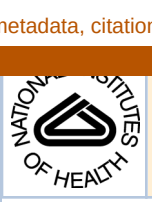

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The Associations of Multiple Dimensions of Discrimination and Abdominal Fat in African American Adults: The Jackson Heart Study

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Abstract

Background—Discrimination may be adversely associated with abdominal obesity, but few studies have examined associations with abdominal fat.

Purpose—The purpose of this study was to examine whether discrimination was independently associated with visceral (VAT) and subcutaneous (SAT) fat and whether these associations differed by sex and age.

Methods—Participants self-reported experiences of everyday and lifetime discrimination. The main reason for and the coping response to these experiences were also reported. VAT and SAT were quantified by computed tomography.

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Results—In fully adjusted models, higher reports of everyday discrimination were associated with greater SAT, but not VAT, volumes in men only: SAT increased by 3.6 (standard error = 1.8)cm^3 for each unit increase in the everyday discrimination score. In women, higher reports of lifetime non-racial discrimination were associated with greater VAT (71.6±32.0, $P<0.05$) and SAT (212.6±83.6, $P<0.05$), but these relationships were attenuated after controlling for body mass index.

Conclusions—These cross-sectional findings do not fully support the independent hypothesis of discrimination and abdominal fat. Additional investigations involving longitudinal designs are warranted.

Keywords

Discrimination; African Americans; Jackson Heart Study; Abdominal fat; Psychological stressors; Racism

Introduction

Abdominal fat is an endocrine organ [1] that is associated with cardiometabolic risk factors including hypertension, type 2 diabetes, and metabolic syndrome [2–6]. Abdominal visceral adipose tissue (VAT), compared with subcutaneous adipose tissue (SAT), is considered to be the more adverse fat depot [2–6] and has been linked to subsequent cardiovascular events [7]. Demographic [5, 6], genetic [8, 9], and behavioral [9, 10] factors contribute, to some extent, to the accumulation of VAT and SAT. The chronic and acute psychosocial stressors that contribute to abdominal fat remain largely understudied. Discrimination, the unjust behavior of an individual or group toward a different individual or group, can be conceptualized as both a chronic (i.e., ongoing stressor in the form of day-to-day experiences) and acute (i.e., manifesting as major discriminatory events over one's lifetime) stressor [11, 12] and may contribute to cardiovascular risk [13–18], especially among African Americans. It has often been hypothesized that discrimination is associated with abdominal obesity, thereby suggesting that VAT may be a potential pathway linking experiences of discrimination to poor cardiovascular health.

A number of studies have documented that higher reports of day-to-day (everyday) [19, 20] and lifetime [21] discrimination were associated with a higher waist circumference and waist/hip ratio, although at least one study among African American women observed an inverse association with waist/hip ratio [22] and two studies among African American women and men observed a null association [19, 23]. Racial/ethnic discrimination experienced by African Americans and non-racial discrimination (i.e., social status factors such as age and sex) experienced by non-Hispanic whites have been shown to be associated with a higher waist circumference [19]. Moreover, passive emotional behaviors in response to discrimination have been shown to be associated with a higher waist/hip ratio in African American women [22]. The only study, to our knowledge, that has examined the association between discrimination and abdominal fat compartments demonstrated a positive dose–response relationship between reports of everyday discrimination and VAT, but not SAT, among African American and white women in the Study of Women Across the Nation Heart Study with a truncated age range (range, 42–61 years) [24].

African American men report greater experiences of discrimination [25] and racism [26] than African American women. African American men also have higher VAT, but lower SAT, volumes than African American women [5]. There are several studies that have demonstrated graded increases in visceral fat across increasing age categories in women and men [27, 28]. In addition, reports of discrimination may decrease with increasing age [29] as older African American adults may perceive these episodic events as minor irritants given

the more traumatic historical events that may have occurred earlier in their life course. Thus, important questions remain regarding whether discrimination is differentially associated with abdominal fat among African American men and women and among different age groups.

The effects of discrimination on abdominal fat, however, have been difficult to understand because of the challenge to determine whether discrimination is associated with abdominal fat independent of other psychosocial stressors [30] and to comprehensively measure discriminatory treatment across the life span [31]. Only three studies have examined whether experiences of everyday and lifetime discrimination were associated with abdominal obesity independent of other measures of stress [19, 22, 24], but the results have been mixed. No study that we are aware of has examined the independent relationship between multiple dimensions of discrimination and subtypes of abdominal fat. A second challenge in studying the effects of discrimination on abdominal fat is determining whether exposure to chronic or acute stress reflects consequences of metabolic dysregulation of the hypothalamic–pituitary–adrenocortical axis and the sympathetic–adrenal–medullary system or whether the accumulation of abdominal fat reflects the initiation of negative health behaviors to cope with stress. This is important given that abdominal fat is strongly influenced by behavioral factors such as physical inactivity and increased energy intake [9, 10]. In addition, behaviors may also partly mediate the effects of discrimination on abdominal fat.

