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Association between Educational Attainment and Body Mass Index: Role of Race

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Abstract

Background: One of the best recognized health effects of high educational attainment is lower body mass index (BMI), however recent research suggests that this association might be racialized and differ for Black and White individuals.

Aims: To investigate whether race moderates the inverse association between educational attainment and BMI as adults.

Methods: This study was a cross-sectional analysis of Midlife in the United States (MIDUS) Refresher with a total sample size of 1972 adults, 128 of whom are Black and 1842 of whom are White, above the age of 24 in the United States. The sample was randomly selected. Educational attainment and income were independent variables. BMI was the outcome. Linear regression was used for multivariable analysis. SPSS was used for data analysis.

Results: Income was inversely associated with BMI. There was a statistical interaction between race and educational attainment suggesting a weaker inverse association between education and BMI for Black than White adults.

Conclusion: Opposite to the pattern for Whites, being a highly educated individual in the US does not lend protection against high BMI for Black people. This finding may reflect racism, social stratification, and marginalization of Black Americans in the US, regardless of their education. High BMI of highly educated Black Americans may be due to poor nutrition, low physical activity, and/or low walkability of neighborhood; however, such conclusions require additional research.

Introduction

Having a high Body Mass Index (BMI) negatively affects individuals' health by increasing risk for chronic diseases[1]. According to the National Heart, Lung, and Blood Institute, high BMI increases the risk of developing heart disease, high blood pressure, stroke, and type 2 diabetes[2]. In the US, prevalence of individuals with high BMI continues to grow with the current prevalence of obesity in adults being at 42%[3]. The prevalence of obesity is highest in non-Hispanic Black communities the non-Hispanic White communities[4].

Socioeconomic Status (SES) of individuals impacts their BMI levels, which then affects their health[5]. Most of the literature has shown that high educational attainment is associated with more healthy behavior, better self-perceived health, and health care[6-8]. Additionally, sub-optimal dietary practices associated with low SES increase the risk of obesity, and worse health and quality of life. High

socioeconomic status such as educational attainment are associated with lower BMI, however, these associations differ across racial groups[9]. Research suggests that there is a correlation between higher education and lower BMI, however, this association is shown to be strongest for White men and women than any other racial groups[10]. This is because, while in general people with higher education have better access to resources which can contribute to maintaining a healthier BMI, highly educated Black individuals live in worse neighborhoods and have worse diet and exercise.

High education level is commonly regarded as a proxy of SES, which is essential for maintaining low BMI. Research suggests that educational attainment leads to more secure, autonomous, higher paying jobs, making high-level healthy foods more affordable[11]. As a result, it is expected to see a trend of low BMI in people with high educational attainment. Although, the impact of educational attainment and other SES indicators on BMI seems to be well established, the same cannot be concluded about all racial groups. Findings support that higher educational attainment and income is associated with lower BMI among White but not Black adults[12]. Moreover, studies show that upward social mobility comes with extra psychological and physiological costs for minority populations[13]. Therefore, highly educated Black people may face more stress compared to their White counterparts.

Minorities' diminished returns (MDRs)[14] is a theory that highlights the unequal and often weaker outcomes experienced by racial and ethnic minority populations, particularly in the United States, despite improvements in SES indicators such as educational attainment. This phenomenon underscores the enduring impacts of structural racism, where historical and systemic inequalities continue to shape contemporary life. When examining health outcomes, such as BMI, minorities, particularly Black individuals, may experience less pronounced improvements in their health compared to their white counterparts with similar levels of education and income. According the MDRs theory, factors beyond individual SES, such as residential segregation, discriminatory practices, and unequal access to healthcare, play a more significant role in shaping the health of Black people. As such, this theory suggests that centuries of racism have created deep-seated structural disparities that persist today, perpetuating health inequalities and emphasizing the need for comprehensive efforts to address systemic racism and promote health equity[14].

Built on the MDRs theory[14], this study had two objectives. The primary objective was to investigate the association between education levels and BMI. The secondary objective explores the association between education and BMI based on race. The first hypothesis states that high education is associated with low BMI. Our second hypothesis was that high education is more strongly associated with lower BMI in Black than White adults.

