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Research Article

Unhealthy Diet of High Socioeconomic Children of Color: Marginalization-Related Diminished Returns

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Abstract

Background: While socioeconomic status (SES) indicators such as parental educational attainment and household income are among the primary drivers of individual health, the effects of household SES indicators (for example, parental educational attainment and family income) on health behaviors such as a healthy diet may differ by ethnicity, as discussed by the Marginalization related Diminished Returns (MDRs) phenomenon.

Objectives: Built on the MDRs, this study had two aims: first, to test the associations between family SES indicators (parental educational attainment and household income) and diet quality, and second, to test ethnic variation in these associations.

Materials and Methods: This longitudinal study used the Adolescent Brain Cognitive Development (ABCD) baseline and year 2 data. Participants included 5,856 individuals who were either Black, White, Latino, or non-Latino. Age, sex, family structure (parental marital status), parental education, and family income were studied. The outcomes were the amount and frequency of consuming fish, soup, vegetables, fruits, hot dogs, French fries, ketchup, soda, and sugary beverages. Linear regression was used for performing the main data analysis.

Results: Overall, high educational attainment and family income showed a positive association with fruit consumption and a negative association with the consumption of hot dogs, fries, soda, and sugary beverages in the overall population. We documented statistically significant interactions between ethnicity and educational attainment and household income on our dietary habits of interest, indicating weaker associations between family SES and diet in Black and Latino than non-Latino White individuals.

Conclusion: We observe that household SES differently improves the dietary quality of diverse ethnic groups. Due to MDRs of education and income in ethnic minorities, children from highly educated and high-income families eat less healthily than their non-Latino White counterparts. This finding is in line with the MDRs framework that ethnic health disparities sustain across class lines.

Keywords: Educational attainment; Diet; Socioeconomic status; Population groups

Introduction

While Marmot [1,2], Hayward [3-5], Link and Phelan [6], Ross and Miroswky [7-9], and others [10] have shown that socioeconomic status (SES) indicators, such as educational attainment, promote population and individual health outcomes, recent research has documented weaker SES effects for ethnic minorities than non-Latino White populations [11,12]. Although one of the mechanisms that explains the impact of education and income on health is improved health behaviors such as diet [13-20], more recent studies have shown that the effects of parental and one's own education and income on dietary habits and food options are weaker for ethnic minorities than non-Latino Whites [21,22]. This is in part because ethnic minorities are still segregated, and their high SES does not improve access to healthy foods to the same level as high SES non-Latino Whites. This is important because a healthy diet is associated with a lower risk of obesity, diabetes, heart, and metabolic diseases [13,23,24].

The Marginalization-related Diminished Returns (MDRs) phenomenon [11,12] refers to the general observation that the effects of educational attainment and household income on generating outcomes are weaker for ethnic minorities than their non-Latino White counterparts [25-31]. Similar MDRs are shown for diet [22], obesity [32,33], heart disease [34], disability [35], chronic disease [36], hospitalization [37], and mortality [38-41]. While stress, labor market discrimination, segregation, food access, neighborhood quality, and various aspects of the social environment are all potential mechanisms, one of the proximal mediators of the MDRs might be dietary behaviors. We expect that pro-health diets are less influenced by educational attainment and income in ethnic minority families because they face many barriers in their lives given racism and social stratification [42-44]. In addition, because ethnic minorities live in marginalized communities and are more likely to be under the influence of parents who had spent their childhoods in poverty, their family SES may not have a large effect on diet and eating for ethnic

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minority families. As an adaptation to poverty, food culture may also contribute to the diminished returns of SES on the dietary quality of Black and Latino people in the US.

