Are Religiosity and Spirituality Associated with Obesity Among African Americans in the Southeastern United States (the Jackson Heart Study)?

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Abstract

There are several lines of evidence that suggest religiosity and spirituality are protective factors for both physical and mental health, but the association with obesity is less clear. This study examined the associations between dimensions of religiosity and spirituality (religious attendance, daily spirituality, and private prayer), health behaviors and weight among African Americans in central Mississippi. Jackson Heart Study participants with complete data on religious attendance, private prayer, daily spirituality, caloric intake, physical activity, depression, and social support ($n =$ 2,378) were included. Height, weight, and waist circumference were measured. We observed no significant association between religiosity, spirituality and weight. The relationship between religiosity/spirituality and obesity was not moderated by demographic variables, psychosocial variables, or health behaviors. However, greater religiosity and spirituality were related to lower energy intake, less alcohol use and less likelihood of lifetime smoking. Although religious participation and spirituality were not cross-sectionally related to weight among African Americans, religiosity and spirituality might promote certain health behaviors. The association between religion and spirituality and weight gain deserves further investigation in studies with a longitudinal study design.

Keywords

Religiosity; Spirituality; Body Weight; Obesity; African Americans

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Introduction

Much research supports religiosity and spirituality as protective factors for both physical and mental health, and postulated mechanisms for this relationship include healthier lifestyles, greater social support, and improved psychological and biochemical factors (e.g., Ellison & Levin, 1998; Koenig, 1999, 2001; Koenig et al., 1999; Larson et al., 1992; Roff, Klemmack, Parker, Sawyer-Baker, & Allman, 2005; Strawbridge, Cohen, Sherma, & Kaplan, 1997). The association between religiosity/spirituality and obesity is less clear. On one hand, religiosity and spirituality have been associated with improved health outcomes, which might suggest that religiosity would reduce the incidence of obesity. Involvement in religious groups with religious doctrines of healthy living may be associated with lower rates of obesity through the promotion of health behaviors such as decreased alcohol intake and increased physical activity (Kim, Sobal & Wethington, 2003; Strawbridge et al., 1997). Healthy coping behaviors and stress reduction practices afforded through religious involvement may also help reduce obesity risk. On the other hand, reduced rates of smoking among religious attendees might inadvertently lead to higher obesity rates as, for example, smoking has been shown to be an appetite suppressant (Jo, Talmage & Role, 2002) and smokers tend to weigh less than non-smokers (Cline & Ferraro, 2006).

Associations between religiosity, spirituality, and obesity are particularly important to understand among African Americans, for whom religion, spirituality, and fellowship in church communities have been viewed as particularly salient (Carter, 2002). In the United States, African Americans have higher rates of obesity and associated comorbidities than other ethnic groups (Cossrow & Falkner, 2004). Cultural patterns that include community fellowship surrounding eating and reported tendencies to eat foods high in fat (Airhihenbuwa, Kumanyika, Agurs, Lowe, Saunders, & Morssink, 1996) may contribute to increased rates of obesity in African Americans, but the current findings are inconsistent. Some religious social settings may encourage less healthy eating and lead to weight gain for African Americans, but these potential relationships are poorly understood. A few studies have observed religious attendance to be associated with increased body weight (Feinstein, Liu, Ning, Fitchett, &Lloyd-Jones, 2010; Ferraro, 1998; Lapane et al., 1997), and some studies indicate that religiosity is associated with increased body weight for certain groups (e.g., African American women) but not others (Bruce, Sims, Miller, Elliott, & Ladipo, 2007). Two studies observed no association between religiosity and obesity (Ellis and Biglione, 2000; Roff et al., 2005). Other lines of evidence suggest that the association between religion/spirituality and obesity is mediated by smoking status (e.g., Kim et al., 2003). Although some of these studies have included African Americans, most have not focused on African American populations.

Feinstein and colleagues (2010) recently investigated the associations between religiosity, spirituality, and obesity in the Multi-Ethnic Study of Atherosclerosis (MESA) cohort, a large, ethnically diverse sample of adults. Participants with higher religious attendance, private prayer, and daily spirituality were more likely to be obese and less likely to smoke than their less religious counterparts, even after controlling for smoking status and other potential confounders. Feinstein et al. (2010), however, did not investigate race as a potential moderating factor, and thus it is possible that relationships between religiosity/spirituality

and obesity differ for African Americans versus other ethnic groups. More research is needed to clarify associations between religiosity/spirituality and obesity among African Americans, particularly in geographic areas where religious communities may be even more salient (e.g., the southeastern United States).

