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Associations among Caregiver Feeding Practices and Blood Pressure in African American Adolescents: The Jackson Heart KIDS Study

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Abstract

Caregiver feeding practices have been linked to youth health outcomes. The present study examined associations among caregiver feeding practices and blood pressure (BP) in 212 African American adolescents via the Child Feeding Practices Questionnaire. Results revealed a positive association between caregivers' concern about their child's weight and diastolic BP, which was more acute for older adolescent boys. Caregivers' perceived responsibility for quality and quantity of food their child receives was also associated with lower diastolic BP in older adolescent boys. Feeding practices are ideal targets of lifestyle intervention, and healthcare providers should continue to involve caregivers as adolescents approach adulthood.

Keywords

obesity; blood pressure; adolescents; feeding; Jackson Heart KIDS Pilot Study

Introduction

For decades, the prevalence of obesity and hypertension among African Americans has been disproportionately higher than that of other racial or ethnic groups in the United States.¹ Evidence suggests that these disparate health patterns may begin to emerge as early as childhood and adolescence.^{2,3} Excess weight and elevated blood pressure (BP) are

particularly salient for African American individuals, families, and communities given the increased risk for costly and debilitating physical health conditions such as premature stroke, chronic kidney disease, and cardiovascular disease (CVD).⁴⁻⁶

Researchers have established an association between excess weight and BP among children and adolescents from diverse backgrounds.⁷⁻¹⁰ Interestingly, Rosner and colleagues¹¹ present results indicating interaction between ethnic group and BMI. The authors observed that African American youth tend to have higher blood pressures than their White peers at lower levels of BMI. Although this study found that hypertension was more prevalent among White youth with higher BMIs, these findings highlight the susceptibility of African American youth at all levels of BMI. In fact, when compared to other racial groups, African American adolescents are twice as likely to develop hypertension by early adulthood.^{12,13} To date, however, relatively few studies have taken a within-group approach to examine this relationship among African American youth.^{14,15} The confluence of excess weight and elevated BP among African American children and adolescents is especially concerning considering their heightened risk for cardiovascular complications and premature mortality, impaired psychological well-being and decreased quality of life across the lifespan.^{6,16}

Excess weight and elevated BP are multifactorial health concerns with biological, behavioral, and environmental underpinnings, and family is a mechanism through which risk can be conferred across generations. Parental caregivers can play a prominent role in child and adolescent health outcomes through heritable traits as well as by establishing behavioral and environmental contexts.¹⁷ One particular path that has been identified in the literature is parenting style.^{18,19} For example, parental feeding practices have been associated with BMI and waist circumference among African American adolescents.²⁰ Considering that African Americans develop risk factors for hypertension earlier in the lifespan,^{21,22} adolescence may be an ideal time to intervene. Lifestyle changes, including modifications to diet and exercise, tend to be first-line recommendations for intervention.⁴ Although adolescents are in the process of establishing more autonomy in their health behaviors, lifestyle practices and behaviors during this stage of development can be malleable and influenced by parents or guardians. Hence, the impact of caregiver influence on youth lifestyle behaviors and the persistence of these behaviors into young adulthood requires further study.

There is a critical need for research to elucidate the individual and collective implications of excess weight and elevated BP for early onset and accelerated progression of cardiometabolic diseases among African American youth. The aim of this study was to examine the associations among caregiver feeding practices and BP in a sample of African American adolescents from the southern United States. We hypothesized that caregiver feeding practices would be associated with their children's level of BP. We also anticipated that age and sex would influence the magnitude of relation among feeding practices and blood pressure.

Methods

Participants

Participants for the present study were 212 African American youth enrolled in the Jackson Heart KIDS Pilot Study (JHS-KIDS) and their caregivers. This offspring cohort consists of children and grandchildren of individuals enrolled in the Jackson Heart Study (JHS), the largest single-site epidemiologic evaluation of cardiovascular disease risk among African Americans.²³ Based in Jackson, MS, a primary aim of JHS-KIDS was to examine the development of obesity and factors related to metabolic and cardiovascular disease among a cohort of African American adolescents.²⁴

Potential JHS-KIDS participants were recruited through JHS participants who identified youth who might meet eligibility criteria. Potential participants were then screened by telephone to ensure eligibility (i.e., 12–19 years of age, English as primary spoken language). Those meeting eligibility requirements were invited to the JHS-KIDS clinic site where they and their accompanying caregiver (i.e., parent/grandparent) completed informed consent and assent forms. Adolescent participants had their BP, height, weight, and waist circumference measured while caregivers provided anthropometric data and completed the Child Feeding Questionnaire.²⁵ This study was approved by the University of Mississippi Medical Center Institutional Review Board.