The Marginalization-related Diminished Returns (MDRs) phenomenon [11,12] also refers to the weaker economic and health effects of SES indicators, such as educational attainment, for the members of marginalized groups (particularly ethnic minorities) than US-born heterosexual non-Latino Whites [11,12]. Assari [11,12], Ferarro [45], Thorpe [46-48], Hudson [49-51], Kaufman [52], Braveman [53], Shapiro [54,55], Williams [56,57], Ceci [58], Navarro [59-61], and others [62] have reported weaker effects of SES indicators for ethnic minorities than non-Latino Whites. Kaufman has discussed the poor overlap between SES across ethnic groups that result in residual and unmeasured confounding as well as not-comparability of SES across ethnic groups [52]. Navarro has described this as "ethnicity and SES," rather than "ethnicity or SES" effects due to the complex interplay between ethnicity and SES [59-61]. Ceci has mentioned that the Have-Nots (ethnic minorities) may gain access to health less than the Haves (non-Latino Whites) from the same resources (SES indicators) due to their lower readiness to uptake and navigate the complex social systems [58]. However, most of the existing literature is on Black-White comparison rather than Latino-non-Latino comparison. Thus, there is a need to study a wider range of ethnic groups that include Black groups and compare Latino and non-Latino groups.

Aims

To better understand whether MDRs observed in the ABCD data for brain outcomes can be, in part, explained by MDRs in diet, we conducted a secondary analysis of the ABCD data to determine the association between two SES indicators namely, household income and parental educational attainment and dietary indicators and variation in these effects by ethnicity. We hypothesize a positive association between educational attainment and household income, and healthy dietary habits of individuals. We also expected a negative association between family SES and unhealthy dietary practices such as hot dogs, fries, and sugary beverage consumption. Built on the MDRs framework, we hypothesize that these positive and inverse associations would be weaker for Latino and Black children than non-Latino White children. As a result, we expect more healthy diets in non-Latino White families with high SES than ethnic minority families with similar SES, indicating a diminished effect of household income and educational attainment on healthy diet in ethnic minority families (due to access and their need to allocate resources to other necessities). These MDRs in diet [21,22] then would partially explain the MDRs on the effects of SES on brain development [63-69].

Materials and Methods

Design and setting

This study is a secondary analysis of the first two years (waves 1 and 2) of data (2016/2018 to 2018/2020) of the Adolescent Brain Cognitive Development (ABCD) study [70-74]. The ABCD is a state-of-the-art and national longitudinal study of children's development in the United States [70,75].

Sampling and participants

In the ABCD study, participating children were 9-10-years-old at the time of recruitment, which took place between 2016 and 2018. Recruitment occurred across 21 study sites in multiple cities across 15 U.S states. The primary recruitment strategy was through the school systems [76]. The original/overall study included 10,875 children at baseline.

Eligibility and analytical sample

From the 10,875 participants, we included children at wave 1 and wave 2 who were either Latino or non-Latino White or Black. This was based on parents' report of ethnicity (see below). This study did not include other ethnic groups such as Asian, Native American, Mixed, Other, or unknown ethnic groups. Participants were only included if they had data on SES, ethnicity, diet, and covariates (n=5856).

Study variables

Primary outcomes: The outcomes were the amount and frequency of consuming fish, soup, vegetables, fruits, hot dogs, French fries, ketchup, soda, and sugary beverages. These food indicators were calculated based on Block Kids Food Screener (BKFS). The BKFS is a 41-item food frequency questionnaire which was developed by NutritionQuest (Berkeley, CA, USA). This instrument is ideal for the measurement of dietary intake of nutrients and food groups for children and youth aged 2-17. The questionnaire can be self-administered or asked using the parents' report. BKFS asks the participant to report the frequency and quantity of food and beverage they consumed during the past seven days. The response items for frequency ranges from 'none' to 'every day'. For each food type, three or four food items are measured. The BKFS provides estimates for the amount of intake of fruit, vegetables, dairy, whole grains, protein sources (meat, poultry, and fish in ounce equivalents), fast food, sugary beverages, soda, and other food types. This measure also details calorie intake, saturated fat, and consumed sugars. For this study, BKFS was administered at wave 2 when the child was 11 or 12 years old. This measure was collected two years after measuring all other variables such as household income, parental education, family structure, and other covariates. This measure is validated and shows reliability and accuracy in this age group.