We examined the association between multiple dimensions of religiosity and spirituality with weight among a large sample of African Americans, subgroup differences, and potential mechanisms. In order to elucidate possible mechanisms, we planned to examine whether demographic characteristics, health behaviors, or psychosocial variables mediated any of the observed associations between religiosity/spirituality and obesity.

Method

Study Population

The Jackson Heart Study (JHS) is a longitudinal population-based observational cohort study designed to prospectively investigate novel determinants of cardiovascular disease in African Americans (Taylor et al., 2005). A total of 5,301 ambulatory African American men and women (63.4% female, age range 21 to 94 years, mean age 55) in the Jackson, MS metropolitan statistical area (MSA; Hinds, Madison, Rankin Counties) were recruited between September 2000 and March 2004. Approximately 31% of the cohort were participants from the Jackson, MS site of the Atherosclerosis Risk in Communities (ARIC) Study. Others were randomly selected residents and volunteers who matched defined demographic cells in proportions designed to mirror those in the overall African American population in the Jackson MSA. The final portion of the cohort consisted of family members. Full details of the recruitment protocol are described elsewhere (Fuqua et al., 2005). Interviews and clinical examinations were conducted by trained research staff. The JHS was approved by the Institutional Review Boards of Jackson State University, Tougaloo College and the University of Mississippi Medical Center, and participants gave written informed consent.

Weight Measures

Body mass index (BMI) and waist circumference (WC) were used as markers of obesity. Standing height and weight were measured in light clothing and without shoes in accordance to standard protocols. BMI was defined as weight (kg) divided by height squared (m^2). WC was measured at the umbilicus and without constricting garments using an anthropometric tape and rounded to the nearest centimeter.

BMI weight status was defined as follows: normal weight: BMI 18.5–24.9 kg/m^2; overweight: BMI 25–29.9 kg/m^2; obesity: BMI 30–39.9 kg/m^2; morbid obesity: BMI 40 kg/m^2. Abdominal obesity was defined as WC > 88cm for women and >102 cm for men.

Religiosity and Spirituality

Dimensions of religiosity and spirituality included organized religious activity, private prayer, and daily spiritual experiences. Organized religious activity was defined as church attendance or involvement in other forms of organized religion such as watching services on

TV or participating in Bible study groups. Participants indicated the frequency of these activities as not at all, less than once a year, a few times a year, a few times a month, at least once a week, or nearly every day. These responses were coded from 1 to 6, respectively, with higher scores indicating more frequent attendance. Private religious experience was assessed as reported frequency of prayer or meditation outside of formal religious activity (rated as never, less than once a month, once a month, a few times a month, once a week, a few times a week, once a day, or more than once a day). This item was coded from 1 to 8, respectively, with higher scores indicating more frequent private prayer. The Daily Spiritual Experiences Scale (DSES; Underwood & Teresi, 2002) assessed daily spiritual experiences in six domains, including feeling God's presence, feeling God's love, and being spiritually touched by creation and has been shown to have good psychometric properties in the JHS (Loustalot, Wyatt, Boss, & McDyess, 2006). Participants were asked to rate the frequency of these experiences from "never" to "many times a day," coded as 1 to 5, respectively, and summed. The DSES score ranged from 5 to 30 with higher scores indicating higher spirituality. Of the JHS participants who completed the baseline examination, 3,968 had complete religiosity and spirituality information. The Cronbach's alpha for the DSES in this sample was .83.

Demographic Variables

Education was measured as the highest level of schooling completed and classified into six categories: less than high school; high school diploma or Graduate Equivalency Degree; vocational training or some college; Associate's degree; Bachelor's degree; and post-graduate degree. Income was self-reported into 11 categories ranging from under $5000 to $100,000 or more and categorized into four categories based on the poverty level for the appropriate family size as defined by the concurrent US Census year of the JHS participant's clinic exam. Low income was defined as a total household income to family size ratio below the poverty level. The middle income categories were separated into lower-middle and upper-middle, respectively, as a ratio of 2.5 times the poverty level. High income was defined as a per capita income ratio of more than four times the poverty level threshold.

Health Behavior Variables

Dietary Intake—Dietary information was ascertained using the 158-item Delta Nutrition Intervention Research Initiative Food Frequency Questionnaire (FFQ; Tucker et al, 2005). This FFQ was adapted from a longer, 283-item FFQ developed (Carithers et al., 2005) and validated (Carithers et al., 2009; Talegawkar et al., 2008) for use in adults living in the Mississippi area. Daily energy intake and percentage of dietary fat were calculated from contributions of each of the 158 food items in the FFQ.