The current study is designed to expand upon prior work [19, 22, 24] by examining associations between multiple dimensions of discrimination and abdominal fat among African American women and men and across different age groups. Based upon previous research, we hypothesized that general everyday and lifetime discrimination would be positively associated with VAT and SAT, independent of behavioral factors and other indicators of psychosocial stressors. Although less is known about the attribution of and the coping strategies in response to discrimination (i.e., secondary dimensions of discrimination), and to be consistent with current theoretical work in this area [31], we further hypothesized that discrimination attributed to racial and non-racial factors and passive coping behaviors in response to discrimination would be associated with greater VAT and SAT. Finally, given the differences in the reporting of perceived discrimination by sex [25, 26] and age [29] and the differences in VAT and SAT volumes by sex [5] and age [27, 28], we further hypothesized that these associations would differ by sex and age.

Methods

Study Population

The Jackson Heart Study (JHS) is a 12-year, population-based observational study of the etiology of cardiovascular disease in African American women and men in a tri-county area in central Mississippi [32]. A total of 5,301 African American adults aged 21–94 years were drawn from several different sources, including surviving participants from the Jackson, MS, site of the Atherosclerosis Risk in Communities Study. Recruitment details are described elsewhere [33, 34], and the cohort has been shown to be representative of the African American population, aged 35–84 years, living in the Jackson, MS, metropolitan area [34]. During the baseline exam (2000–2004), participants underwent clinical exams, provided blood samples and medical and health histories, and completed psychosocial assessments administered by trained African American interviewers.

Approximately 4 years later, 4,203 participants returned to the JHS visit 2 and underwent computed tomography (CT) scanning. According to standard protocols used in other epidemiologic studies [35], participants were unable to undergo the CT exam if they: (1) weighed more than 160 kg (~350 lbs), (2) were pregnant or pregnancy status was unknown

(in women), or (3) were <40 years for women and <35 years for men. Of the 2,884 participants who completed the CT scanning, a total of 493 were excluded for the following reasons: uninterpretable abdominal fat volumes (n = 17), incomplete discrimination (n = 146) and stress (n = 87) information, or an incomplete covariate profile (n = 243), leaving 2,391 participants (mean (range) age of 55.0±10.9 (30–90) years at the JHS baseline exam and 59.7±10.9 (35–96) years at JHS visit 2, 62.7% female) for analysis.

Visceral and Subcutaneous Abdominal Fat

Imaging of the abdomen was conducted in the supine position by multi-detector CT scanning (GE Healthcare Light-speed 16 Pro, Milwaukee, WI) and analyzed using Interactive Data Language software, version 6.3 (Research Systems, Inc., Boulder, CO). A series of continuous scout images through the lower abdomen from L3 to S1 assessed abdominal AT depots using the lumbosacral junction (centered at L4–L5) as an anatomic landmark [35]. Twenty-four slices, covering approximately 48 mm, were used in this study. The abdominal muscular wall was manually traced and the VAT and SAT volumes measured by a semiautomatic segmentation technique. Inter-reader (two readers) reproducibility was assessed on a subset of 60 randomly selected scans. The interclass correlations were 0.992 for VAT and 0.997 for SAT.

Dimensions of Discrimination

Participants completed the JHS discrimination instrument during the JHS baseline exam. Experiences of discrimination included general everyday and lifetime experiences. Embedded within these experiences of discrimination were the perceived causes of (attribution) and reactions to (coping strategies) these experiences. The psychometric properties of the full JHS discrimination instrument have been described elsewhere [29] and can be found at http://jhs.jsums.edu/jhsinfo/. A major strength of the JHS is the inclusion of multiple dimensions of discrimination.

Everyday Discrimination—The nine-item everyday discrimination scale assessed the participant's perception that (1) they were treated with less courtesy, (2) they were treated with less respect, (3) they received poor service at restaurants, (4) people acted as if they think they were not smart, (5) people acted as if they were afraid of them, (6) people acted as if they think they were dishonest, (7) people acted as if they were not as good, (8) they were called names or insulted, and (9) they were threatened or harassed in their day-to-day life. Responses ranged from "several times a day" to "never" and scored from 1 to 7, respectively. Scores were reverse-coded, rescaled to range from 0 to 6 (e.g., 1 = 6, 2 = 5, …, 7 = 0), and summed, with total scores ranging from 0 to 54. The Cronbach's alpha for this scale in the entire JHS cohort was 0.88.