Independent variable

Socioeconomic status: This study used two indicators of household SES. These indicators were household income and parental education, both treated as continuous measures. Parents reported their years of schooling. This variable ranged between 0 (for no formal education) and 21 (doctoral degree). Annual family income had a range between 1 and 10 that referred to the following income levels: 1 = less than $5000; 2 = $5000; 3 = $12,000; 4 = $16,000; 5 = $25,000; 6 = $35,000; 7 = $50,000; 8 = $75,000; 9 = $100,000; 10 = $200,000+.

Moderator

Ethnicity: Ethnicity was composed of two categorical variables which were identified by the parents. All participants were non-Hispanic or Hispanic White or Black.

Confounders

Demographic factors. Age, sex, and family structure were measured as covariates. Parents reported the children's ages, the child's age acting as a continuous variable, and measured in months. The sex of the child was a dichotomous variable with 1 representing

males and 0 representing females. Family structure was married or unmarried.

Data analysis

We used the SPSS 25 for data analysis. First, we ruled out multi-collinearity between our study variables and confirmed that our outcomes had near to normal distributions. Next, we applied multivariable linear regression models with parental educational attainment and household income as the independent variables, a diet indicator as an outcome, and ethnicity as moderators; all models were performed in the pooled sample. Model 1 did not include an interaction term but included all the confounders. Model 2, however, did include interaction terms between parental education and household income and ethnicity, in addition to all the confounders. We performed similar models for outcomes. We reported the values b, SE, 95% CI, and p from our regression models.

Ethical considerations

This analysis was exempt from a full IRB review by Charles R Drew University of Medicine. The study of origin (ABCD) was approved by the Institutional Review Board (IRB) at the University of California, San Diego (UCSD). Assent and consent were received from children and their parents, respectively [75].

Results

Overall, 5,856 individuals entered our analysis. Our participants were either White, Black, non-Latino, or Latino. Table 1 shows the summary of descriptive statistics overall.

Linear regression models in the pooled sample

As shown by Table 2, while educational attainment and household income increased apple, vegetable, soup, and fish consumption, and reduced hot dogs, fries, ketchup, soda, and sugary beverage consumption, these effects were weaker for Latino and Black individuals than non-Latino White children.

Discussion

High family SES indicators, namely parental educational attainment and household income, were associated with a healthier diet; however, ethnicity moderated this association. We observed weaker associations for Black and Latino than non-Latino White individuals. As a result, children in highly educated and high-income Black and Latino families reported unhealthy dietary practices than non-Latino White children in highly educated and high-income families. This unhealthy diet in high SES Black and Latino children contributes to the development of obesity in high SES ethnic minority individuals.

The association between high SES and better dietary habits is aligned with fundamental cause theory [6,77-81], social determinants of health framework [1,2,82-84], and other SES and SDoH theories. Pro-health behaviors, including more healthy diets, are among the mechanisms that social determinants of health and high SES, such as parental educational attainment and family income, impact population and individual health [5,85,86]. For example, time spent to prepare home-based meals might be one of many mechanisms that explains why families with high educational attainment and income have a lower risk of obesity and cardiovascular conditions [23,24].

Table 1: Descriptive data overall.

	All N = 8591 (100%)	
	Mean	***SD***
Child Age (Years)	9.514	0.50646
Parental Education (Years)	17.0415	2.37173
Household Income	7.4896	2.20671
Diet (Soup Consumption)	0.56	0.872
Diet (Apple Consumption)	2.09	0.459
Diet (Vegetable)	2.21	1.378
Diet (Fish)	1.45	0.749
Diet (Hot dogs Consumption)	1.19	0.434
Diet (Fries Consumption)	1.3	1.021
Diet (Ketchup)	2.34	1.223
Diet (Sugary Beverage Consumption)	1.48	1.366
Diet (Sugary Beverage Consumption)	0.2363	0.24563
	Mean	***SD***
Ethnicity		
Non-Hispanic	4975	85
Hispanic	881	15
White	4807	82.1
Black	1049	17.9
Sex		
Female	2771	47.3
Male	3085	52.7
Family Marital Status		
Spouse Not Present	1626	27.8
Spouse Present	4230	72.2

The second finding on weaker effects of family SES on dietary practices is in line with some recent observations that SES indicators, for instance, educational attainment and household income, on behaviors such as diet are larger for non-Latino White families than Black Latino families. Education of oneself and parents is associated with a larger improvement of diet in non-Latino White than ethnic minority people [21,22]. Similar patterns are shown for the SES effects on obesity [32,33], hypertension [87], heart disease [34], exercise [88] and substance use [89-101].

