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Chronic stress and decreased physical exercise: impact on weight for African American women

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Abstract

Objective—African American women continue to have the highest prevalence of obesity in the United States and in the state of Maryland they are disproportionately affected by overweight and obesity. There are many contributing factors including chronic stress and the use of health behaviors such as physical exercise that play a role in increased weight for African American women. We examined the relationship of stress to weight and the role of physical exercise in African American paraprofessional women.

Design—Cross-sectional study

Setting—African American paraprofessionals were asked about their perspectives regarding association with chronic stress and physical exercise.

Results—The three most salient stressors for the women were finances (33%), work (28%) and family/friends (19%). Ninety percent of the women were overweight or obese. Significant predictors of increased BMI were lack of physical exercise (P=.004) and health compared to others (P=.006). Ethnic discrimination was a form of chronic stress (r=.319) but was not correlated with BMI (r=.095). Decreased physical exercise (P=.02) mediated the relationship between chronic stress and BMI.

Conclusion—Findings regarding finance and work stress suggest the need for employers to consider the impact of job strain when implementing employee health programs to decrease stress and improve health. A focus on decreased physical exercise, unhealthy eating habits and misperceptions regarding increased risk for obesity related diseases with health status may be helpful to include in intervention strategies to decrease obesity for this population.

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Keywords

Chronic Stress; Physical Exercise; Weight; African American Women

Introduction

Overweight and obesity have been increasing for over twenty years in the United States, with African American women having the highest prevalence of obesity (53%) that continues to rise.[1] This increase in obesity affects health as well as health care costs for employers. As reported in the 2008 Maryland Behavior Risk Factor Surveillance Survey, adult females aged 18–34 and 35–49 years had the highest and second highest percent of increase in obesity (8.5% and 7.8%) when compared to other age groups in the state.[2] African American women in Maryland are disproportionately affected in that 41% are overweight or obese.[2]

Many factors may contribute to the higher prevalence of overweight/obesity for African American women. Associations between chronic stress and various psychological symptomatology and health behaviors have been identified.[3–5] The role of perceived ethnic discrimination and/or ethnic related stress has been conceptualized as a chronic or recurrent condition[6] that can impact health.[7–10] Perceived chronic stress may lead to changes in behaviors such as eating habits that have an influence on weight.[10,11] The effects of greater perceived stress have been associated with increased self-reported eating and body mass index (BMI), changes in meal choices and food patterns resulting in increased intake of snack food, decreased intake of fruits and vegetables, and an overall increase in caloric intake.[5] Eating habits that include diets high in fats and sweets have also been associated with chronic stress.[4]

Physical exercise can be a way to reduce stress, however, African American women have difficulty initiating and maintaining physical exercise programs due to occupational and/or personal stress, lack of social support and cultural perceptions of the acceptance of higher weight levels, among other barriers.[12–16] Unhealthy eating habits due to stress were also associated with physical exercise in that African American women who increased their control over emotional eating were more likely to lose weight and those who lost weight increased their exercise activity level.[14] These impediments to physical exercise are magnified for health care workers owing to changing work shifts. Consistent with this finding, African American hospital workers were found to have higher mean BMI and higher carbohydrate intake when compared to nonhospital workers with similar socioeconomic status (SES).[17]

Although studies have examined stressors that negatively impact health and weight from psychological and psychosocial perspectives,[14,18–20] African American women continue to have high percentages of overweight and obesity. So far, studies in the United States have not examined the unusual African American experience that includes the impact of chronic stress from a psychological and ethnic discrimination perspective coupled with the use of health behaviors (ie, physical exercise) on obesity.

We hypothesized that as perceived chronic stress increases, BMI levels increase, after controlling for SES factors, and that the association between chronic stress and BMI is mediated by the coping strategy of physical exercise. We further hypothesized that eating habits and specific SES factors are associated with BMI and will need to be controlled for in the analyses.