Participants who reported any experience of everyday discrimination were asked to provide the main reason for this experience. Experiences attributed to race (racial discrimination) were distinguished from non-racial discrimination—those attributed to other social status factors (age, sex, physical appearance, and some other reason). Responses were combined with the general everyday discrimination score to create five categories: no reports of discrimination, low racial discrimination (below the median of the general everyday discrimination score), high racial discrimination (at or above the median), low non-racial discrimination, and high non-racial discrimination. Participants were also asked to provide the coping strategy most often used in response to discrimination; responses were trichotomized as active (speak up, try to change, work harder, and pray); passive (accept it, ignore it, keep it to yourself, avoid it, and forget it); and external/other (blame yourself, get violent, or other specified response).

Lifetime Discrimination—Major lifetime discriminatory events is a count of the number of major experiences of *unfair treatment* in nine domains, including at school or work, in getting a job, housing, resources (money), medical care or services, on the street or in public places, and other experiences that respondents had experienced over their life span. Similar to everyday discrimination, a follow-up question ascertained the main reason for this unfair treatment. Responses were combined to create similar categories (e.g., high racial discrimination, high non-racial discrimination). For each lifetime discrimination item endorsed, participants were asked about the occurrence of each type of coping strategy (e.g., speak up and try to change). Responses were "yes" and "no," coded as 1 and 0, respectively, and averaged in accord to the coping behavior categories (active, passive, and external/other). Lifetime coping behavior was defined as the category with the highest coping score. Participants were classified as having a mixed coping strategy if any of the scores were equal and highest amongst the coping category scores.

General Psychosocial Stress

Consistent with prior work [19, 22, 24], we included the major life events scale to determine whether psychosocial stress mediated the association between discrimination and abdominal fat. Participants were asked about the occurrence (yes/no) of major life events in the last 12 months across 11 domains, including death of close relatives/friends or job loss [36]. The count of the domains (0–11) for which an event occurred was the summary major life events score.

Body Mass Index

Body mass index (BMI, kilograms per square meter) was calculated from in-clinic measurements of standing weight and height using standardized procedures and participants wearing light weight clothing and without shoes and constricting garments.

Covariates

Age and self-reported socioeconomic status (SES), defined as educational attainment and annual household income, were considered as standard socio-demographic covariates. Menopausal status, hormone replacement therapy, and parity in women, correlates of VAT [37], were assessed using standard questionnaires. Postmenopausal status was present for women who had not experienced a menstrual period or bleeding within the last 2 years or a self-reported history of having reached menopause or the change of life. Hormone replacement therapy was defined as current use of estrogen alone or estrogen plus progestin. Parity was defined as the number of live births over a woman's lifetime. Risk factors for abdominal fat [9] include cigarette smoking status, physical activity, alcohol consumption, and dietary energy and fat intake, and were included in the analysis to examine the extent to which the associations between discrimination and abdominal fat persisted after adjustment for behavioral factors. Cigarette smoking status was classified as current, former, and never smoker. Physical activity information was collected on the intensity, frequency, and duration of activities associated with transportation to and from work, school, or running errands and engaging in moderate exercise during leisure time [38]. Alcohol consumption, in grams per day, was estimated from the frequency and portion size of beer, wine, and liquor ascertained from a well-validated 158-item food frequency questionnaire [39]. Daily energy intake and percentage of dietary fat was calculated from the contributions of each of food item contained in the food frequency questionnaire.

Statistical Analysis

VAT and SAT were normally distributed. Distributions of selected covariates across categories of reports of everyday and lifetime discrimination were examined by sex; P

values for trends across ordered categories were estimated by including everyday and lifetime categories as an ordinal variable in the model. Statistical interactions of sex and age with dimensions of discrimination (everyday and lifetime, attribution and coping) with respect to the abdominal fat outcomes were tested in multivariable-adjusted models. Although no heterogeneities were observed by sex (all *Ps*> 0.10), all analyses were stratified by sex because (a) prior work suggests associations of discrimination with abdominal obesity to be stronger in men than women [20], (b) African American men have been shown to have higher VAT, but lower SAT volumes [5], and report higher levels of discrimination [29] than African American women, and (c) because there is limited evidence of the effect of discrimination on abdominal fat in African American men. No statistical heterogeneities were observed by baseline age category (defined as <45, 45–54, 55–64, 65–74, and 75+, all *Ps*>0.10); therefore, all subsequent analyses were pooled and adjusted for baseline age (continuous). Independent associations between discrimination and VAT and SAT depots were estimated using linear regression models. Multivariable models were fit in sequence to examine the mediating or confounding effect of different covariates on the association of discrimination with abdominal fat: model 1 adjusted for age and menopausal/hormonal status and reproductive history (in women); model 2 added SES to model 1; models 3 and 4 additively adjusted for health behaviors and BMI, respectively; and, finally, model 5 additionally adjusted model 4 for major life events. SAS version 9.2 (SAS Institute Inc., Cary, NC) was used to perform all analyses.