According to MDRs, Black and Latino people remain at risk even if non-Latino White people show benefits of their educational attainment. For example, in the ABCD data and other data sets, weaker SES effects on memory [65,102], academic performance [28,29,103-105], emotion regulation [106], mental health [107], and several other intermediate factors [32,33] are weaker for Black and Latino than non-Latino White children.

As a result of a poor diet and high-risk behaviors of high SES Black and Latino people, educational attainment and income have weaker effects on a poor diet [21], chronic disease [108], disability [109], diet [21,22], and self-rated health [110-112] for ethnic minorities than non-Latino White individuals and adults. These MDRs may explain why we observe a higher-than-expected risk of chronic diseases

Table 2: Summary of linear regression models without (M1) and with (M2) interactions.

	M1 All (No Interaction)						M2 All (M1 + Interaction)					
	B	SE(B)	Beta	95% CI		P	B	SE(B)	Beta	95% CI		P
Hot dog Consumption												
Black	0.115	0.016	0.101	0.083	0.147	0	0.286	0.106	0.252	0.078	0.493	0.007
Hispanic	-0.082	0.016	-0.068	-0.114	-0.05	0	-0.424	0.094	-0.349	-0.609	-0.239	0
Sex (MALE)	0.01	0.011	0.012	-0.011	0.031	0.365	0.011	0.011	0.012	-0.011	0.032	0.334
Age	0.089	0.011	0.102	0.067	0.111	0	0.089	0.011	0.102	0.067	0.111	0
Family Married	0.008	0.015	0.009	-0.021	0.037	0.569	0.011	0.015	0.011	-0.018	0.04	0.46
Parental Education	-0.012	0.003	-0.064	-0.017	-0.006	0	-0.015	0.004	-0.081	-0.022	-0.007	0
Household Income	-0.023	0.004	-0.116	-0.03	-0.016	0	-0.024	0.005	-0.122	-0.033	-0.015	0
Parental Education x Black	-	-	-	-	-	-	-0.011	0.008	-0.161	-0.026	0.004	0.135
Household Income x Black	-	-	-	-	-	-	0	0.008	0.001	-0.015	0.015	0.985
Parental Education x Latino	-	-	-	-	-	-	0.017	0.007	0.223	0.004	0.03	0.012
Household Income x Latino	-	-	-	-	-	-	0.011	0.008	0.063	-0.005	0.028	0.187
Fries Consumption												
Black	0.323	0.039	0.121	0.247	0.399	0	-0.284	0.252	-0.107	-0.779	0.21	0.259
Hispanic	-0.022	0.038	-0.008	-0.097	0.053	0.567	-0.855	0.225	-0.3	-1.295	-0.415	0
Sex (MALE)	0.028	0.026	0.014	-0.023	0.079	0.278	0.027	0.026	0.013	-0.024	0.078	0.297
Age	0.06	0.026	0.029	0.008	0.111	0.023	0.06	0.026	0.029	0.008	0.111	0.022
Family Married	-0.103	0.035	-0.045	-0.172	-0.034	0.004	-0.1	0.035	-0.044	-0.169	-0.031	0.005
Parental Education	-0.043	0.007	-0.101	-0.057	-0.03	0	-0.066	0.009	-0.153	-0.084	-0.047	0
Household Income	0.011	0.009	0.024	-0.006	0.028	0.206	0.01	0.011	0.022	-0.012	0.032	0.369
Parental Education x Black	-	-	-	-	-	-	0.034	0.018	0.203	-0.002	0.069	0.062
Household Income x Black	-	-	-	-	-	-	0.006	0.018	0.015	-0.029	0.042	0.734
Parental Education x Latino	-	-	-	-	-	-	0.056	0.016	0.315	0.025	0.088	0
Household Income x Latino	-	-	-	-	-	-	-0.014	0.02	-0.033	-0.053	0.026	0.494
Ketchup												
Black	0.232	0.047	0.073	0.14	0.325	0	-0.34	0.306	-0.107	-0.94	0.259	0.266
Hispanic	-0.031	0.047	-0.009	-0.122	0.06	0.506	-0.764	0.272	-0.223	-1.297	-0.231	0.005
Sex (MALE)	-0.036	0.031	-0.015	-0.098	0.025	0.25	-0.037	0.031	-0.015	-0.098	0.025	0.242
Age	0.197	0.032	0.081	0.135	0.26	0	0.198	0.032	0.081	0.135	0.26	0
Family Married	0.012	0.043	0.004	-0.072	0.096	0.78	0.014	0.043	0.005	-0.07	0.098	0.742
Parental Education	-0.022	0.008	-0.043	-0.039	-0.006	0.009	-0.04	0.011	-0.078	-0.063	-0.018	0
Household Income	0.012	0.01	0.021	-0.009	0.032	0.266	0.007	0.014	0.013	-0.019	0.034	0.595
Parental Education x Black	-	-	-	-	-	-	0.033	0.022	0.166	-0.01	0.076	0.133
Household Income x Black	-	-	-	-	-	-	0.002	0.022	0.004	-0.041	0.045	0.924
Parental Education x Latino	-	-	-	-	-	-	0.04	0.019	0.186	0.002	0.078	0.042
Household Income x Latino	-	-	-	-	-	-	0.011	0.024	0.022	-0.037	0.059	0.648
Soda												
Black	0.183	0.052	0.051	0.082	0.285	0	-0.817	0.335	-0.229	-1.474	-0.16	0.015
Hispanic	0.024	0.051	0.006	-0.076	0.124	0.64	-1.366	0.298	-0.358	-1.95	-0.781	0
Sex (MALE)	0.08	0.035	0.03	0.013	0.148	0.02	0.079	0.034	0.029	0.011	0.146	0.022
Age	0.247	0.035	0.09	0.178	0.315	0	0.247	0.035	0.09	0.179	0.316	0
Family Married	-0.117	0.047	-0.039	-0.209	-0.026	0.012	-0.112	0.047	-0.037	-0.204	-0.02	0.017
Parental Education	-0.088	0.009	-0.153	-0.106	-0.07	0	-0.122	0.012	-0.212	-0.146	-0.098	0