We report on the relationship between perceived chronic stress (psychological and ethnic discrimination), physical exercise and BMI for African American female hospital workers.

Here we report on the relationship between perceived chronic stress (psychological and ethnic discrimination), physical exercise and BMI for African American female hospital workers. The role of physical exercise as a mediator in the relationship between chronic stress and BMI was also examined.

Methods

Participants

Participants were employees at the University of Maryland Medical Center. Study volunteers were recruited through advertisements posted throughout the hospital. Paraprofessional women were targeted to increase homogeneity of the study sample. Employees eligible to participate were African American females aged 18 to 50 years holding a paraprofessional position (required an associates degree or less) that involved direct patient care or patient contact. Employees were excluded from the study if they held professional positions (due to job strain level differences),[21] were pregnant, or had a diagnosis of clinical depression.[22–24]

Procedure

The study protocol was approved by the Institutional Review Boards at the University of Maryland School of Medicine and Morgan State University. Informed consent was obtained from each participant. Of the 496 employees who were potentially eligible to participate in the study, 91 volunteered and 90 completed all study protocols. The one exclusion was due to professional job status. Participants represented 47 departments throughout the hospital. The majority of the women were single (62%), had completed some college courses (57.8%) and had jobs that required patient contact (66.7%) as opposed to direct patient care (33.3%).

From May 2007 to July 2007, using a cross-sectional study design, data were collected on demographics, perceived chronic stress, ethnic discrimination, and physical exercise using computer based questionnaires. To gain access to the computer based questionnaires, participants were given the web address and login information and then allowed to complete the questionnaires at home or on designated computers at the University of Maryland General Clinical Research Center. Overall time to complete all questionnaires was 15–30 minutes. Participants were required to complete the questionnaires within one week of enrollment in the study. Additionally, height was measured using a Seca 214 portable stadiometer and weight was measured using a Tanita BF-350 foot to foot Bioelectric Impedance Analysis machine according to the manufacturer's directions. Waist circumference was measured according to NIH treatment guidelines for measuring waist circum-ference.[25] A MaBander forma flexible roller tape measure was used to measure the waist. The tape suspension fitting allowed for exact circumference measurements of the waist. After locating the upper hip bone and top of the right iliac crest, the tape measure was placed to fit snugly around the abdomen at the level of the iliac crest and the measure was taken at the end of a normal expiration.[25] Body mass index was calculated as weight (kg) divided by height (m) squared.

Measures

Body mass index (outcome) scores were saved as continuous data as well as recoded for analysis using the following categories: normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), obese (30– 39.9 kg/m^2) and extreme obesity (> 40 kg/m^2).[26,27] None of the

participants had BMI scores that fell into the underweight category (< 18.5 kg/m^2), therefore this category was not part of the analysis.

Waist circumference was used as a proxy for body fat and disease risk.[13,25] Intercorrelation between waist circumference and BMI was conducted using Pearson's correlation to validate BMI as a measure of obesity.

Questionnaires

Health Behavior—A modified 19-item Block Dietary Fat Screener[28] was used to estimate dietary fat. Scores were summed for a total dietary fat score. Based on the screener, very high fat intake was defined as ≥35% energy from fat (score ≥26.6), high fat intake was defined as 30%–34.9% energy from fat (score=22.8– 26.5) and low fat intake was defined as <30% energy from fat (score≤22.8).[28] The Block Dietary Fat Screener is a modified version of the validated Block full length Food Frequency Questionnaire that was developed in 1995. The Block Dietary Fat Screener significantly correlated (*P*=.0001) with the Block Food Frequency Questionnaire in identifying persons with high percentages of calories from fat, saturated fat and cholesterol in a multi-ethnic sample.[28]

The physical exercise subscale (4 questions) of the Brief COPE Inventory used a 4-point Likert scale ("don't do this at all" to "do this a lot") to measure engagement in physical exercise as a means of coping with chronic stress.[3] Cronbach's alpha for the original sample was .89.[3]

