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Neighborhood Level Disadvantage is Associated with Reduced Dietary Quality in Children

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Abstract

Research has linked neighborhood socioeconomic status to differential dietary quality among adults. However, the relationship between neighborhoods and children's diet remains understudied. The aim of the research was to examine if neighborhood disadvantage (e.g. socioeconomic status, social and physical disorder) affected dietary quality among children. Data for this cross-sectional study were gathered between June 2005 and December 2008. Research participants included 182 children aged 7 to 12 years who were of Hispanic (26%), European (28%) and African American (45%) descent. Dietary intake was gathered via two 24 hour recalls and analyzed using the Nutrition Data System for Research. Descriptive statistics and ANOVA's were conducted to determine if there were significant differences in dietary intakes by quartile grouping of neighborhood disadvantage. Multivariate linear regression analyses were used to determine if neighborhood disadvantage (as a continuous measure) was associated with dietary quality. Overall, there were no significant differences in total caloric intake, however, children in disadvantaged neighborhoods consumed a greater percentage of calories from fat (P=.039), trans fat (P=.018), and had a higher sodium intake (P=.01). The results suggest that neighborhood factors may contribute to dietary quality among children. Future interventions should assess mechanisms to improve the availability of healthy foods while taking into account neighborhood level conditions.

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Keywords

neighborhood; children; diet

While community food environments are critical for the health and development of children, (1–3) many youth live in obesogenic environments (4–6). Children who reside in urban, low-income, and rural neighborhoods have higher risks for reduced access to healthy food environments where fresh fruits, vegetables, whole grains, and fish are readily available (4,7,8). This limited access may negatively impact the health of children and have long lasting consequences that may manifest as obesity, hypertension, diabetes, and other health-related consequences (2,3,8–12).

Though a direct causal influence has not been established, research has supported that a possible mechanism through which neighborhoods indirectly affect health outcomes may be through access to healthy diets and dietary quality (5,13,14). Objective assessments of neighborhood level socioeconomic characteristics have revealed geospatial differences in access to grocery stores, supermarket chains, differential dietary patterns, and increased obesity risks (4,15). In low-income urban environments, supermarkets are less accessible and urban residents are more likely to report inferior quality of food products, limited selection, and mediocre service (16,17). In one multi-regional study, individuals residing in areas with fewer supermarkets in their neighborhoods were 25 to 46 percent less likely to have healthy diets relative to those with greater resources (7). This relationship between neighborhood factors and diet persists after adjusting for individual level income, race/ethnicity, and gender (7,18). Further, qualitative assessments of women in low socioeconomic environments has shown that the lack of proximity to health promoting food environments are barriers that affect the eating patterns and diets of their children (19).

While most studies have used neighborhood level characteristics to evaluate dietary patterns among adults, very few researchers have assessed the relationship between neighborhood level characteristics and dietary quality among children. Therefore, the intent of this research was to examine relationships between census tract neighborhood level disadvantage and dietary quality among youth. It was hypothesized that children in disadvantaged neighborhoods would have lower dietary quality compared to children who live in more advantaged neighborhoods.

METHODS

Study Design and Participants

The data were gathered from a cross-sectional clinical study evaluating pediatric metabolic outcomes among children aged 7 to 12 residing in the Birmingham-Hoover Metropolitan Area. After receiving Institutional Review Board approval from the University of Alabama at Birmingham, children and their parents were recruited via school presentations, churches, health fairs, newspapers, parent magazines, wide-distribution mailers, and participant referrals. Only healthy children who were not consuming any medications known to affect metabolism (e.g. Attention Deficit Hyperactivity Disorder, asthma, and steroid medications) were included in the study.

Measures

Dependent Variable

Diet—Dietary recalls were gathered via two 24-hour recalls by trained researchers and one registered dietitian using the multiple pass method (20). The parent and child were presented with cup and bowl sizes to assist in the approximation of food portions. The first recall was obtained during the first visit to the local university and the second was obtained during an overnight visit at the General Clinical Research Center. Dietary data were analyzed using Nutrition Data System for Research software (version 2006 developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN). The data provided represents the average of the two 24-hour recalls.