Household Income	-0.004	0.011	-0.007	-0.026	0.018	0.723	-0.014	0.015	-0.022	-0.043	0.015	0.349
Parental Education x Black	-	-	-	-	-	-	0.049	0.024	0.221	0.002	0.096	0.041
Household Income x Black	-	-	-	-	-	-	0.026	0.024	0.045	-0.022	0.073	0.286
Parental Education x Latino	-	-	-	-	-	-	0.085	0.021	0.356	0.043	0.127	0
Household Income x Latino	-	-	-	-	-	-	-0.003	0.027	-0.005	-0.055	0.049	0.912
Sugary Beverage												
Black	0.035	0.009	0.055	0.017	0.053	0	-0.13	0.06	-0.203	-0.248	-0.012	0.031
Hispanic	0.001	0.009	0.001	-0.017	0.019	0.954	-0.256	0.054	-0.373	-0.362	-0.151	0
Sex (MALE)	0.014	0.006	0.028	0.002	0.026	0.026	0.014	0.006	0.028	0.001	0.026	0.029
Age	0.045	0.006	0.091	0.033	0.057	0	0.045	0.006	0.091	0.033	0.057	0
Family Married	-0.022	0.008	-0.039	-0.038	-0.005	0.01	-0.021	0.008	-0.038	-0.037	-0.004	0.014
Parental Education	-0.015	0.002	-0.147	-0.019	-0.012	0	-0.021	0.002	-0.207	-0.026	-0.017	0
Household Income	-0.002	0.002	-0.014	-0.006	0.003	0.461	-0.003	0.003	-0.026	-0.008	0.002	0.27
Parental Education x Black	-	-	-	-	-	-	0.008	0.004	0.205	0	0.017	0.058
Household Income x Black	-	-	-	-	-	-	0.004	0.004	0.039	-0.005	0.012	0.362
Parental Education x Latino	-	-	-	-	-	-	0.016	0.004	0.372	0.008	0.023	0
Household Income x Latino	-	-	-	-	-	-	-0.001	0.005	-0.01	-0.01	0.008	0.843
Vegetable												
Black	-0.042	0.051	-0.012	-0.143	0.059	0.413	1.224	0.333	0.341	0.57	1.878	0
Hispanic	-0.389	0.051	-0.101	-0.489	-0.289	0	1.428	0.297	0.371	0.846	2.01	0
Sex (MALE)	-0.093	0.034	-0.034	-0.161	-0.026	0.007	-0.092	0.034	-0.034	-0.159	-0.024	0.008
Age	-0.124	0.035	-0.045	-0.192	-0.055	0	-0.125	0.035	-0.045	-0.193	-0.057	0
Family Married	0.102	0.047	0.033	0.011	0.194	0.029	0.094	0.047	0.031	0.003	0.186	0.043
Parental Education	0.085	0.009	0.146	0.067	0.103	0	0.128	0.012	0.22	0.103	0.152	0
Household Income	0.043	0.011	0.068	0.02	0.065	0	0.06	0.015	0.096	0.031	0.089	0
Parental Education x Black	-	-	-	-	-	-	-0.058	0.024	-0.259	-0.105	-0.011	0.015
Household Income x Black	-	-	-	-	-	-	-0.043	0.024	-0.075	-0.09	0.004	0.075
Parental Education x Latino	-	-	-	-	-	-	-0.108	0.021	-0.448	-0.149	-0.066	0
Household Income x Latino	-	-	-	-	-	-	-0.004	0.027	-0.007	-0.056	0.048	0.884
Apple												
Black	0.058	0.018	0.048	0.023	0.093	0.001	0.335	0.115	0.28	0.11	0.561	0.004
Hispanic	0.008	0.018	0.006	-0.026	0.043	0.639	0.224	0.102	0.174	0.023	0.425	0.029
Sex (MALE)	-0.007	0.012	-0.008	-0.031	0.016	0.532	-0.007	0.012	-0.007	-0.03	0.017	0.571
Age	0.01	0.012	0.011	-0.014	0.033	0.406	0.01	0.012	0.011	-0.013	0.034	0.4
Family Married	-0.011	0.016	-0.011	-0.042	0.021	0.497	-0.011	0.016	-0.011	-0.043	0.02	0.493
Parental Education	-0.011	0.003	-0.057	-0.017	-0.005	0	-0.003	0.004	-0.014	-0.011	0.006	0.533
Household Income	0.001	0.004	0.006	-0.007	0.009	0.762	-0.001	0.005	-0.006	-0.011	0.009	0.792
Parental Education x Black	-	-	-	-	-	-	-0.018	0.008	-0.243	-0.034	-0.002	0.028
Household Income x Black	-	-	-	-	-	-	0.003	0.008	0.017	-0.013	0.02	0.691
Parental Education x Latino	-	-	-	-	-	-	-0.018	0.007	-0.227	-0.033	-0.004	0.013
Household Income x Latino	-	-	-	-	-		0.013	0.009	0.068	-0.005	0.031	0.169
Fish												
Black	0.168	0.029	0.086	0.111	0.224	0	0.78	0.188	0.399	0.412	1.148	0
Hispanic	0.063	0.029	0.03	0.007	0.119	0.027	0.621	0.167	0.296	0.294	0.948	0
Sex (MALE)	-0.01	0.019	-0.007	-0.048	0.028	0.597	-0.009	0.019	-0.006	-0.047	0.029	0.629
Age	0.023	0.02	0.016	-0.015	0.062	0.231	0.023	0.02	0.015	-0.015	0.061	0.239