Measures

Primary Outcomes—Primary outcomes for the present study were systolic (SBP) and diastolic (DBP) blood pressure. Trained study personnel measured resting blood pressure using a Critikon Dinamap automated random zero sphygmomanometer (Tampa, FL). SBP and DBP variables used in the present study represent the average of three seated readings with a 1-minute rest period between each reading.

Independent Variables—The Child Feeding Questionnaire²⁵ is a self-report measure of caregivers' views and concerns regarding child obesity risk and their use of controlling feeding practices. This 31-item questionnaire comprises seven subscales, each rated on a corresponding 5-point (0–4) Likert-type scale: (1) *perceived responsibility*, 3 items measuring caregiver's perceived responsibility for quality and quantity of food served to their child; (2) *perceived parent weight*, 4 items querying caregiver's perception of their own weight status; (3) *perceived child weight*, 6 items assessing caregiver's perception of child's weight status; (4) *concern about child weight*, 3 items measuring caregiver's concerns about child's risk for obesity; (5) *restriction*, 8 items assessing caregiver's regulation of unhealthy foods (e.g., sweets) that may contribute to obesity risk; (6) *pressure to eat*, 4 items measuring caregiver insistence that their child eat enough food; (7) *monitoring*, 3 items assessing caregiver oversight and tracking of child's intake of unhealthy foods (e.g., high fat snacks). Due to the present focus on caregiver feeding practices, the present study did not use the *perceived parent weight* or *perceived child weight* subscales. The remaining subscales demonstrated acceptable internal consistency (Cronbach's alphas range .71 – .93).

Demographic and Anthropometric Variables—Basic demographic information was obtained during the caregiver interview, and included adolescent participant age, sex, race/ethnicity, and medical history. Caregiver's relationship to the child participant and highest level of education completed was also collected.

Trained research staff collected adolescents' height and weight in duplicate using a Shorr Height Measuring Board (Olney, MD) and Seca 770 Model scale (Vogel and Halke, Hamburg, Germany), respectively. The average of these measures were used to calculate crude body mass index (BMI), which was transformed to z-scores using the using the lambda-mu-sigma (LMS) method.^{26,27} These values were standardized by age and sex using the 2000 Centers for Disease Control and Prevention Growth Charts as reference.²⁸ Waist circumference (WC) was measured at the level of the umbilicus with a Tech-Med Model #4414 fiberglass measuring tape (Hauppauge, NY). Measurements were taken in triplicate and averaged for precision.

Statistical Analyses

The sample was described in total and by sex using means and standard deviations (for continuous variables) and proportions (for categorical variables). T-tests and chi-square tests were used to assess variability by sex of independent and dependent variables included in multivariate analyses. Multivariable ordinary least squares regression was used to examine the relationship between caregiver feeding practices and blood pressure outcomes; interaction terms were included to investigate hypothesized moderation effects. Models were conducted for the total sample and stratified by sex. Significance level was set at $p < .05$ and all tests were two-sided. All statistical analyses were conducted with StataSE Version 15.

Results

Table 1 reports descriptive characteristics of the sample of African American adolescents and their caregivers. The average age of the adolescents was 15.16 years ($SD = 2.19$), and there was equal distribution of boys (49.5%) and girls (50.5%) in the sample. Mean SBP and DBP readings were approaching adult pre-hypertensive levels in this sample of adolescents, and boys had significantly higher SBP ($p < .0001$) when compared to girls. Mean BMI z-scores and waist circumference measures were also approaching levels that correspond with increased risk for cardiometabolic complications among youth.²⁹ There were no mean differences in anthropometric measures by sex.

The preponderance of caregiver respondents were women (86.5%), parents (70.3%), and baccalaureate degree recipients (58.04%). Mean scores on Child Feeding Questionnaire subscales revealed that caregivers perceived themselves moderately responsible for their adolescent's eating decisions and were somewhat concerned about their child's weight. On average, caregivers reported moderate restrictive and monitoring practices, and disagreed that they pressure their children to eat more food. When compared to grandparents, parents reported greater perceived responsibility for type and amount of food provided to their child ($p < .001$). No other mean differences between study variables were noted for parents and grandparents.