Independent Variables

Objective Neighborhood Disadvantage—The index of objective neighborhood disadvantage was operationalized based on the work of Wilson (21,22). Specifically, Wilson highlights urban decline and its effects on unemployment, increased poverty and female headed households within a given area as indicators of neighborhood disadvantage. It is further postulated that changes in the economic and social circumstances within an environment will result in the emergence of specific cultural values, life chances, norms, and behaviors that cannot be understood without taking into account the social context from which they emerged. Census tract information was gathered from home addresses provided by the study participants. Although block group data are the smallest geographic units of the census (average of 1,000 compared to 4,000 for census tracts), census tracts have been widely used and are able to detect socioeconomic gradients (23). The percentages of unemployment, poverty, female headed households, and vacant housing within an area were gathered from each census tract and then summed to create an index (United States Census Bureau 2000) using the methods by Ross and colleagues (24). This scale had a reliability of =.938. In addition to using this measure as a continuous variable, quartiles of neighborhood disadvantage (groups 1 to 4) were created with higher values indicating greater disadvantage.

Self-reported meal frequency—Traditional meal consumption of breakfast, lunch, and dinner was assessed by asking the child to report meal frequency over the past 7 days, response options were 0 = 0 times, 1 = 1 to 2 times, 2 = 3 to 4 times, 3 = 5 to 6 times, and 4 = 7 times.

Fast food—This was assessed by asking the child to report the number of fast-food meals eaten within a 7 day period, response options were 0 = never, 1 = 1–2 times, 3 = 3–4 times, 4 = 5–6 times, and 5 = 7 times or more.

SES—Socioeconomic status was measured using the Hollingshead Four Factor Index (25). This is a 4-factor index of social class that combines educational attainment and occupational prestige for the number of working parents in the child’s family. Scores ranged from 8 to 66, with higher scores indicating higher theoretical social status. If there were two working parents, the scores were averaged, and for those who were unemployed, their previous occupation was used to develop occupational prestige scores.

Statistical Analyses

Simple bivariate correlations were evaluated to test for multicollinearity among all independent variables with a removal criterion of $r \geq .60$. None of the variables were highly correlated and were therefore included in further analyses. Additionally, preliminary analyses included a measure of family structure, with 0 = intact family and 1 = single parent, this measure did not significantly contribute to dietary patterns (P=.98) and was thus excluded from further analyses. Also, other indicators of diet quality including iron, added sugars, and calcium were not significantly related to the independent predictors or covariates (with the exception of total energy intake), and to present the most parsimonious findings, these variables were excluded from further analyses. Simple descriptive statistics including means, standard deviations, and percentages are presented. To test for significant differences in diet, demographics, and food habits by neighborhood disadvantage group were conducted using ANOVA's with a significance level of $P<.05$ and Tukeys post hoc analyses. Multivariate linear regression analyses were used to determine if characteristics of neighborhoods influenced dietary quality among children. In this model, objective neighborhood disadvantage was entered as a continuous variable. Because there was heterogeneity in the census tracts, no analyses were used to account for neighborhood clustering (26). Other important covariates included the child's age as reported by the parent, gender with male as the reference category. The significance probability for the model was set at $p<.05$ and variables were log transformed where appropriate. All analyses were performed using SAS (version 9.1, 2002, SAS Institute, Cary, NC).

RESULTS AND DISCUSSION

Demographics

A total of 182 children (n = 48 Hispanic American; n = 82 African American and n = 52 European American) and their parents were included in the analytic cohort. Based on their population proportions in the Birmingham-Hoover Metropolitan Area, 1.8%, 36%, and 60% respectively, (2000 United States Census) Hispanics and African Americans were overrepresented and European Americans were underrepresented in this sample.

Neighborhood Grouping and Dietary Quality

Approximately 27% of respondents were in each of the quartiles 1 through 3, and 19% were in the highest quartile (quartile 4) of disadvantage (Table 1). Children who lived in quartile 1 were of significantly higher socioeconomic status than children residing in quartile 4 ($p<.05$). While there were no overall differences in caloric intake between the groups, children in all neighborhood groupings were likely to exceed dietary recommendations for daily caloric intake (28) and there were differences in composition of these calories by neighborhood group. Children in the most disadvantaged neighborhoods (quartile 4) reported a greater percentage of their energy from fat (36.3% versus 34.3%) and had a higher sodium intake ($p<.05$) than those in the least disadvantaged neighborhoods. On average, all of the children in this study exceeded the maximum recommended intake of sodium for their age group (~1200–1500 mg recommendation) (28). This mirrors national trends among young children (28, 31). However, children in the most disadvantaged neighborhoods took in 23% more sodium than the least disadvantaged (3549 mg and 2885 mg respectively). This is quite alarming considering the adverse health outcomes, such as increased hypertension risk, associated with the overconsumption of sodium (28). The higher sodium intake may be an indicator of increased consumption of processed foods (29,30). Also, children in the third quartile of disadvantage reported a greater intake of protein, than children in the lowest quartile of disadvantage ($p<.05$).

