhood income	-0.05	0.03	*0.07	*0.03	
% of neighborhood with bachelor's degree or higher	-0.01	0.01	-0.04	0.01	

* p<0.10 1 Controlling for age, gender, and marital status

Step 3.

Socioeconomic Status and Neighborhood Context as **Predictors of Fat and Fiber Behaviors**

	Fat Behaviors				Fiber Behaviors				
	Model 1		Model 2		Model 1		Model 2		
	Beta	SE	Beta	SE	Beta	SE	Beta	SE	
SES ¹									
Median neighborhood income	-0.05	0.03	-0.05	0.03	*0.07	*0.03	*0.07	*0.03	
% of neighborhood with bachelor's degree or higher	-0.01	0.01	-0.01	0.01	-0.04	0.01	-0.03	0.01	
Food Store Quality			0.03	0.03			-0.01	0.03	
Perceived Neighborhood Size			0.03	0.03			-0.02	0.03	
Overall Significance	F =8.0; df= 5; p<0.001; R2 = 0.05		F =5.9; p<0 R2 =	F =5.9; df= 7; p<0.001; R2 = 0.04		F =9.5; df= 5; p<0.001; R2 = 0.05		F =6.8; df= 7; p<0.001; R2 = 0.05	

* p<0.10 1 Controlling for age, gender, and marital status

Discussion

Tests of our first hypothesis indicate that individuals in neighborhoods with high median income do consume more fiber than those in lower median income neighborhoods when controlling for the percent of residents with bachelor's degrees or higher. No statistically significant association was found between any measure of socioeconomic status and participants' fat behaviors. Nor was a statistically significant association found between neighborhood education attainment and participant's fiber behaviors. There are some aspects of our study that may have hindered us from identifying the associations predicted in our first hypothesis. We would have liked to have controlled for individual level income as reported by the participants in our models. However, this data was missing for over 15% of our sample. We did not want to restrict our sample size by including this measure of individual socioeconomic status, thus it was removed. Our Census data corresponding to our participants' neighborhoods may not have been as accurate as that obtained using other tools, such as a Geographic Information System (GIS). Unfortunately this resource was not available to us. In addition, Census data on income and education may be subject to over-reporting. They also may be inaccurate because they are obtained from a 1 in 6 sample then weighted to represent the entire population. Slight measurement error associated with the use of the FFB as an indicator of dietary behaviors may also have contributed to our unexpected findings.

Tests of our second hypothesis, only yielded results which expand upon the findings in tests of our first hypothesis. Individuals in neighborhoods with high median income do consume more fiber than those in lower median income neighborhoods when controlling for food store quality and perceived neighborhood size in addition to the percent of residents with bachelor's degrees or higher. However, we did not find any evidence to support the second hypothesis. The guidelines for our analytical methods indicated to establish mediation we must demonstrate socioeconomic status has no effect on dietary behaviors when neighborhood context is controlled. Our tests did not yield any statistically significant results to indicate the relationship between neighborhood socioeconomic status and individual dietary behaviors is mediated by neighborhood context. There are some aspects of our study to consider that may have hindered us from identifying the mediational relationship hypothesized in addition to those mentioned regarding the test of our first hypothesis. Our sample was primarily composed of educated white females. It is possible the neighborhoods where most of our population resided were comparatively similar; therefore, some of the trends we expected were not present among our sample nor their neighborhoods. Our sample size was moderate; however, it was not as large as those in the few similar studies which studied large, nationally-based samples. It is also possible individuals sampled who refused to participate, tend to have different socioeconomic status levels and dietary behaviors than those who agreed to be in the study. Most of all, because this study addressed a relatively new area of knowledge, identifying the proper measures to gauge neighborhood geography and neighborhood context was very difficult. Perhaps the use of different measures would have resulted in the findings we predicted.

Future Directions

Overall, our findings offer some new evidence to support the idea that elements of neighborhood socioeconomic status should be considered when trying to understand the dietary behaviors of individuals. One of our measures of socioeconomic status, median neighborhood income, was found to be a significant predictor of fiber consumption when controlling for neighborhood education attainment, and neighborhood context (measured by quality of food stores and perceived neighborhood size). Further analysis of our data may lead to the development of other models testing potential mechanisms of the relationship between neighborhood socioeconomic status, neighborhood context and individual dietary behaviors. Investigating the relationship between dietary behaviors, neighborhood socioeconomic status, and neighborhood context has the potential to impact public health policies and interventions. Therefore, the scientific community should strive to identify the causal mechanism within this relationship. This information could drive future policies and interventions addressing the neighborhoods in which people live. Such initiatives may improve individuals' dietary choices, and reduce the burden of diseases associated with individual dietary behaviors.