Methods

Design and Setting

This is an analysis of the predictive effect of educational attainment and income on BMI. This report used statistical data from Midlife in the United States (MIDUS) among young adults and adults. Overall, at baseline MIDUS enrolled 3,577 individuals in the analysis between ages 24 to 74 at baseline. From this sample, 128 (6.5%) were Black individuals and 1842 (93.5%) were White individuals. This national study was conducted in the United States between 2011 and 2014. Although the analysis included Latinos, the analysis is not focused on ethnicity. We were interested in the association between educational attainment and income on BMI, rather than ethnicity on BMI.

Populations and Sampling

Data are derived from a random sampling of 1972 White and Black adults, selected from 3,577 individuals through the MIDUS Refresher study survey 2011-2014. The study used samples from MIDUS Refresher Younger decades and MIDUS Refresher Older decades (MRO). All participants were between 24 and 74. The survey used the same assessments as those assembled on the original MIDUS sample[15].

Conceptual Model

To briefly describe our conceptual model, we proposed that education would be inversely associated with BMI in the total sample. However, we expect race to moderate this association. In other words, we expect a weaker inverse association between educational attainment and BMI in Black than White participants.

Measures

The variables for this analysis included race, ethnicity, age, gender, educational attainment, income, and BMI.

Race: Race was self-identified by the participant as African American/Black versus White.

Ethnicity: Participants self-identified their ethnicity as Latino/Hispanic or non-Latino/non-Hispanic.

Age: Participants self-reported age by determination from date of birth, age was measured as a continuous variable.

Gender: Gender was self-reported and used as a dichotomous variable: (0) Male and (1) Female.

Educational Attainment: Educational Attainment was a fourteen-level variable and was reported as: (1) no school/some grade school (1-6); (2) eight grade/ junior high school (7-8); (3) some high school (9-12 no diploma/no GED); (4) GED; (5) graduated from high school; (6) 1 to 2 years of college, no degree yet; (7) 3 or more years of college, no degree yet; (8) grad. from 2-year college, vocational school, or Assoc. deg.; (9) graduated from a 4- or 5-year college, or Bachelor's deg.; (10) some graduate school; (11) Master's degree; (12) Ph.D., Ed.D, MD, DDS, LLB, LLD, JD, or other professional deg; (97) do not know; (98) refused. Educational attainment was a continuous measure with a high score reflecting higher education. This variable was ranging between 1-12 after omission of categories do not know or refused.

Body Mass Index (BMI): Participants self-reported their height and weight. BMI was calculated based on self-reported height and weight. BMI was used as a continuous variable.

Institutional Review Board

The IRB was approved by the University of Minnesota. All participants provided written consent. The data were collected, stored, and analyzed anonymously. This study used deidentified data and therefore no IRB review was necessary. This report used available public data from MIDUS - Institute on Aging and National Study[9].

Statistical Analysis

SPSS 27.0 (IBM Inc., NY (New York), USA) was used for data analysis. Age, educational attainment, BMI, and income were used for the univariate analysis of continuous variables as was mean and standard deviations (SD). In addition, for univariate analysis of categorical variables such as race, gender, US Born, and Latino, we used frequency and percentage. An independent sample t-test was used to show the significant differences for age, income, and BMI between Black and White participants. We used two models. *Model 1* did not include any interactions. The multivariable analysis number two (*Model 2*) included race interaction with both income and education attainment. Multivariable modeling assisted in observing the role of SES and race net of confounders. We included interaction because previous studies suggest that high educational attainment does not have same protective effect against high BMI for Black Americans as it does for White Americans. The summary of linear regression models displayed as beta, standard error, confidence interval, and p values.

Results

Univariate

Table 1 summarizes univariate descriptive data. Overall, 1972 entered our analysis, 128 of which were Black individuals and 1842 were White individuals. For gender, 1008 (51.1 %) individuals were female and 963 (48.9 %) were male. The age range was 24-76 with a mean of 52.12% (SD=14.10). The mean for BMI was 28.94 (SD=7.01). The mean income is $52,279.90 (SD=$49,732.17). For educational attainment, the mean was 8.04 (SD=2.46).

Bivariate

Table 2 displays a summary of bivariate variables of an independent sample t-test. There are significant differences for age (p = .006), income (p < .001), and BMI (p < .001) between Black and White individuals, but not in educational attainment (p = .140).