Physical Activity—Trained JHS interviewers asked participants standard physical activity (PA) questions using the JHS Physical Activity Cohort Survey (PAC) (Dubbert et al, 2005). The JHS PAC consists of 30 items regarding PA in four different domains: active living; work; sports; and home and family life, with domain-specific values ranging from 1 to 5, and has been validated against accelerometer and pedometer data (Smitherman et al., 2009). A total PA score was calculated as the sum of the four individual index scores with higher scores indicating more activity (range 4 –20).

Smoking Status—Current cigarette smoking was defined as a positive response to "Have you smoked more than 400 cigarettes in your lifetime?" and "Do you now smoke cigarettes?" Former cigarette smoking was defined as a positive response to the first question and a negative response to the latter question.

Alcohol Intake—Alcohol intake was assessed with standard questions used in the ARIC Study and the Third National Health and Nutritional Examination Survey (NHANES-3; National Health and Nutrition Examination Survey, 1994); participants were classified as lifetime abstainers, ever users, and users during the last twelve months.

Psychosocial Variables

Social Support—A modified 16-item Interpersonal Support Evaluation List (ISEL; Cohen and Hoberman, 1983) scale was used to measure functional aspects of positive social support. The ISEL assesses perceived availability of four different types of social support: tangible (material resources), belonging (people to socialize with), self-esteem (positive social comparisons), and appraisal (people to discuss problems/difficulties with). Adequate psychometric properties of this modified scale have been demonstrated previously in the JHS (Payne et al., 2005). The Cronbach's alpha for this scale in the entire JHS cohort was .83.

Depression—Frequency of depressive symptoms during the preceding week was measured using the 20-item Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). The CES-D was developed for use in large epidemiologic studies and has been shown to have excellent psychometric properties, including in African American samples (Radloff, 1977; Naughton & Shumaker, 2003). Individual items were scored from 0 to 3 (depending on the item) and the total depressive symptoms scale ranged from 0 to 60. The Cronbach's alpha for the CES-D for the entire JHS cohort was .82.

Statistical Analysis

Only participants with complete information on religious attendance, private prayer and daily spirituality measures; health behaviors (daily energy intake, physical activity, smoking status, and alcohol intake), and psychosocial measures (depression and social support) were included in the current study. Of the 3,968 participants with complete religiosity and spirituality measures, a total of 1590 were excluded (missing health behavior information: n = 340, missing psychosocial measures: n = 1250), leaving 2,378 participants for analysis.

Sample characteristics were compared by sex and across categories of religiosity and spirituality using proportions and Chi-square tests for categorical variables and means (SD) and t-tests for continuous variables. The statistical significance of linear trends across religiosity and spirituality categories were assessed by including these variables as ordinal covariates (i.e., coded as 1–4) in unadjusted regression models.

The independent association between religiosity/spirituality and obesity was assessed using hierarchical multivariable linear regression. BMI and WC were entered as continuous dependent variables in order to examine relationships between religiosity and the full

continuum of body weight. Models were built in stages: religiosity/spirituality (in separate models), age and sex were entered on Step 1, and education level and income status were entered on Step 2. Health behaviors (smoking status, physical activity, caloric intake, percent of calories from fat, alcohol use) were entered on Step 3. Psychosocial factors (social support and depression) were entered on Step 4.

Next, we examined whether demographic characteristics, health behaviors, or psychosocial variables moderated the association between religiosity/spirituality and obesity using a series of sequential hierarchical multivariable linear/logistic regression models. The test of moderation examines whether one variable (the "moderator") affects the direction and/or strength of the relationship between the independent variable (religiosity/spirituality) and the dependent variable (obesity; Baron & Kenny, 1986). In Step 1, age, gender, education, income, and smoking status were entered. Religious attendance, private prayer, daily spirituality, and the moderator to be tested were entered in Step 2. Interaction terms to test for interactions between each of the three religiosity/spirituality variables and each potential moderator were entered in Step 3.

Finally, we examined whether any of the demographic characteristics, health behaviors or psychosocial variables mediated any of the observed associations between religiosity/ spirituality and obesity.

Due to the large number of analyses, the alpha level for significance was set at 0.001 for all analyses. All statistical analyses were performed with PASW Statistics 18. In all regression analyses, data were examined for adherence to assumptions of normality and homoscedasticity, and outliers greater than 3.3 standard deviations from their predicted mean were removed, as suggested by Tabachnick and Fidell (2007).