Results

Men had higher VAT, but lower SAT, volumes than women (Table 1). Men reported greater everyday and lifetime discrimination and were more likely to attribute these experiences to racism than women. Compared with women, men also reported higher levels of active coping behaviors in response to lifetime discrimination than women. Other selected characteristics are displayed in Table 1. Among women and men, higher reports of everyday discrimination were associated with lower age, SES, and postmenopausal status and parity (in women) and greater current cigarette use (in men), physical activity (in women), daily energy intake and percentage of energy from fat, and reports of major life events (Table 2). Similar associations were observed for reports of lifetime discrimination (results not shown).

Experiences of Perceived Discrimination

Higher reports of everyday discrimination were associated with greater SAT, but not VAT, volumes in men only (Table 3). In models adjusted for age, SES, and behavioral factors, SAT increased by 6.1 (SE = 2.8)cm^3 for each unit increase in the everyday discrimination score. This association persisted, but was reduced, after adjustment for BMI (3.9±1.8, *P*<0.05) and major life events (3.6±1.8, *P*<0.05).

Attribution of Perceived Discrimination

Low reports of everyday non-racial discrimination were associated with lower VAT volumes (−85.1±43.4, *P*<0.05) in men after adjustment for age, SES, behavioral factors, and BMI (results not shown). This relationship remained after adjustment for major life events (−85.5±43.4, *P*< 0.05). An expanded table is provided in the Electronic Supplementary Material (ESM) Table 1.

Higher reports of lifetime non-racial discrimination were associated with greater VAT (71.6±32.0, *P*<0.05; Table 4) and SAT (212.6±83.6, *P*<0.05; Table 4) volumes among women in models adjusted for age and women's reproductive health. These relationship persisted after adjustment for SES (79.0±32.0 and 218.9±83.7, respectively, all *P*<0.05) and health behaviors (82.1±31.5 and 229.8±82.6, respectively, all *P*<0.01), but was attenuated

after controlling for BMI. Among men, a low report of lifetime non-racial discrimination was associated with greater SAT volumes (205.9±103.4, $P<0.05$) in age- and SES-adjusted models. This association was attenuated after adjustment for behavioral factors.

Coping Response to Discrimination

Among men, passive coping behaviors in response to lifetime discrimination were associated with greater VAT, but not SAT, volumes in age-adjusted models (78.5±32.0, $P<0.05$; Table 5). This relationship remained in fully adjusted models (60.6±28.0, $P<0.05$). An expanded table is provided in ESM Table 2.

Discussion

To our knowledge, this is the first study to comprehensively investigate multiple dimensions of discrimination (experiences of everyday and lifetime discrimination and the attribution of and coping strategy in response to these experiences of discrimination) with subtypes of abdominal fat in a large community-based cohort of middle-aged and elderly African American women and men. Higher reports of everyday discrimination were associated with a greater volume of SAT, but not VAT, independent of behavioral factors, overall adiposity, and other stress measures. No significant associations of experiences of everyday and lifetime discrimination with VAT or SAT were observed among women, suggesting that the effects of discrimination on abdominal fat may differ by sex and fat depot. Moreover, passive coping behaviors in response to lifetime discrimination were associated with higher VAT, but not SAT, volumes among men. Among women, higher reports of lifetime discrimination attributed to non-racial factors were associated with higher VAT and SAT volumes, although not independent of BMI. These findings indicate that the secondary dimensions of discrimination over the life span (attribution and coping strategies) may be a better correlate of discrimination than the systemic experiences of everyday and lifetime discrimination, especially among women, and that this association is not independent of overall adiposity.

In the present study, we observed that experiences of everyday discrimination were associated with SAT, but not VAT, in men and not women. A recent cross-sectional study found that greater reports of everyday discrimination may be linked to higher VAT, but not SAT, among African American and white women [24]. Lewis et al. [24], however, only considered a limited sample ($n = 182$) of African American women with a restricted age range (42–61 years). These mixed results may be due to differences in the measures of everyday discrimination. In the Study of Women Across the Nation Heart Study, participants were asked to indicate how often they experienced various forms of day-to-day mistreatment over the previous 12 months, whereas in the JHS, participants were not given a reference time frame. In addition, the measures of everyday discrimination in the Study of Women Across the Nation Heart Study have been shown to remain consistent over time. Therefore, chronic exposure to discrimination over the past 12 months could be linked to abdominal fat that took a year to accumulate. Further investigations with longitudinal designs are warranted to fully elucidate the effects of discrimination on the accumulation of abdominal fat over the life span and the sex differentials in these associations.