Multivariable regression analyses were conducted to explore the associations among child feeding practices, SBP, and DBP (see Table 2). While results revealed no direct effects for SBP, caregivers' report of concern about their child's weight was positively related to DBP ($B = 0.32, p < .05$). The relationship between caregiver concern and DBP varied by sex as the sex-stratified models produced results indicating that association for girls was similar to the pooled model while the corresponding results for boys were not statistically significant.

Interaction terms were added to the regression models to investigate the degree to which age moderates the relationship between caregiver feeding and blood pressure. Moderation analyses conducted on sex-stratified models revealed that the association between concern for obesity risk and DBP was more acute for older adolescent boys ($B = 0.23, p < .05; R^2 = .20$). This finding is illustrated in Figure 1. Similarly, as can be seen in Figure 2, caregiver perception of greater responsibility for providing the appropriate types and amounts of food was associated with lower DBP as adolescent boys got older ($B = 0.24, p < .05; R^2 = .19$). Each of these interaction models demonstrated a medium effect size (Cohen's $f^2 = .26$ and $.24$, respectively).

Discussion

The rising rates of obesity and CVD risk factors among adolescents is a concerning trend that is even more pronounced among African Americans.^{6,21} Taken together, the high prevalence and early onset of hypertension in this population indicate a strong need for developmentally and culturally appropriate interventions that may redirect the trajectory of hypertensive disease as adolescents approach adulthood. Modifications to lifestyle behaviors, key targets of early intervention efforts, are strongly influenced by caregivers, who model eating and activity patterns as well as facilitate or impede access to healthy choices.^{30,31} The present study fills an important gap in the literature by examining associations among caregiver feeding practices and blood pressure outcomes among a sample of African American adolescents.

The study sample comprised adolescents who, on average, presented with elevated BMI, waist circumference, and blood pressure readings; indicating an elevated risk for premature CVD and related diseases. While there were no sex differences for markers of weight status, boys in the sample had higher mean SBP when compared to girls. This finding is consistent with reports using data from the National Health and Nutrition Examination Survey (NHANES),³² and underscores the importance of tailoring health intervention efforts to consider factors such as sex. Our hypothesis that caregiver feeding practices were related to blood pressure outcomes was partially supported. Caregivers who expressed concern about their child's weight were more likely to be parenting a child with higher DBP. This finding held for girls in a sex stratified model, and highlights the moderating role of sex on the relationship between obesity and hypertension. The combination of obesity and hypertension portends heightened cardiometabolic consequences,⁶ and both should be the focus of future prevention and intervention efforts.

Results from the present study indicate that age as well as sex may be important factors in how caregiver feeding practices influence blood pressure outcomes. Specifically, caregiver

concern for the risk of obesity and perceived responsibility for their adolescent's intake were associated with lower DBP among older boys. These findings suggest that caregivers of boys approaching adulthood who appreciate the deleterious effects of obesity and who are more cognizant of their role in providing healthy food options may be directly or indirectly influencing DBP. It is important to note that elevated DBP is typically quite amenable to lifestyle changes,^{33,34} and while elevated SBP is the hallmark indicator of hypertension, long-term elevation of DBP has been linked to isolated systolic hypertension.³⁴ African American adolescent and young adult men are particularly susceptible to elevations in DBP, which highlights the importance of early culturally and developmentally appropriate intervention.^{35,36}

Limitations

The strengths of the present study include a focus on an offspring cohort of African American adolescents affiliated with the Jackson Heart Study. Obesity, hypertension, and other cardiometabolic conditions are of particular prevalence and concern in the southern region of the United States; however, generalizability of these findings to other geographic regions is limited. The cross-sectional design of this study does not allow for temporal relationships or causal inferences to be established from the results, and the use of self-report questionnaires introduced the possibility of biased or socially desirable responses. However, anthropometric and vital measurements were obtained by trained medical providers in a clinical setting, which adds to the strengths of this study design.

Conclusions

Results from this study suggest that medical providers managing weight and BP concerns among African American adolescents should continue to involve caregivers in the care of these youth, even as they approach adulthood. Additionally, intervention strategies should be tailored for sex of the youth. These findings are consistent with recommendations for family-based approaches to implementing healthy lifestyle behaviors.^{37,38} The physiological and psychosocial sequelae associated with excess weight and elevated BP are relevant across the lifespan. Early intervention, however, holds promise for improved health and quality of life outcomes as individuals age. There is a particular need for more interventional research on implementation and consistent maintenance of healthy lifestyle behaviors among African American youth, and this study supports the important role that caregivers play in adolescent health outcomes.