Results

The 2,387 participants included in these analyses did not differ substantially on obesity measures from the other JHS participants but had reported more involvement in religious activities and private spirituality ($ps < .001$, Table 1). In addition, participants included in these analyses were more likely to be female, report lower SES, engage in less physical activity and report lower social support than the rest of the JHS cohort ($ps < .001$, Table 1). As shown in Table 1, the majority of these differences were quite small and would not be considered clinically significant.

Our analytic sample consisted of 811 men and 1,567 women, with a mean age of 53.6 years. Compared to women, men were less obese, but had higher WC, reported lower religious attendance, private prayer, and daily spirituality ($ps < .001$, Table 2).

Participants with more frequent organized religious activity tended to be older, were more likely to be female, and reported consuming fewer calories, less alcohol use, less smoking, lower depressive symptoms, and higher social support (Table 3). Similar trends were observed across categories of private prayer (Table 4) and daily spirituality (data not shown). In unadjusted analyses, there were trends for individuals who attend religious services a few times per year or less to have higher WCs than those who attend a few times per month (p

= .02; Table 3), and for participants who report praying more than once per day to have higher BMI's than those who pray once per day ($p = .03$; Table 4).

In hierarchical regression analyses, organized religious activity, private prayer, and daily spiritual experiences were not associated with BMI or WC (Table 5). To test for possible non-linear relationships between religiosity/spirituality, analyses were repeated using analyses of covariance (ANCOVAs) in which independent variables were categorical religiosity and spirituality variables (each in quartiles as in Tables 3 and 4), dependent variables were BMI and WC, and covariates were age, sex, education, and income. Similarly, these categorical analyses indicated no significant associations between religiosity/spirituality and obesity. Because separate models of religious attendance, private prayer, and daily spirituality revealed identical results, the combined model is shown in Table 5.

There was no evidence of moderation by demographic characteristics, health behaviors, or psychosocial variables on the association between religiosity/spirituality variables and obesity (Table 5). Since no significant associations were observed between religiosity, spirituality, and obesity, mediational analyses were not conducted.

Discussion

This study examined whether multiple dimensions of religiosity and spirituality were associated with obesity in a large cohort of African Americans in the southeastern US. Although some studies have included African Americans, few were exclusively African American. Our findings suggest that religiosity and spirituality are not reliably related to obesity indicators in this population. The association between religiosity and spirituality variables and obesity also did not appear to be moderated by demographics, psychosocial variables, or health behaviors. We did find positive associations between religiosity, spirituality, and health behaviors: participants who reported praying more often did report consuming fewer calories per day; attendance, prayer, and daily spiritual experiences were each related to less likelihood of self-reported alcohol use in the past year; and participants who attended church more often were less likely to report a lifetime history of smoking. Religious attendance, private prayer, and daily spirituality were also each related to several indices of improved psychosocial functioning (e.g., lower depression, higher social support).

Our results were consistent with studies that have indicated no relationship between religiosity, spirituality, and body weight (Ellis & Biglione, 2000; Gillum, 2006; Roff et al., 2005). Notably, the study by Roff et al. utilized a sample in the southeastern United States, as in the present study. Our results confirm Roff et al.'s findings that although religiosity and spirituality may be related to some health behaviors, they are not related to body weight per se. The present study extends these results to a large African American sample in the southeastern United States, as Roff and colleagues' sample included African Americans and Caucasians. Our sample also allows examination of intraracial differences.

In contrast to some previous studies that have suggested that religion and spirituality may increase risk of overweight or obesity (Feinstein et al., 2010; Ferraro, 1998; Lapane et al.,

1997), our findings suggest that this is not the case in the current sample. Why this might be the case is unclear. One possibility is that the positive relationships between religion and body weight found in large multiethnic samples (e.g., Feinstein et al., 2010) do not apply to African Americans. Our discrepant results could also be explained by differences in demographics other than race. For example, in Feinstein and colleagues' study using MESA data, the sample tended to be older and less predominantly female (mean age = 63; 52% female) than the present sample (mean age = 54; 66% female). However, neither age nor sex emerged as moderating factors in our study.