We found no clear evidence that experiences of everyday discrimination were linked to VAT or SAT in our large population-based sample of African American adults. Prior studies linking everyday discrimination to abdominal adiposity have not always been consistent [19–24], perhaps in part because of the differences in the ages of the samples, limited sample sizes of African Americans, and the exclusion of African American men. We assessed the effect of reports of perceived everyday discrimination and attribution of and the main coping behavior in response to everyday discrimination and found similar null results

for the different dimensions (except for reports of everyday discrimination in men). First, VAT has been shown to increase during the menopause transition due to decreased energy expenditure and declining estrogen levels [37]. In addition, there is some empirical evidence which suggests that experiences of discrimination decrease with increasing age and that African American men report higher levels of discrimination than African American women in the JHS cohort [29]. Additional work is needed to understand the comprehensive dynamics of discrimination on region-specific abdominal fat depots in African Americans over time.

The present data extend the literature by providing the first population-based evidence that secondary dimensions of lifetime discrimination may be linked with higher VAT and SAT (in women) volumes in African American adults. The finding for increased reports of lifetime discrimination attributed to non-racial factors in African American women is notable because other data suggest increasing trends in weight-based discrimination with rates that are almost equal to rates of race- and age-based discrimination [40]. Excluding participants who attributed everyday and major lifetime discriminatory events to physical appearance (i.e., height or weight) did not materially change any of the observed associations (results not shown). Moreover, the proportion of participants who reported weight/height discrimination was small (rates ranging from 0.6% to 2.5%), and no significant effect of modification of BMI on the association between discrimination and abdominal fat was observed (all $P>0.10$) in the present study. Although there is limited evidence on the attribution of experiences over the life course, it is plausible that the increasing prevalence of weight discrimination (which is similar to rates of racism and age discrimination) [40] may be especially relevant in the USA. However, we did not find the hypothesized association of non-racial discrimination in African American men. It is plausible that the large number of African American men who attribute their experiences to racism may have made it difficult to detect associations of other attributes with VAT and SAT.

The finding for passive coping responses among African American men extends the results from a prior cross-sectional study that provided data suggesting that high passive emotional responses to discrimination may be associated with a higher waist/hip ratio [22]. Results from prospective studies have demonstrated that positive coping behaviors, including reductions in problem-focused disengagement behavior, are associated with weight loss [41]. Moreover, ‘confrontive’ coping has been shown to be associated with lower weight [42]. The lack of a significant association among African American women (and the lower mean differences for women with a mixed coping behavior; see ESM Table 2) suggests that African American women in this cohort may engage in a variety of coping mechanisms that reflect differential psychosocial consequences of discrimination than African American men. Future analyses examining changes in abdominal fat over time may shed light on these important questions and provide a better understanding of how experiences of discrimination “gets under the skin.”

We have no clear explanation for the observed sex differences with VAT and SAT. In this cohort, women have been shown to have higher SAT volumes [5] and to report higher levels of other chronic and acute psychosocial stressors [43] than men. Cortisol is a biomarker produced in response to chronic exposure to stress, and prior work has shown that, unlike with VAT, cortisol is released from SAT by 11β-hydroxysteroid dehydrogenase type 1—and this enzyme has been linked to increased adiposity [44]—and provides a plausible explanation for the higher SAT volumes in women in this cohort. The release of cortisol in response to psychological stressors such as discrimination, therefore, may contribute to the accumulation of SAT, rather than VAT, in women. Current data from the JHS cohort highlighting differential associations of obesity-related adipokines such as leptin and

adiponectin with VAT and SAT compartments may help further clarify these differences [45].

Strengths and Limitations

It is worth noting the strengths of our study. This is the first study to examine the association of multiple dimensions of discrimination with radiographically assessed AT depots in a population-based sample of African American women and men. Moreover, we examined quantified volumes of VAT and SAT via a highly reproducible technique, rather than thickness, or crude measures of abdominal fat. The statistical power provided by the use of a large population-based sample of women and men allowed us to examine heterogeneities by sex and age. Another important strength is the detailed covariate data which allowed us to adjust for a number of potential confounders. Similar to other studies, we adjusted for other traditional measures of stress [19, 22, 24] to determine whether experiences of discrimination were associated with abdominal fat above and beyond other psychosocial stressors. Given the lines of evidence linking depression to racism [46] and to abdominal fat [47], we examined whether depressive symptoms (assessed using the Centers for Epidemiologic Studies Depression Scale [48]) mediated the independent association of discrimination with abdominal fat in a second set of analyses (n = 1,460). The additional adjustment for depressive symptoms attenuated the associations between discrimination and abdominal reported among men (results not shown). This suggests that future studies must comprehensively measure stress in order to fully understand how multiple psychosocial factors interact to impact adiposity. In addition, future work should investigate the moderating effect of psychosocial factors such as social support and religion/spirituality that have been shown to confer to better psychological and cardiovascular health.