Neighborhood Disadvantage and Trans Fat

The relationship between neighborhood disadvantage and dietary patterns was evident after accounting for individual level covariates, age, gender, socioeconomic status, total caloric intake, self-reported meal frequency, and fast food consumption (Table 2). Neighborhood disadvantage was associated with an increased percentage of calories from fat ($P=.039$) and increased trans fat intake ($P=.018$). While the American Heart Association (31) has suggested that total intake of trans fat should not exceed more than 1 percent of total calories, children in the most disadvantaged neighborhoods consumed an average of 7.1g (± 3.5g) which translated to 3.3 percent of total calories. This is particularly troublesome because diets high in trans fats have been linked to increased risks for coronary artery disease (32). This may suggest that children in the most disadvantaged neighborhoods consume nutrient poor foods which put them at higher risks for future adverse health related outcomes. Children in disadvantaged neighborhoods also had higher sodium intakes ($P<.001$), and consumed a lower percentage of calories from carbohydrate ($P=.026$). The current findings build upon established literature showing differential diet quality based upon social and community contexts (18,33,34).

Socioeconomic status was inversely associated with percentage of calories from protein ($P<.001$) and total sodium ($P=.018$), and was positively associated with percentage energy from carbohydrates ($P=.002$). This is consistent with the literature indicating differential dietary patterns by socioeconomic status, with those of higher SES having overall healthier eating patterns (9,34). However, more information is needed to identify the sources of carbohydrates among each socioeconomic stratum. Socioeconomic status related variables were not predictive of total caloric intake for the children in this sample. The lack of significant findings for total caloric intakes, percentage of calories from fat, and trans fat related variables, may be due in part to the proportion of children in this study receiving free or reduced school lunch through the National School Lunch Program (approximately 41%), which may have acted as a buffer to reduce disparities in nutrient outcomes and total caloric intake (28). Future research should assess dietary patterns among children in the absence of such programs to understand the extent of dietary quality differentials in children.

While informative, this research is not without limitations. The sample size was relatively small and the sample was not representative of the population. However, the use of objective indicators of neighborhood disadvantage may make these results translatable to areas with similar neighborhood characteristics. Also, the use of self-reports to classify dietary intake may introduce recall bias (20). The sources for differential dietary patterns by neighborhood grouping (e.g. higher consumption of snack foods, increased energy from beverages, or fatty meats), were not accounted for by the 24 hr. recall, this information may be pertinent to explain the observed differences in diet quality. As well, the dietary recalls only include sodium that is added to foods during processing and excludes salt added at the table. Therefore, the results for sodium found in this research may actually underestimate intakes (35). Also, future studies should include measures of the home environment that address food security and crowding in the home which in turn, may provide insight into differential eating patterns by neighborhood.

CONCLUSION

There has been a dearth of studies evaluating dietary quality in young children using census tract analyses. Significant dietary patterns among the children emerged and the results indicate that census level neighborhood characteristics - poverty, unemployment, increased vacant housing, and single-parent female headed households - significantly contribute to differential dietary quality patterns in young children. This is of particular concern because these disparities may be due to differences in grocery store access, differences in the prices, quality, and selection of fresh fruits and vegetables, or possible cultural food preferences. The results suggest that the unhealthy differences in diet associated with neighborhoods may translate into increased disease risk for children. Future policy should be aimed at addressing dietary quality in children and ways to reduce disparities by neighborhood.

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Table 1

Descriptive characteristics of children's dietary patterns by neighborhood disadvantage group (higher quartiles indicate greater disadvantage). Means (standard deviations).