One alternative explanation is that a relationship between religiosity, spirituality, and body weight did not emerge because of a restricted range of religiosity and body weight. The majority of our participants reported high levels of religious attendance, prayer, and daily spirituality, and also tended to have higher BMI's. These characteristics are quite common among African Americans in Mississippi, and thus our sample appears representative of our target population. Indeed, Feinstein et al. (2010) noted that African Americans tend to report higher levels of religiosity and spirituality than other ethnic groups. The lack of a relationship between religiosity, spirituality, and body weight could be due to a restricted range of both of these variables in the current sample. Despite the lack of relationship between religiosity variables and body weight, associations did emerge between religiosity/ spirituality and health behaviors (i.e., self-reported caloric intake, alcohol use, and smoking).

Although our results suggesting a lack of relationship between religiosity, spirituality, and obesity is in contrast with other studies suggesting an association, the current findings regarding health behavior are generally consistent with extant research. For example, several studies suggest a lower lifetime history of smoking among more religious individuals (Feinstein et al., 2010; Lapane et al., 1997; Roff et al., 2005). Obisesan, Livingston, Trulear, and Gillum (2006) found some evidence of healthier eating associated with religion: among African American women in the Third National Health and Nutrition Examination Survey, weekly religious attendance was associated with fish intake at least once weekly. However, religious attendance was not related to caloric intake in that particular study.

Recent research has focused on implementing weight loss interventions for African Americans in church settings (Kim, Linnan, Campbell, Brooks, Koenig, & Wiesen, 2008). Given that religious participation and private spirituality predict some health behaviors (i.e., reduced caloric intake, less alcohol and tobacco use) among African Americans, religious settings are a potentially important venue for health behavior education in this population.

Limitations and Future Directions

The current study has several limitations. We cannot conclude that any aspect of religion causes changes in health behaviors because of the cross-sectional nature of our study; we can only indicate associations between these variables. Future research in this area should include longitudinal studies that would at least help to clarify temporal relationships between religiosity, health behavior, and body weight.

A notable limitation of the current study is the extent of missing data on self-report measures (particularly for religiosity, spirituality, and depressive symptoms). Despite extensive follow-

up to facilitate return of questionnaire booklets containing these measures, response rates remained less than ideal, though not unexpected given the already extensive time required for in person data collection. Fortunately, the resulting sample size ($n = 2,378$) is still quite large, and participants with complete versus missing data did not differ on BMI or obesity status. The differences that were detected between included and excluded participants (i.e., religiosity, spirituality, physical activity, and social support) were small in magnitude and not considered clinically significant. The issue of missing data does present the possibility of selection bias; perhaps results would differ for the subset of excluded participants who tend to be less religious. However, the levels of religiosity and spirituality reported in this sample appear consistent with other studies of African Americans (e.g., Feinstein et al., 2010). An additional limitation is that because a social desirability measure was not administered, there is the possibility for social desirability bias.

Although results suggest that religious participation might promote health behavior in this African American sample, we must note that this study employed self-reported measures of caloric intake, alcohol use, and smoking. It is possible that church attenders are less likely to report their "sinful" eating, drinking or smoking habits. Participants' under-reporting of caloric intake or alcohol use could potentially explain why church attenders report lower caloric intake yet do not show differences in body weight. However, the present study is strengthened by some objective measures (e.g., BMI and waist circumference). Future research should include more objective measures, such as biochemical measures of smoking, pedometer data indicating physical activity, and objective records of church attendance.

Information on participants' religious denominations was not collected in the JHS. Future research should assess relationships between religion, body weight, and health as a function of different religions and religions dominations.

Finally, our results may only apply to African Americans living in the Southeastern United States. Future studies should assess relationships between religion, body weight, and health in different regions of the United States, as well as in different countries.

Despite these limitations, the present study is strengthened by a large sample size, assessment of multidimensional aspects of religion (organized religious participation, private prayer, and daily spiritual experiences), and statistical analyses controlling for important variables related to body weight and health (e.g., smoking status, income, education level). We also tested whether relationships between religion and health were moderated by age, sex, education level, income status, and smoking status. We found no relationships between religion and obesity in any demographic subgroups within this population.

Our results suggest that in a large sample of African Americans living in the Southeastern United States, religious attendance, private prayer, and daily spirituality are not related to body weight when demographic variables are statistically controlled. However, certain religiosity and spirituality variables are related to lower self-reported caloric consumption, alcohol use, and lifetime history of smoking. Future research should continue to investigate relationships between religion and health among African Americans, as well as potential mediators of these relationships. We hope that this area of research will lead to tailored

health behavior interventions for African Americans to reduce health disparities in this population.

Acknowledgments

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Table 1

Characteristics of Included versus Excluded (those with missing data) Participants (standard deviations in parentheses).