Psychological—The 19-item Salient Stressor Impact Questionnaire was used to measure chronic stress.[29] While the questionnaire typically asks for the two most salient stressors from the following eight stressor categories: 1) work, 2) family/ friend, 3) personal health, 4) home/ neighborhood, 5) financial, 6) overload/ time pressure, 7) expectations from self and 8) other, since we were interested in the single most important stressor, participants were asked to choose only the most important stressor from the eight categories. Eleven questions related to the most important stressor were answered using a 4 to 9 point Likert scale (number of points varied based on the question) that represented four separate subscales associated with chronic stress (chronic stress appraisal, event chronicity, distress chronicity and distress intensity). Cronbach's alpha for the original sample was .89.[29]

The 22-item Perceived Ethnic Discrimination Questionnaire[6] was used to measure perceived ethnic discrimination. A 7-point Likert scale measured verbal rejection, avoidance, devaluation, exclusion, denial of equal treatment and threat-aggression. Cronbach's alpha for all subscales for African Americans only and combined ethnic groups in the original questionnaire were: verbal rejection (α =.77 and .78, respectively), avoidance (α =.73 and .74), devaluation (α =.90 and .89), and threat-aggression (α =.85 and .84).[6] Perceptions of discrimination for the past six months were used to determine chronicity.

Sociodemographic—Demographic information (including perceived health) was collected on age, marital status, education, income and job description. Job description data were used to verify positions requiring direct patient care or contact and paraprofessional inclusion criteria. Continuous data on age were categorized into young adult (18–34 years) and middle-aged adult (35–50 years) for cross-tabulation analysis. To control for SES, marital status and education were entered into the regression of BMI on chronic stress.

Analyses

Frequency distributions were reviewed for all study variables to obtain the mean, standard deviation and percentages. Histograms and skewness values (all<1) for continuous data from

all variables were checked for normality. Continuous data for BMI were maintained for correlation and linear regression analyses. For the univariate analysis only, BMI data were transformed into a different variable for cross tabulation with independent variables to examine patterns of relationships.

Cronbach's alpha was used to test reliability for all self-administered questionnaires for this sample population. Internal reliability for all questionnaires was high (Block Dietary Fat Screener=.86, physical exercise subscale=.86, Salient Stressor Impact Questionnaire=.86 and perceived ethnic discrimination=.94,). Reliability of subscales for perceived ethnic discrimination were also high (verbal rejection =.76, avoidance=.85, devaluation=.92 and threat-aggression=.83).

Items were ranked in the same direction (higher ranking indicated greater chronic stress perceptions or greater physical exercise). The mean score for each questionnaire was calculated with scores above the mean indicating higher levels of perceived chronic stress, ethnic discrimination and physical exercise.

Bivariate associations between BMI and categorized demographic and health variables were analyzed using a one-way ANOVA. Tukey's post-hoc tests were conducted if between group mean differences were found in the one-way ANOVA analysis. Continuous data for psychological variables were analyzed using Pearson Correlation Coefficient. Multiple linear regression analysis was used to estimate the strength of association between BMI and chronic stress, and to determine independent variables that predicted changes in BMI. Variables that were significantly related to BMI ($P \leq .05$) on the bivariate analyses were chosen as independent variables. Reduced models using the variables-added-in order method were run and evaluated using significant F change and R^2 to determine if the variable should be included in the model. Based on this analysis, three models were developed: chronic stress on BMI (Model 1), physical exercise on BMI (Model 2) and marital status and education (to control for SES), chronic stress and physical exercise on BMI (Model 3). The final model explained the greatest amount of variation in BMI based on the above criteria.

The mediation path of the Transactional Model of Stress and Coping[30] was used to analyze the relationship between chronic stress, physical exercise and BMI. To test physical exercise as a mediator between chronic stress and BMI, the following regression models were estimated: 1) regression of physical exercise (mediator) on chronic stress, 2) regression of BMI (dependent variable) on chronic stress and 3) regression of BMI on physical exercise and chronic stress.