Multivariate

Table 3 presents 1 main effect model with no interaction: *Model 1* showed a protective effect of education against BMI, however, *Model 2* showed a statistical interaction between race and education suggesting weaker protection for Black compared to White individuals.

Table 1: Descriptive Statistics Overall

	Mean	SD
Age (Year)	52.12	14.10
Educational Attainment (1-12)	8.04	2.46
Body Mass Index (BMI)	28.94	7.01
Income (USD)	$52,279.90	$49,732.17
	N	%
Race		
Black	128	6.5
White	1843	93.5
Gender		
Female	1008	51.1
Male	963	48.9
US Born		
Yes	1899	96.3
No	73	3.7
Latino Ethnicity		
Yes	51	2.6
No	1921	97.4

Table 2: Summary of Bivariate Tests

	White		Black		p-value
	Mean	SD	Mean	SD	
Age (years)	52.35	14.14	48.84	13.27	.006
Educational Attainment	8.07	2.46	7.73	2.42	.140
Income ($)	53268.01	50440.16	38052.70	35298.07	<.001
BMI	28.75	6.84	31.69	8.79	<.001

Independent samples t test were used.

Table 3: Summary of Linear Regression Models

	B	Standard Error	95% CI Lower	95% CI Upper	P
Model 1					
Race (Black)	2.914	.653	1.633	4.194	<.001
Ethnicity (Latino)	-.242	1.027	-2.256	1.771	.813
US Born	1.951	.854	.277	3.625	.022
Gender (Male)	.224	.332	-.427	.876	.500
Age (Year)	.023	.011	.000	.045	.046
Income (USD)	.000	.000	.000	.000	.165
Education (1-12)	-.534	.071	-.674	-.394	<.001
Model 2					
Race (Black)	-1.393	2.155	-5.620	2.834	.518
Ethnicity (Latino)	-.315	1.026	-2.328	1.697	.759
US Born	1.967	.853	.295	3.640	.021
Gender (Male)	.217	.332	-.434	.868	.514
Age (Year)	.023	.011	.001	.045	.045
Income (USD)	.000	.000	.000	.000	.155
Education (1-12)	-.570	.073	-.713	-.426	<.001
Race (Black) × Education (1-12)	.556	.265	.036	1.077	.036

Model 1: No Interaction Model 2: Model 1 + Interaction

Discussion

This study was conducted with two aims: To test the inverse association between educational attainment and BMI, and to investigate racial variation in this association. Our study indicated lower BMI in individuals with higher education; however, this protective association was weaker for Black than White individuals. That means, while high educated Whites are protected against high BMI, highly educated Black individuals remain at risk of high BMI, which is in line with minorities' diminished returns theory.

The first result was in line with previous observations that education is protective against the risk of high BMI in general population[16-19]. This protective effective can at least partially be attributed to better health choices and better access to healthy food options in people with higher education[20-23]. For adults, high education increases the chance of better employment, living in better neighborhoods, and having a higher income[24]. In one study, all the effects of education on obesity was mediated by income[24]. Thus, through multiple pathways, highly educated people remain healthy and can avoid obesity[19,25,26].

Our second finding was also in line with the observed weaker protective effects of education and income on BMI and obesity in children[13], adolescents[27], adults[28], and older adults[29], all supporting MDRs theory[30]. For instance, in the Fragile Families study, for over 15 years, children of highly educated parents were protected against obesity, however, this protection was weaker for Black than White youth[27]. MDRs theory suggests that due to structural racism, individual level protective factors such as education are not enough to guarantee health for marginalized populations such as Blacks[14].

Structural racism operates as a pervasive and insidious force that systematically perpetuates disparities in access to opportunities and well-being among marginalized and racialized communities[31,32]. It functions through a web of interconnected mechanisms, including historical segregation, which has spatially isolated these communities and limited their access to resources[33,34]. This segregation often leads to inadequate infrastructure and lower-quality education systems, hindering the development of skills and opportunities for residents[35-37]. Consequently, even when individuals from these communities possess high levels of education and ambition, they still face formidable barriers[38-40]. These barriers extend to basic aspects of a healthy lifestyle, such as limited access to nutritious food options and safe spaces for exercise. Despite their personal resources and aspirations, structural racism continues to undermine the health and well-being of these individuals, perpetuating deeply entrenched inequalities[38-40]. The link between high education and low BMI is complex and multifaceted[13]. Several factors contribute to the association, including the access to healthy foods, opportunities for physical activity, levels of stress, and health literacy[41]. High educational attainment can interact and create an environment that makes it less challenging for individuals with low education to maintain a healthy weight[42].