	Included Participants (*n* = 2378)	Excluded Participants (*n* = 2923)	*p* value
Age ***	53.60 (12.39)	55.89 (13.09)	< .001
% Female ***	65.9%	61.4%	< .001
Education Level ***			< .001
< High School	12.5%	22.9%	
High school/GED	18.0%	21.7%	
Vocational Training	22.7%	21.1%	
Associate Degree	7.4%	6.4%	
Bachelor Degree	18.9%	13.8%	
Post-graduate degree	20.4%	13.0%	
Income Category ***			< .001
Low Income	11.4%	14.7%	
Lower-Middle	19.3%	22.8%	
Upper-Middle	27.3%	23.2%	
High Income	28.6%	21.9%	
BMI	31.81 (7.12)	31.70 (7.34)	.58
BMI Status			.15
Normal	13.6%	15.3%	
Overweight	33.3%	31.2%	
Obese	26.0%	27.1%	
Morbidly Obese	27.1%	26.4%	
WC (cm) *	100.19 (16.15)	101.09 (16.14)	.04
Calories per day **	2116.45 (1160.59)	2218. 17 (1310.17)	.003
% Calories from fat	35.11 (6.92)	34.87 (6.87)	.23
JHS PAC ***	8.56 (2.55)	8.10 (2.64)	< .001
% Current Smokers	18.8%	18.8%	.83
% who reported consuming alcohol in past year	46.3%	44.8%	.54
Religious Attendance ***	5.02 (.88)	4.93 (1.01)	.001
Private Prayer *	7.33 (.99)	7.26 (1.06)	.04
Daily Spiritual Experiences ***	28.50 (5.14)	27.87 (5.55)	< .001

	Included Participants (*n* = 2378)	Excluded Participants (*n* = 2923)	*p* value
Depression (CES-D)	10.73 (8.10)	11.34 (8.12)	.07
Social Support (ISEL) ***	52.50 (7.83)	50.61 (9.33)	< .001

BMI = Body mass index; WC = Waist circumference; JHS PAC = Jackson Heart Study Physical Activity Cohort Survey; CES-D = Center for Epidemiological Studies Depression Scale; ISEL = Interpersonal Support Evaluation List

Tests of significant differences between included and excluded participants:

*
p<.05,

**
p< .01,

***
p<.001

Table 2

Sample Characteristics by Gender (standard deviations in parentheses).

	Total Sample (*n* = 2378)	Men (*n* = 811)	Women (*n* = 1567)	*p* value
Age	53.60 (12.39)	53.10 (12.69)	53.86 (12.23)	.16
Education Level [***]				< .001
< High School	12.5%	13.7%	11.9%	
High school/GED	18.0%	16.8%	18.7%	
Vocational Training	22.7%	22.6%	22.8%	
Associate Degree	7.4%	5.9%	8.1%	
Bachelor Degree	18.9%	23.3%	16.6%	
Post-graduate degree	20.4%	17.7%	21.9%	
Income Category [***]				< .001
Low Income	11.4%	8.3%	15.6%	
Lower-Middle	19.3%	18.5%	24.4%	
Upper-Middle	27.3%	31.7%	31.4%	
High Income	28.6%	41.5%	28.5%%	
BMI [***]	31.81 (7.12)	29.91 (6.14)	32.80 (7.39)	< .001
BMI Status [***]				< .001
Normal	12.7%	16.8%	10.5%	
Overweight	33.3%	40.8%	29.4%	
Obese	41.8%	36.1%	44.8%	
Morbidly Obese	12.2%	6.3%	15.3%	
WC (cm) [**]	100.19 (16.15)	101.43 (15.70)	99.55 (16.35)	.01
Calories per day [***]	2116.45 (1160.59)	2437.45 (1245.73)	1950.32 (1077.44)	< .001
% Calories from fat	35.11 (6.92)	35.04 (6.51)	35.14 (7.12)	.72
JHS PAC [***]	8.55 (2.55)	8.88 (2.53)	8.39 (2.55)	< .001
% Current Smokers	18.8%	25.15%	15.51%	
% who reported consuming alcohol in past year [***]	46.3%	57.95%	40.33%	< .001
Religious Attendance [***]	5.02 (.88)	4.85 (.98)	5.11 (.81)	< .001
Private Prayer [***]	7.33 (.99)	7.07 (1.09)	7.46 (.90)	< .001
Daily Spiritual Experiences [***]	28.50 (5.14)	27.75 (5.52)	28.89 (4.89)	< .001
Depression (CES-D) [***]	10.73 (8.10)	9.45 (7.16)	11.39 (8.47)	< .001