Four criteria had to be met for physical exercise to be considered a mediator between chronic stress and BMI: 1) with every unit increase in physical exercise, chronic stress had to significantly ($P \leq .05$) decrease in model 1; 2) with every unit increase in chronic stress, BMI had to significantly ($P \leq .05$) increase in model 2; 3) with every unit increase in physical exercise, BMI had to significantly ($P \leq .05$) decrease in model 3; and 4) while maintaining its significance, the positive prediction of chronic stress on BMI had to be less in model 3 when compared to model 2.[31]

Results

Demographic and health characteristics of study participants are presented in Tables 1 and 2. The mean age was 35 ± 8.7 years and average annual income range was $25,000 to $34,999. Ninety percent of participants had a BMI≥25 kg/m^2 with an overall mean of 34.3 ± 8.37 kg/m^2. The mean waist circumference was 105 ± 17.4 cm, with 82% of participants having a

waist circumference >88 cm (the cut off for increased risk of obesity-related chronic illnesses in women).[25]

The three most important stressors were finances (33%), work (28%) and family/friends (19%). None of the women who identified work as the most important stressor had a normal BMI (mean BMI 32 ± 6 kg/m^2).

Seventy-three percent of participants reported consuming high or very high fat diets. However, they reported slightly higher consumption of food categorized as sweets and chocolate (50%) as compared to food categorized as fats (48%).

Given their eating habits, only a small percent of participants (12.2% [*n*=11]) reported obesity-related diagnoses such as diabetes or hypertension. Additionally, 86% reported that they did not get sick more often than other women their age, 96% did not expect their health to worsen, and 62% perceived their health to be good to excellent compared to others.

Psychological perception questions revealed that higher percentages of scores on each questionnaire fell below the calculated mean indicating lower rankings. Therefore, the findings indicated lower levels of chronic stress (38.1 ± 11.5; score range=11–80), ethnic discrimination (52.7 ± 23.9; score range=22–154) and physical exercise (8 ± 2.8; score range=4–16). The data revealed that 37.8% percent of scores fell in the higher rankings and above the calculated mean of 8, which indicated lower engagement in physical exercise.

Based on Tukey's post-hoc analysis, marital status and health compared to others had significant group differences as a function of BMI (marital status F [2, 87]=4.92, *P*=.009 and health compared to others F [4, 84]=3.93, *P*=.006). Within the groups, mean BMI for widowed/divorced (27 ± 5.8 kg/m^2) women was significantly lower than single (34 ± 7.7 kg/m^2, *P*=.03) and married (37 ± 9.4 kg/m^2, *P*=.007) women. Mean BMI for women who perceived their health as being poor (44 ± 5.5 kg/m^2) was significantly higher than those who perceived their health as good (33 ± 8.5 kg/m^2, *P*=.04) or very good (31 ± 7.9 kg/m^2, *P*=.016). Other demographic characteristics including age, education, income, job description, and health variables were not associated with BMI (data not shown).

Correlational analyses revealed that chronic stress (*r*=.222, *P*=.018) and physical exercise (*r*=–.300, *P*=.004) were significantly correlated with BMI. Ethnic discrimination, a separate measure of chronic stress (*r*=.319), was not correlated with BMI (*r*=.095) (Table 3).

Health characteristics including diabetes, hypertension, sick more often, expect health to worsen, health compared to others did not add significantly to any of the models and therefore were excluded in the final model. Additionally, perception of poor health, compared to others, was not included in the final model due to its very small contribution (5.6%).