Family Married	-0.023	0.026	-0.014	-0.074	0.029	0.388	-0.024	0.026	-0.014	-0.076	0.027	0.356
Parental Education	0.006	0.005	0.018	-0.005	0.016	0.283	0.021	0.007	0.066	0.007	0.035	0.003
Household Income	0.003	0.006	0.009	-0.009	0.016	0.624	0.01	0.008	0.028	-0.007	0.026	0.252
Parental Education x Black	-	-	-	-	-	-	-0.031	0.013	-0.257	-0.058	-0.005	0.02
Household Income x Black	-	-	-	-	-	-	-0.013	0.013	-0.043	-0.04	0.013	0.317
Parental Education x Latino	-	-	-	-	-	-	-0.032	0.012	-0.246	-0.056	-0.009	0.007
Household Income x Latino	-	-	-	-	-	-	-0.002	0.015	-0.008	-0.032	0.027	0.874
Soup												
Black	-0.218	0.033	-0.096	-0.283	-0.152	0	-0.186	0.217	-0.082	-0.61	0.239	0.391
Hispanic	0.135	0.033	0.055	0.07	0.199	0	1.035	0.193	0.424	0.657	1.413	0
Sex (MALE)	-0.052	0.022	-0.03	-0.096	-0.008	0.02	-0.053	0.022	-0.031	-0.097	-0.009	0.017
Age	-0.095	0.023	-0.055	-0.14	-0.051	0	-0.096	0.023	-0.055	-0.14	-0.051	0
Family Married	0.101	0.03	0.052	0.041	0.16	0.001	0.096	0.03	0.049	0.037	0.156	0.001
Parental Education	0.011	0.006	0.031	0	0.023	0.057	0.023	0.008	0.063	0.007	0.039	0.004
Household Income	-0.023	0.007	-0.058	-0.038	-0.009	0.002	-0.015	0.01	-0.038	-0.034	0.004	0.117
Parental Education x Black	-	-	-	-	-	-	-0.003	0.015	-0.023	-0.034	0.027	0.836
Household Income x Black	-	-	-	-	-	-	0.01	0.016	0.027	-0.021	0.04	0.526
Parental Education x Latino	-	-	-	-	-	-	-0.031	0.014	-0.204	-0.058	-0.004	0.024
Household Income x Latino	-	-	-	-	-	-	-0.06	0.017	-0.168	-0.093	-0.026	0.001