	Total Sample (*n* = 2378)	Men (*n* = 811)	Women (*n* = 1567)	*p* value
Social Support (ISEL)	52.50 (7.83)	52.73 (7.19)	52.39 (8.13)	.31

BMI = Body mass index; WC = Waist circumference; JHS PAC = Jackson Heart Study Physical Activity Cohort Survey; CES-D = Center for Epidemiological Studies Depression Scale; ISEL = Interpersonal Support Evaluation List

Tests of significant differences between men and women:

*
p<.05,

**
p< .01,

***
p<.001

Table 3

Demographics, health behaviors, obesity indicators, and psychosocial variables by frequency of religious attendance.

	Few Times/Yr or Less (*n* = 136)	Few Times/Month (*n* = 307)	At Least Once per Week (*n* = 1243)	Nearly Every Day (*n* = 692)	*p* value
Age ***	46.40 (12.26)	49.93 (11.71)	54.36 (12.17)	55.28 (12.31)	<.001
% Female ***	47.1%	56.4%	66.7%	72.4%	<.001
Income Status *					.02
Low Income	20.9%	14.2%	10.9%	15.2%	
Lower Middle	20.9%	20.2%	21.9%	24.4%	
Higher Middle	25.2%	32.2%	31.8%	32.0%	
High Income	33.0%	33.3%	35.4%	28.5%	
Education Level ***					<.001
<High School	15.4%	11.4%	10.7%	15.8%	
High school/GED	18.4%	18.9%	16.8%	19.7%	
Vocational	23.5%	23.8%	21.7%	23.9%	
Associate Degree	8.1%	6.2%	7.2%	8.0%	
Bachelor Degree	24.3%	23.5%	19.1%	15.5%	
Post-graduate	10.3%	16.3%	24.5%	17.0%	
Body Mass Index	32.95 (9.48)	31.56 (7.31)	31.72 (6.70)	31.86 (7.22)	.25
Waist Circumference *	103.87 (22.68)	98.94 (15.68)	100.14 (15.40)	100.11 (16.07)	.03
% Abdom. Obesity	43.4%	35.2%	37.8%	39.9%	.30
BMI Status					.31
Normal	15.6%	15.1%	11.2%	13.6%	
Overweight	28.9%	32.4%	35.3%	30.8%	
Obese	38.5%	39.8%	42.1%	42.9%	
Morbidly Obese	17.0%	12.7%	11.3%	12.7%	
Kilocalories ***	2864.91 (1673.58)	2352.60 (1338.96)	2016.00 (1047.18)	2045.02 (1078.44)	<.001

	Few Times/Yr or Less (n = 136)	Few Times/Month (n = 307)	At Least Once per Week (n = 1243)	Nearly Every Day (n = 692)	p value
% Calories from Fat	35.79 (6.53)	34.94 (6.72)	35.23 (6.88)	34.83 (7.15)	.40
Total Physical Activity	8.82 (2.38)	8.71 (2.43)	8.52 (2.54)	8.50 (2.66)	.37
% Consumed Alcohol in Past Year [***]	78.7%	70.4%	45.3%	31.2%	< .001
Smoking Status [***]					< .001
Never Smoker	58.1%	64.5%	69.9%	75.0%	
Former Smoker	19.1%	15.3%	20.6%	17.1%	
Current Smoker	22.8%	20.2%	9.5%	7.9%	
Depression (CES-D) [***]	12.91 (9.82)	11.75 (9.24)	10.13 (7.43)	10.91 (8.21)	< .001
Social Support [***]	49.69 (9.84)	51.57 (7.71)	52.67 (7.62)	53.17 (7.67)	< .001

Tests of significant differences between levels of attendance:

[*]
$p<.05$,

[**]
$p<.01$,

[***]
$p<.001$

Table 4

Demographics, health behaviors, obesity indicators, and psychosocial variables by frequency of private prayer.