Linear regression analyses revealed that chronic stress alone (model 1) accounted for a small but significant positive relationship with BMI increasing .16 kg/m^2 for every unit increase in chronic stress score (*P*=.035). Increased physical exercise (model 2) contributed significantly to larger negative variation, with BMI decreasing .90 kg/m^2 for every unit increase in physical exercise (*P*=.004). When physical exercise and SES variables were included in model 3, chronic stress was no longer associated with significant variation in BMI. Thus, predictions regarding positive variation between chronic stress and BMI were not found in the final analysis (R^2=.20) (Table 4).

A separate linear regression analysis using three regression blocks identified physical exercise as a mediator between chronic stress and BMI. Model 1 revealed that with every

unit increase in chronic stress, physical exercise decreased –.08 (P=.002). Furthermore, model 1 revealed that with every unit increase in chronic stress, BMI increased 1.61 kg/m^2 (P=.035) while model 2 revealed that increased physical exercise contributed to a decrease in BMI by –.77 kg/m^2 (P=.02). The addition of physical exercise to the model eliminated the effect of chronic stress on BMI (data not shown). Therefore, higher levels of chronic stress and lower levels of physical exercise predicted higher BMI levels.

Variables predicting decreased physical exercise showed that dietary fat and health compared to others accounted for 24% of the variation with perceived poor health being the strongest predictor of decreased physical exercise.

Discussion

The findings from this study indicate that increased BMI levels for young adult female hospital paraprofessionals had a stronger association with decreased physical exercise than perceptions of chronic stress. Furthermore, women who identified family/friends as their most important stressor had higher mean BMI levels, which was associated with lower physical exercise. The literature indicates that social support from family and friends positively impact African American women's ability to initiate and maintain exercise to manage weight.[13,32,33] Our study shows that having family/friends as major stressors may be negatively associated with levels of social support and physical exercise. Therefore, if family and friends are not perceived as a source of support, they will not add to the women's ability to initiate, maintain and manage their weight.

The perception of finances and work as the top two stressors for paraprofessionals are related to each other in that these types of jobs receive lower pay and in health care settings tend to have high concentrations of ethnic minorities with high job demand/low control, which has been associated with increased stress.[21,34] These issues are not usually considered by employers in efforts to address employee obesity.

Another important but disturbing outcome of the study is the apparent disconnect between the women's perception of good health and the role that nutrition and BMI play in maintaining good health. The effect of stress and normative coping on eating habits for African American women implicates cultural differences in body image (lack of need to maintain a healthy weight) and differences in learned behaviors from social, environmental and family systems that influence coping regarding eating habits and attitudes, which may account for the perception that consuming high fat food is normal.[35,36] This perception can adversely impact public health efforts to decrease obesity for this population.

Based on the results of our study and others,[12,13,16,31,32] clinical interventions to decrease obesity should include strategies that address family support and perceptions regarding health, eating habits and physical exercise.

Based on previous studies,[37] the excessive high fat food consumed by the women may be associated with physiological chronic stress. Further research is required to examine this possible association. If this theory is found to be correct, health care providers will need to monitor the physical manifestations of chronic stress to bridge the gap between health perceptions and physical conditions that impact BMI.

The strength of this study is that few studies have examined, as we have here, African American female employees to determine sources of stress and health behaviors that may impact obesity or clinical interventions addressing sources of stress to decrease obesity. One study limitation is its cross-sectional design. The cross-sectional design hindered our ability to determine sequential events regarding stress, physical exercise and weight. However, our

study did provide prevalence data regarding the impact of associations between lack of physical exercise and poor perceived health with increased BMI. Including these variables may be useful in designing future interventions to decrease obesity in this population. A second study limitation was the high percentage of obese and extremely obese participants that limited our ability to examine perceptions and eating habits for women with normal BMI levels. To minimize this problem, continuous data were analyzed to avoid missing BMI relationships with study variables. We use caution regarding implications of the study and the intervention strategies suggested due to the study design and inclusion criteria.