[36,113,114], depression [115], anxiety [116], suicide [106,107,117], disability [109], hospitalization [37], and mortality [118-120] for high SES ethnic minority individuals, while the same risks remain low in non-Latino Whites with similar SES. As a result of these MDRs, we see lower than expected health effects of investments that rely on equalizing SES across ethnic groups [58].

This is an extension of the MDRs at the behavioral level. Other MDRs exist for mental [121], behavioral [90,94], and physical health [35], as well as healthcare use [122,123]. In addition, poor mental health [124,125], poor sleep [126], and high substance [90,127,128], and tobacco [38,129] use are also shown in high SES Black and Latino people.

MDRs framework can be regarded as a paradigm shift in disparities research [11,12] because, different from most of the existing literature that has exclusively focused on low SES as the mechanism for ethnic health inequalities, MDRs acknowledge that ethnic disparities can occur across the full SES spectrum; thus, researchers and quantitative modelers should allow SES effects to vary by ethnicity. Second, they invite researchers to study structural and environmental mechanisms that explain why the health effects of available SES indicators are weaker in ethnic minority groups. A solution for testing MDRs is to test moderated-mediation rather than mediation models. Studies built on MDRs do not reduce the problems of health and behavioral disparities to the problem of low SES and SES gaps. By testing non-linear and non-additive effects of ethnicity and SES, MDRs allow SES effects to vary by group. Such an assumption is more realistic than the universality of SES effects. One size never fits all, after all. The application of MDRs may also help us understand why ethnic health gaps sometimes widen rather than narrow as SES increases [11,12].