The design of this study was cross-sectional, so the results should be reviewed with caution. Second, the current study is specific to African Americans in the southeastern USA; therefore, the findings observed in the current study may not be generalizable to other ethnic, less obese, or other geographically placed populations. We have no a priori knowledge, however, to believe that the associations between discrimination and visceral obesity are not generaliz-able to other African American populations as previous studies have generally reported similar results [19–24]. Third, the discrimination measures and abdominal AT volumes were measured at different time periods. The exposure and covariate data, however, were assessed simultaneously and regressed on outcomes measured approximately 4 years later. This methodological approach has been used in a number of recent studies from the JHS and Framingham Heart Study [5, 6, 10].

Discrimination has been linked to cardiovascular risk in African Americans [13–18]. In the current study, we found that several dimensions of lifetime discrimination, especially attribution and coping strategies, are generally associated with higher VAT and SAT volumes in African American women and men. However, since most of these associations were attenuated by BMI or other psychological confounds, they do not fully support the independent hypothesis of discrimination and abdominal fat and suggest that these dimensions of discrimination may be mechanistically linked to the nature of AT deposition, generation or metabolic activity through cumulative exposure to psychological stressors in this population. The importance of discrimination in the accumulation of abdominal fat in African Americans deserves additional scrutiny in studies involving longitudinal designs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Selected cohort characteristics by sex: Jackson Heart Study, Jackson, MS

Characteristics	Women (*N* = 1,499)	Men (*N* = 892)	*P* value
Visceral adipose tissue (cm^3)	801.9±362.2	884.7±412.1	<0.001
Subcutaneous adipose tissue (cm^3)	2,628.5±941.0	1,722.8±805.6	<0.001
Everyday discrimination[a]	9.3±8.5	11.1±9.6	<0.001
Attribution of discrimination (%)			<0.001
Age	11.1	9.0	
Gender	8.3	3.3	
Race	38.5	51.1	
Height or weight	2.5	1.9	
Other	23.9	22.2	
Coping response to discrimination (%)			0.050
Active	56.1	55.6	
Passive	25.5	29.6	
Other	2.7	2.2	
Lifetime discrimination[b]	3.0±2.1	3.5±2.2	<0.001
Attribution of discrimination (%)			<0.001
Age	4.5	3.9	
Gender	7.4	2.5	
Race	50.5	64.7	
Height or weight	1.7	0.6	
Other	22.6	16.0	
Coping response to discrimination (%)			<0.001
Active	45.8	50.7	
Passive	27.6	26.2	
Mixed	2.0	2.6	
Other	11.1	8.2	
Age (years)	55.7±10.8	53.8±10.9	<0.001
Education (%)			0.093
<High school diploma	12.6	15.6	
High school diploma/GED	21.0	17.8	
Some college	28.6	28.3	
Bachelor degree and above	37.9	38.3	
Annual household income (%)			<0.001
<US $25,000	30.4	17.6	
US $25,000–49,999	26.6	19.8	
US $50,000 and above	27.5	47.9	
Unknown	15.5	14.7	
Postmenopausal status (%)	73.1	–	
Hormone replacement therapy (%)	25.6	–	
Parity	3.1±2.0	–	

Characteristics	Women (*N* = 1,499)	Men (*N* = 892)	*P* value
Cigarette smoking status (%)			<0.001
Current smoker	8.2	14.4	
Former smoker	15.7	26.1	
Never smoker	76.1	59.5	
Alcohol consumption, grams/day	1.4±5.9	8.8±28.3	<0.001
Physical activity score	2.1±0.8	2.2±0.8	0.225
Energy (kcal/day)	1,902.5±952.9	2,410.3±1,278.2	<0.001
Total fat (% energy)	35.5±7.1	35.5±6.4	0.930
Body mass index (kg/m^2)	32.3±6.8	29.4±5.0	<0.001
Major life events	1.4±1.2	1.2±1.2	0.001

Data are means±SD for continuous variables and percents for categorical variables

[a] Data contain participants with no reports of everyday discrimination: women, 15.7%; men, 12.6%

[b] Data contain participants with no reports of lifetime discrimination: women, 13.4%; men, 12.3%

Table 2

Sex-specific baseline characteristics across quartiles of everyday and lifetime discrimination by sex: Jackson Heart Study, Jackson, MS