Given this caution, two very interesting outcomes were revealed that should be considered in attempts to decrease overweight/obesity for this population. First, the outcome regarding the two top stressors of finances and work suggest the need for additional research to determine the impact of job strain on obesity for this employee population and to identify methods/processes to decrease job stress. This research would benefit overall employee health as well as employer health care cost.

Second, the lack of physical exercise, unhealthy eating habits and discrepancy between perceptions of health and increased risk for disease was prevalent among our cohort of African American female paraprofessional health care workers. The impact of these misperceptions could be devastating on public health efforts to decrease obesity and risk for obesity-related diseases and suggest that interventions need to target these misperceptions to improve health outcomes for this population.

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Table 1

Demographic characteristics of African American female participants (*n*=90)

Characteristic	%
Age	
18–34 years	47.8
35–50 years	52.2
Marital status	
Married	27.8
Single	62.2
Divorced	8.9
Widowed	1.1
Education completed	
Less than HS	2.2
HS/GED/voc. degree	40.0
Some college/AA	57.8
Household income/year	
<$14,999	4.4
$15,000–$24,999	10.0
$25,000–$34,999	43.3
$35,000–$44,999	17.8
≥$45,000	24.5
Job description	
Direct patient care	33.3
Patient contact	66.7

Table 2

Reported health and psychological characteristics of African American female participants (*n*=90)

Characteristic	%	Mean ± SD
Health characteristics		
Body mass index, kg/m^2		34.3 ± 8.4
<18.5, underweight	0.0	-
18.5–24.9, normal	10.0	21.8 ± 1.6
25–29.9, overweight	24.0	27.4 ± 1.7
30–39.9, obese	39.0	34.5 ± 2.7
>40, extreme obesity	27.0	45.3 ± 5.0
Waist circumference, cm		105.0 ± 17.4
≤88 cm	17.8	82.1 ± 4.7
>88 cm	82.2	110.4 ± 14.9
Block dietary fat		29.6 ± 11.5
Screener, total		
Low fat, <30%	26.7	
High fat, 30–34.9%	12.2	
Very high fat, ≥35%	61.1	
Current diagnosis		
Diabetes		
Yes	12.2	
No	87.8	
Hypertension		
Yes	12.2	
No	87.8	
Sick more often		
Yes	13.3	
No	86.7	
Expect health to worsen		
Yes	4.4	
No	95.6	
Health compared to others		
Excellent	6.7	
Very Good	18.0	
Good	37.1	
Fair	32.6	
Poor	5.6	
Psychological	Score range	Mean ± SD
Chronic stress	11–80	38.1 ± 11.5
Ethnic discrimination	22–154	52.7 ± 23.9
Physical exercise	4–16	8.0 ± 2.8

Table 3

Correlation between psychological variables with BMI(*n*=90)

Characteristic	Chronic stress	Perceived ethnic discrim.	Physical exercise	BMI
Chronic stress	—	.319[b]	–.316[b]	.222[a]
Perceived ethnic discrim.		—	–.150	.095
Physical exercise				–.300[b]
BMI				—

[a] Correlation is significant at .05 (2-tailed).

[b] Correlation is significant at .01 (2-tailed).

Table 4

Regression of BMI on chronic stress

Characteristic	Model 1[a] B±SE	Model 2[a] B±SE	Model 3[a] B±SE
Chronic stress	.161 ± .08[b]		.071 ± .077
Physical exercise		−.901 ± .31[b]	−.837 ± .344[b]
Marital status			
Married			2.62 ± 1.90
Widowed/divorced			−4.41± 3.00
Single (RC)			—
Education			
Less than HS			10.25 ± 6.00
Some college			1.14 ± 1.89
AA degree			.650 ± 2.25
HS/GED (RC)			—
Model R^2	R^2 .049	R^2 .090	R^2 .200
F Change	F(1,88) 4.56	F(1,88) 8.73	F(1,82) 5.91
Sig. F Change	.035	0.04	0.017

[a] See text for model descriptions.

[b] $P \leq .05$.

RC, reference category.