Many structural, social, and behavioral mechanisms may explain these MDRs. It is difficult to decompose the mechanisms and processes that can interfere with the return of educational attainment for ethnic minorities, but employment conditions and residential conditions may play some role. In the presence of labor market discrimination and segregation, education generates fewer outcomes for ethnic minorities [11,12]. For example, highly-educated minority individuals work in jobs with lower pay and lower occupational prestige than non-Latino Whites. Highly educated ethnic minority individuals work in jobs with higher stress and environmental hazards [130]. Ethnic compositions of jobs and neighborhoods may increase discrimination of highly educated ethnic minorities in predominantly White areas [131]. As a result, highly educated ethnic minorities [11,12] remain at risk of economic insecurity [132], stress [133], poor residential areas [134], and low wealth [135], while Whites with similar educational attainment do not experience the same risk.

More research should test if time use is why educational attainment generates less health and behavioral benefits for ethnic minorities than non-Latino White individuals. As past work shows that diet [136], exercise [88], sleep [137], and substance use [138] for highly educated ethnic minority people, and as time allocation is key for securing these outcomes, we should test the MDRs of time allocated to each of these behaviors. Thus, time-use patterns may play a role in explaining the diminishing returns of SES for the cardiometabolic risk of minority people.

Limitations

This study had a few limitations. First, this was a short-term longitudinal study, and our results should not be inferred as causal. While household income and educational attainment precede diet, this study had many unmeasured confounders. We did not include SES indicators other than educational attainment and income. We also did not include ethnic minority groups other than Blacks, Latinos, and Whites. We need to test the same hypotheses for Native

American, Asian American, and other-ethnic families. In addition, we did not include several potential measures of food culture, norms, options, fast food availability, etc. Future research may include multilevel determinants of food choices that collectively impact diet and obesity. Given these limitations, the results should be interpreted with caution.

Implications

To eliminate the ethnic inequalities in obesity and cardiometabolic risk, policies, practices, and programs are needed that go beyond closing the ethnic gap in SES and poverty. While SES equality should be a goal, there is also a need for policies and programs that equalize the individuals' living conditions and reduce the obstacles in the lives of ethnic minority families. Health, economic, social, and public policies are needed to reduce ethnic disparities that do not emerge due to low SES but the MDRs. Such disparities may be resistant to our efforts to equalize SES. MDRs operate independently of the average of group differences in SES. Potential contributors to the MDRs are segregation and differential access to healthy options, parks, and green areas that promote health. However, segregation differentially exposes various populations to risk factors such as obesogenic environments [44,139,140]. Acknowledging the role of MDRs as a contributor to ethnic disparities is needed because solutions that address MDRs (lower returns of SES indicators for ethnic minorities) are different from solutions that emphasize the SES gap-closing. Multilevel policies and interventions should address various mechanisms that increase the health returns of SES (undo MDRs) for ethnic minority families. This includes enhancing the built environment and increasing access to healthy food options for middle-class Black and Latino communities. Suppose policies exclusively focus on closing the SES gap and ignore the fact that the very same SES may generate more outcomes for the Haves than the Have-Nots; we may have failed to fully and efficiently close the health gap. Thus, it is important to go beyond universal intervention and those which focus on access and also guarantee the uptake of the policies and resources by ethnic minority and marginalized populations. To do so, we need to reduce stigma and address structural causes of ethnic health inequalities that operate across the SES and class lines. Otherwise, universal interventions that only increase the average SES of the overall community may increase rather than decrease the existing gap in health.

Conclusion

Family SES, such as parental education and household income, do not show similar associations with healthy diet across ethnic groups. Children in highly educated and high-income Black and Latino families have a less healthy diet, a pattern different from children in highly educated and high-income non-Latino White families whose diet is far more healthy. As a result, ethnic disparities in dietary practices, obesity, and cardiovascular and metabolic conditions may remain across the full SES spectrum. As proposed by the MDRs, ethnic health disparities should not be reduced to the problem of poverty or low human capital. While low SES is also a major contributor, social stratification, structural racism, and marginalization reduce the health of middle-class Black and Latino families.

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