		Neighborhood Disadvantage[a]			
Variable	**Total Sample N = 182**	**Quartile 1 n = 50 (28%)**	**Quartile 2 n = 48 (27%)**	**Quartile 3 n = 50 (28%)**	**Quartile 4 n = 34 (19%)**
Diet					
Total energy (kcal[d])	1910.9(419.8)	1890.54(474.1)	1949.50(334.59)	1866.2(385.1)	1940.7(475.9)
Protein g[e]	14.8(3.4)	13.7(3.2)[b]	14.7(2.7)[bc]	16.0(3.5)[c]	15.0(3.7)[bc]
Fat g[e]	34.8(6.0)	34.3(5.8)[bc]	33.4(7.0)[b]	35.1(5.0)[bc]	36.3(5.8)[c]
Carbohydrate g[e]	51.4(7.7)	53.3(6.8)	53.0(8.1)	50.0(6.5)	49.5(8.6)
Trans fat (g[e])	6.4(2.9)	6.0(2.5)	6.1(3.0)	6.9(2.7)	7.15(3.5)
Sodium (mg[f])	3233.3(984.9)	2885.2(811.4)[b]	3212.2(838.8)[bc]	3304.4(873.0)[bc]	3549.8(1272.5)[c]
Demographics					
Age	9.5(1.55)	9.7(1.5)	9.6(1.6)	9.2(1.5)	9.7(1.5)
SES[g]	39.8(14.35)	44.4(13.6)[b]	39.5(15.3)[bc]	37.9(14.6)[bc]	37.0(12.7)[c]
Ethnicity					
Hispanic American	26.2	26.0	31.2	30.0	17.0
European American	45.1	60.0	54.2	24.0	19.2
African American	28.7	14.0	14.6	46.0	63.8
Food Habits					
Fast Food[h]	0.9(0.8)	0.8(0.8)	0.9(0.8)	1.0(0.7)	1.1(0.8)
Meal frequency[i]	3.1(1.1)	3.2(1.1)	3.0(1.1)	3.2(1.0)	2.8(1.1)

[a]Neighborhood disadvantage index includes census tract level percent unemployment, poverty, single female headed households with dependent children, and vacant housing. Higher quartiles indicate greater disadvantage.

[b,c]denote significant group differences at $p<.05$.

[d]kcal = kilocalories

[e]g = grams expressed as percentage of calories

[f]mg = miligrams

[g] SES = socioeconomic status

[h] Fast food refers to the number of times fast food was eaten in the past 7 days

[i] Meal frequency is the number of times the child eats 3 meals per day

Table 2

Neighborhood disadvantage and dietary quality patterns among children

Variable	Total energy (kcal[a]) $\beta^e \pm se^f$	p^g	Protein (g[b]) $\beta^e \pm se^f$	p^g	Fat (g[b]) $\beta^e \pm se^f$	p^g	Carbohydrate (g[b]) $\beta^e \pm se^f$	p^g	Log Trans fat (g)[c] $\beta^e \pm se^f$	p^g	Log Sodium (mg)[d] $\beta^e \pm se^f$	p^g
Neigh[h]	−59.50 ± 49.39	.115	0.33 ± 0.39	.203	1.32 ± 0.74	.039*	−1.84 ± 0.94	.026	0.11 ± 0.05	.018*	0.08±0.03	.001*
SES[i]	1.5 ± 2.19	.239	−0.07 ± 0.01	.001*	−0.03 ± 0.03	.124	0.11 ± 0.04	.002*	0.00 ± 0.00	.310	−0.00 ± 0.00	.018*
Meals[j]	48.7± 27.3	.038*	0.06 ± 0.22	.385	−0.48 ± 0.41	.122	0.41 ± 0.52	.212	−0.04 ± 0.03	.064	0.01 ± 0.02	.285
Fast food[k]	8.3 ± 39.6	.416	−0.25 ± 0.31	.214	−0.15 ± 0.60	.397	0.45 ± 0.75	.275	−0.01 ± 0.04	.405	−0.02 ± 0.02	.144
R^2[l]	4.2		6.8		2.1		5.9		30.8		40.9	
F statistic[m]	2.31		3.16		1.66		2.87		12.26		18.56	

All models adjusted for age and gender

[a] kcal = kilocalories

[b] g = percentage of total calories expressed in grams

[c] g = grams adjusted for total energy intake

[d] mg = milligrams adjusted for total energy intake

[e] = unstandardized coefficient

[f] se = standard error

[g] p values are based on the t statistic for linear regression

[h] Neigh = neighborhood disadvantage index includes census tract level percent unemployment, poverty, single female headed households with dependent children, and vacant housing

[i] SES = individual level socioeconomic status

[j] meals refers to the number of times the child consumed breakfast, lunch, and dinner over a 7 day period

[k] fast food refers to the number of times the child ate fast food over a 7 day period

[l] R^2 = adjusted R^2, total variance explained by the model, expressed as a percantage.

[m] F-statistic test of significance for multiple linear regression

* $p < .05$