Characteristics	Experiences of everyday discrimination				*p* for trend
	Quartile 1	Quartile 2	Quartile 3	Quartile 4	
Women	(0–2), *n* = 352	(3–7), *n* = 431	(8–13), *n* = 327	(14–47), *n* = 389	
Age (years)	58.5±11.1	56.2±10.2	55.0±10.9	53.1±10.5	<0.001
Less than high school diploma (%)	19.9	10.7	10.4	10.0	<0.001
Household annual income <25,000 (%)	38.9	30.9	23.9	27.5	<0.001
Postmenopausal status (%)	77.8	73.3	72.8	68.6	0.007
Hormone replacement therapy (%)	22.2	23.9	32.4	24.7	0.142
Parity	3.5±2.2	3.0±1.9	2.8±1.8	3.0±1.9	<0.001
Current smoker (%)	6.3	8.4	8.3	9.8	0.104
Alcohol consumption (g/day)	1.1±5.2	1.2±5.3	1.2±4.1	1.9±8.0	0.074
Physical activity score	2.0±0.8	2.1±0.8	2.2±0.8	2.2±0.7	<0.001
Energy (kcal/day)	1,777.1±808.8	1,782.2±811.6	1,971.5±1,155.2	2,091.3±996.2	<0.001
Total fat (% energy)	34.6±6.8	35.2±7.3	35.5±7.0	36.5±6.9	<0.001
Body mass index (kg/m^2)	32.0±6.3	32.6±7.0	31.6±6.5	32.7±7.3	0.449
Major life events	1.2±1.2	1.3±1.1	1.5±1.2	1.6±1.3	<0.001
Men	(0–3), *n* = 206	(4–8), *n* = 215	(9–15), *n* = 234	(16–53), *n* = 237	
Age (years)	57.8±11.1	53.9±11.2	52.9±10.7	51.1±9.7	<0.001
Less than high school diploma (%)	28.6	13.5	6.4	15.2	<0.001
Household annual income <25,000 (%)	21.4	17.2	12.4	19.8	0.460
Current smoker (%)	13.1	8.8	14.1	20.7	0.006
Alcohol consumption (g/day)	8.4±27.4	6.6±27.4	10.6±33.7	9.4±23.9	0.416
Physical activity score	2.1±0.8	2.1±0.8	2.3±0.8	2.1±0.8	0.216
Energy (kcal/day)	2,218.2±1,036.5	2,318.7±1,116.3	2,441.0±1,220.1	2,630.2±1,595.8	<0.001
Total fat (% energy)	34.6±6.4	35.9±6.3	35.1±6.4	36.3±6.4	0.022
Body mass index (kg/m^2)	29.0±4.7	29.6±5.1	29.3±4.8	29.7±5.3	0.300
Major life events	1.1±1.1	1.2±1.2	1.2±1.0	1.5±1.3	0.001

Data are means±SD for continuous variables and percents for categorical variables

Table 3

Sex-specific mean differences in VAT and SAT adipose tissue volumes per unit increase in everyday and lifetime discrimination by sex: Jackson Heart Study, Jackson, MS

	VAT (cm^3)		SAT (cm^3)	
	Women	**Men**	**Women**	**Men**
Everyday discrimination				
Model 1	0.0±1.1	2.0±1.4	3.2±2.8	5.4±2.8 †
Model 2	−0.1±1.1	2.0±1.4	2.9±2.8	5.4±2.8 †
Model 3	−0.1±1.1	1.9±1.4	3.5±2.8	6.1±2.8 *
Model 4	−0.9±0.9	1.1±1.2	0.2±1.9	3.9±1.8 *
Model 5	−1.0±1.0	1.1±1.3	0.5±1.9	3.6±1.8 *
Lifetime discrimination				
Model 1	1.2±4.5	3.3±6.1	14.7±11.7	14.7±12.1
Model 2	3.1±4.5	4.1±6.1	17.6±11.7	14.2±12.2
Model 3	5.0±4.4	4.2±6.2	22.5±11.6 †	13.4±12.2
Model 4	−0.9±3.9	2.4±5.3	−1.5±7.7	8.0±7.7
Model 5	−1.0±4.0	1.9±5.5	0.2±7.8	6.2±8.0

Model 1 adjusts for age and menopausal/hormonal status and reproductive history (in women). Model 2 adds educational attainment and annual household income to model 1. Model 3 adjusts for variables in model 2 and for cigarette smoking status, alcohol consumption, physical activity, energy, and percent energy from total fat. Model 4 adjusts for variables in model 3 and for body mass index. Model 5 adds major life events

† $p<0.10$;

* $p<0.05$;