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Figure 1.
Interaction Plot: DBP on Concerns X Age (Boys)

Figure 2.
Interaction Plot: DBP on Responsibility X Age (Boys)

Table 1.

Demographic, Anthropometric, and Study Variables for Full Sample and by Sex

	Total (N = 212) <i>M (SD) or %</i>	Girls (n = 107) <i>M (SD) or %</i>	Boys (n = 105) <i>M (SD) or %</i>	<i>p</i> - value
Demographics				
Age	15.16 (2.19)	15.17 (2.14)	15.14 (2.24)	0.53
Caregiver Education				0.63
Less than High School	1.4%	<1%	1.9%	
High School Graduate	18.9%	16.8%	20.9%	
Some College	22.1%	19.6%	24.8%	
College Graduate	33.94%	37.4%	29.5%	
Graduate Education	24.1%	25.2%	22.9%	
Respondent				0.95
Parent	70.3%	70.1%	70.5%	
Grandparent	29.7%	29.9%	29.5%	
Anthropometrics				
BMI z-score	0.96 (1.13)	0.98 (1.09)	0.94 (1.18)	0.58
Waist Circumference	83.91 (19.81)	85.34 (21.45)	82.45 (17.98)	0.86
Dependent Variables				
Systolic Blood Pressure	114.43 (11.78)	111.55 (9.85)	117.36 (12.87)	0.0001
Diastolic Blood Pressure	66.78 (8.98)	67.82 (8.71)	65.72 (9.17)	0.95
Independent Variables				
Responsibility ^a	2.72 (1.16)	2.59 (1.19)	2.85 (1.12)	0.05
Concerns ^b	1.81 (1.41)	1.98 (1.43)	1.65 (1.40)	0.95
Monitoring ^c	2.15 (1.09)	2.12 (1.11)	2.19 (1.06)	0.31
Restriction ^d	2.62 (0.78)	2.58 (0.77)	2.66 (0.79)	0.23
Pressure to Eat ^e	1.32 (1.18)	1.33 (1.38)	1.31 (0.98)	0.56

Note.

^a0 = never responsible, 4 = always responsible^b0 = unconcerned, 4 = very concerned^c0 = never, 4 = always^d0 = agree, 4 = disagree^e0 = disagree, 4 = agree

Table 2.

Summary of Regression Analyses for Variables Predicting Metabolic Outcomes

Independent Variables	Dependent Variables					
	Systolic Blood Pressure			Diastolic Blood Pressure		
	Total Sample	Boys	Girls	Total Sample	Boys	Girls
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Sex	5.60 (1.59) *	---	---	-1.84 (1.17)	---	---
Respondent	-0.78 (1.82)	-2.74 (2.85)	1.48 (2.41)	-1.27 (1.34)	-3.67 (1.97)	1.23 (1.95)
Caregiver Education	-0.10 (0.07)	0.26 (1.18)	0.28 (1.07)	-0.33 (0.57)	0.00 (0.81)	-0.19 (0.87)
Age	1.31 (0.38) *	1.71 (0.60)	0.95 (0.49) *	1.45 (0.28)	1.43 (0.41) *	1.58 (0.40)
Responsibility	0.17 (0.29)	-0.24 (0.44)	0.75 (0.38) *	-0.05 (0.21)	-0.14 (0.31)	0.13 (0.31)
Concerns	0.01 (0.21)	-0.24 (0.34)	0.27 (0.27)	0.32 (0.16) *	0.20 (0.23)	0.47 (0.22) *
Monitoring	0.12 (0.29)	0.67 (0.45)	-0.59 (0.37)	-0.07 (0.22)	0.27 (0.31)	-0.46 (0.30)
Restriction	0.09 (0.15)	0.13 (0.25)	0.02 (0.19)	0.13 (0.11)	0.10 (0.17)	0.08 (0.15)
Pressure	-0.19 (0.21)	-0.16 (0.34)	-0.28 (0.25)	-0.02 (0.15)	-0.02 (0.23)	-0.01 (0.20)
F	4.61 *	1.43	1.29	4.87 *	2.31 *	3.81 *
R ²	.05	.11	.10	.18	.16	.24
Cohen's <i>f</i> ²	.05	.12	.11	.23	.19	.32

Note. Sex: 0 = girl, 1 = boy. Respondent: 0 = parent, 1 = grandparent.

* $p < .05$