Having high education does not equate to positive health outcomes such as low BMI for Black Americans because Black individuals face larger amounts of debt and fewer resources which ultimately prevent them from having upward mobility. Challenges of upward social mobility contribute to limited access to healthy food and an increased proximity to under-resources areas affected by poverty. In addition, highly educated Black Americans

work in jobs with higher demand, lower pay, and higher stress[43], limiting their available time for exercise and healthy food preparation[44]. In this situation, individuals are likely to turn to fast food options due to time restraints and proximity[42].

The study has significant implications for improving health and well-being of Black Americans across education levels. Our findings can inform interventions, policies, and programs that promote healthy BMI, reduce health disparities, and enhance overall well-being for Black individuals in this particular age group. In addition, the study's findings have implications for public health policies and programs. By suggesting that structural rather than personal factors influence health and well-being of Black populations, policymakers can develop evidence-based policies that address structural needs of Black communities to promote healthy lifestyles, prevent chronic diseases, and improve overall population health. To be more specific, additional support is needed for maximized healthy food options and physical activity opportunities for middle-class Black communities. Structural interventions that increase availability of parks, lightings of neighborhoods, walkable sidewalks, and low-cost groceries that are accessible through transportation can be some actionable solutions for policymakers. However, such costly interventions require considerable environmental investment and a political commitment to promote health equity.

This study had several limitations to consider before interpreting the findings. The first limitation is due to its cross-sectional design, which limits our ability to establish causality or determine the direction of the relationship between educational attainment and BMI; we can only infer that there is an association between education and BMI. The study was limited to White and Black individuals, other racial groups were not considered, therefore findings cannot be generalized to the whole US population. In addition, the study relied on self-reported data that might be subject to recall bias or social desirability bias[27]. This study also relied on self-reported height and weight. Bias could result from participants who underreported their weight or over report their height[45]. The study only included adults aged 24 and over, which is not representative of the entire population of adults. The findings are therefore not applicable to younger individuals or to other age groups. Low sample size of Black participants was a limitation; however, our inference was based on analysis of the pooled sample. Overall, while the study provides a valuable perspective into the relationship between educational attainment and BMI for Black Americans, it is important to consider these limitations when interpreting the results. Future studies should include other races such as Asian, Pacific Islanders, etc. to represent all the US. Additionally, the sample size was imbalanced between racial groups with a far larger sample for White individuals than Black individuals, reducing reliability and validity for Black groups. Finally, SES variables were limited to the individual level constructs, neighborhood SES and wealth were not investigated. In the future, studies should test the role of food environment, stress, physical activity, neighborhood crime, social stratification and discrimination as potential mechanisms for the observed unequal health returns of education by race.

This study specifically addressed Black and White Americans. The study did not investigate the relationship between educational attainment and BMI for Latinos or other racial/ethnic groups. It is crucial to conduct separate research to understand the specific dynamics and factors that might influence the relationship between educational attainment and BMI for Latinos and other racial and ethnic groups[46]. This could help guide and provide a more comprehensive understanding of the issue and inform targeted interventions and policies for this population.

Conclusion

In a nationally representative study of adults (age 24 and above) in the United States, high educational attainment shows a weaker inverse association with lower BMI for Black than White Americans. Contrary to highly educated Whites, Black individuals in the US do not benefit in terms of protection of their educational attainment against high BMI. This is important because having a high BMI negatively affects highly educated Black individuals' health statuses by increasing their risk for chronic diseases such as high blood pressure, heart disease, stroke, and diabetes. This finding may reflect racism, social stratification, and marginalization of Black Americans in the US, including those who are highly educated. High BMI of highly educated Black Americans may indicate poor nutrition, low physical activity, and/or low walkability of neighborhoods, however, such conclusion requires additional robust research.

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