** $p<0.01$;

*** $p<0.001$

Table 4

Sex-specific mean differences in VAT and SAT adipose tissue volumes by categories of lifetime discrimination attributed to racial and non-racial factors and by sex: Jackson Heart Study, Jackson, MS

		Acute lifetime discrimination				
		Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Visceral adipose tissue (cm^3)						
Women	Racial/Low	−7.1±34.0	−1.9±34.0	2.6±33.4	14.1±29.3	14.2±29.3
	Racial/High	26.8±29.7	36.7±29.8	43.4±29.3	13.7±25.7	14.0±25.8
	Non-racial/Low	36.1±34.7	33.7±34.6	35.5±34.0	10.8±29.8	10.9±29.8
	Non-racial/High	71.6±32.0 *	79.0±332.0 *	82.1±31.5 **	31.8±27.7	32.2±27.9
Men	Racial/Low	9.0±51.8	10.4±51.8	6.9±51.8	−18.9±44.9	−19.9±44.9
	Racial/High	31.7±42.8	36.2±43.2	36.8±43.4	21.8±37.6	19.6±38.1
	Non-racial/Low	−26.4±60.8	−22.8±60.7	−14.3±60.5	−25.6±52.4	−26.1±52.5
	Non-racial/High	−29.4±52.0	−23.1±52.0	−24.6±52.0	−22.2±45.1	−24.7±45.7
Subcutaneous adipose tissue (cm^3)						
Women	Racial/Low	−54.6±88.8	−40.7±88.8	−34.0±87.5	12.9±57.7	15.4±57.7
	Racial/High	74.2±77.5	94.0±77.8	113.0±76.8	−8.7±50.7	−3.0±50.9
	Non−racial/Low	83.0±90.7	77.2±90.5	86.5±89.2	−14.7±58.9	−12.3±58.9
	Non-racial/High	212.6±83.6 *	218.9±83.7 **	229.8±82.6 **	23.9±54.6	32.6±55.1
Men	Racial/Low	206.9±103.2 *	205.9±103.4 *	199.1±102.7 †	120.0±65.0 †	116.1±65.1 †
	Racial/High	140.7±85.3 †	138.2±86.1	131.2±86.0	85.1±54.4	76.3±55.2
	Non-racial/Low	162.5±121.1	160.9±121.1	171.1±120.1	136.4±76.0	134.4±75.9 †
	Non-racial/High	100.0±103.5	97.0±103.7	98.2±103.2	105.8±65.3	95.6±66.1

Model 1 adjusts for age and menopausal/hormonal status and reproductive history (in women). Model 2 adds educational attainment and annual household income to model 1. Model 3 adjusts for variables in model 2 and for cigarette smoking status, alcohol consumption, physical activity, energy, and percent energy from total fat. Model 4 adjusts for variables in model 3 and for body mass index. Model 5 adds major life events

Referent groups: No reports of everyday or lifetime discrimination

† $p<0.10$;

* $p<0.05$;

** $p<0.01$;

*** $p<0.001$

Table 5

Sex-specific mean differences in VAT and SAT adipose tissue volumes by categories of coping behaviors in response to lifetime discrimination by sex (n = 2,080): Jackson Heart Study, Jackson, MS

		Model 1	Model 2	Model 3	Model 4	Model 5
Visceral adipose tissue (cm^3)						
Men	Passive coping	78.5±32.0 *	76.5±32.2 *	74.5±32.1 *	59.8±28.0 *	60.6±28.0 *
	Mixed coping	77.7±50.0	78.2±49.8	79.0±49.6	63.2±43.2	62.6±43.2
	Other coping	38.0±84.7	41.4±84.6	30.9±84.4	72.6±73.6	73.0±73.5
Subcutaneous adipose tissue (cm^3)						
Men	Passive coping	62.3±64.2	59.1±64.8	51.5±64.5	5.2±41.0	7.6±41.0
	Mixed coping	−69.9±100.3	−69.8±100.3	−66.0±99.6	−116.0±63.2	−117.7±63.2 †
	Other coping	−147.0±170.0	−150.1±170.3	−136.9±170.5	−5.3±107.7	−4.3±107.6

Model 1 adjusts for age and menopausal/hormonal status and reproductive history (in women). Model 2 adds educational attainment and annual household income to model 1. Model 3 adjusts for variables in model 2 and for cigarette smoking status, alcohol consumption, physical activity, energy, and percent energy from total fat. Model 4 adjusts for variables in model 3 and for body mass index. Model 5 adds major life events

Reference group: Since passive coping responses have been shown to be associated with a higher risk of adiposity in prior work [21], participants who responded with an active coping behavior served as the referent group

Women: n = 1,298; men: n = 782

† p<0.10;

* p<0.05;

** p<0.01;

*** p<0.001