	Once per Week or Less (*n* = 121)	A Few Times per Week (*n* = 270)	Once per Day (*n* = 613)	More than Once per Day (*n* = 1374)	*p* value
Age ***	49.82 (12.03)	50.42 (12.17)	53.34 (12.10)	54.67 (12.43)	<.001
% Female ***	47.9%	48.9%	59.9%	73.5%	<.001
Income Status					.06
Low Income	17.5%	9.0%	14.4%	13.0%	
Lower Middle	19.4%	21.0%	21.0%	23.5%	
Higher Middle	30.1%	28.8%	29.8%	33.0%	
High Income	33.0%	41.2%	34.8%	30.6%	
Education Level					.37
<High School	16.5%	7.8%	12.9%	13.0%	
High school/GED	15.7%	17.4%	17.9%	18.4%	
Vocational	20.7%	22.2%	24.6%	22.2%	
Associate Degree	5.0%	9.3%	6.9%	7.4%	
Bachelor Degree	24.0%	22.6%	18.3%	18.0%	
Post-graduate	18.2%	20.7%	19.4%	21.0%	
Body Mass Index *	32.05 (8.25)	31.52 (7.01)	31.15 (6.55)	32.14 (7.26)	.03
Waist Circumference	101.70 (22.12)	100.54 (15.14)	100.02 (15.73)	100.07 (15.93)	
% Abdom. Obesity	41.7%	39.6%	35.1%	39.4%	.25
BMI Status					.17
Normal	12.7%	13.3%	12.8%	12.2%	
Overweight	33.1%	34.6%	37.8%	30.4%	
Obese	41.5%	41.1%	40.3%	41.9%	
Morbidly Obese	12.7%	11.0%	9.2%	13.5%	
Kilocalories ***	2523.73 (1331.72)	2382.36 (1420.16)	2137.19 (1126.44)	2019.08 (1085.35)	<.001

	Once per Week or Less (n = 121)	A Few Times per Week (n = 270)	Once per Day (n = 613)	More than Once per Day (n = 1374)	p value
% Calories from Fat	34.66 (6.70)	35.44 (6.16)	34.96 (6.84)	35.15 (7.12)	
Total Physical Activity	8.77 (2.50)	8.81 (2.46)	8.59 (2.54)	8.47 (2.58)	.17
% Consumed Alcohol in Past Year ***	66.1%	63.7%	54.8%	37.4%	< .001
Smoking Status ***					< .001
Never Smoker	58.7%	68.1%	66.4%	73.0%	
Former Smoker	18.2%	17.0%	21.5%	18.0%	
Current Smoker	23.1%	14.8%	12.1%	9.0%	
Depression (CES-D)	11.36 (8.01)	11.54 (8.18)	10.62 (7.88)	10.56 (8.17)	.24
Social Support **	51.99 (7.60)	51.31 (8.04)	51.94 (7.58)	53.03 (7.88)	.001

Tests of significant differences between frequencies of prayer:

*
$p < .05$,

**
$p < .01$,

***
$p < .001$

Table 5

Hierarchical Regression Analysis predicting body mass index (BMI) and waist circumference. Unstandardized regression coefficients shown (standard errors in parentheses).

Variable	Model 1	Model 2	Model 3	Model 4	Tests of Moderation (p values)
Body Mass Index (BMI)					
Religious Attendance	−.05 (.18)	−.05 (.18)	−.10 (.18)	−.12 (.18)	
Private Prayer	.17 (.16)	.17 (.16)	.11 (.16)	.08 (.16)	
Daily Spirituality	−.03 (.03)	−.03 (.03)	−.03 (.03)	−.01 (.03)	
Age	−.05 (.01)***	−.05 (.01)***	−.07 (.01)***	−.06 (.01)***	.37
Gender (0 = female, 1 = male)	−2.90 (.30)***	−2.86 (.31)***	−2.65 (.31)***	−2.20 (.32)***	.29
Education Level		−.14 (.10)	−.15 (.10)	−.11 (.10)	.09
Income Status		−.13 (.16)	−.15 (.16)	−.09 (.16)	.56
Lifetime Smoking			−1.48 (.47)**	−1.47 (.47)**	.42
Current Smoking			1.66 (.54)**	1.57 (.53)**	.14
Physical Activity			−.21 (.06)***	−.21 (.06)***	.12
Calories per Day			.00 (.00)	.00 (.00)	.40
% Calories from Fat			.08 (.02)***	.08 (.02)***	.06
Alcohol Use (Past Year)			−.29 (.31)	−.27 (.30)	.65
Social Support				−.01 (.02)	.17
Depressive symptoms				.07 (.02)**	.21
Waist Circumference (WC)					
Religious Attendance	−.31 (.43)	−.31 (.42)	−.31 (.43)	−.34 (.43)	
Private Prayer	.06 (.39)	.04 (.39)	−.05 (.39)	−.12 (.38)	
Daily Spirituality	−.05 (.07)	−.03 (.07)	−.03 (.07)	.02 (.07)	
Age	.09 (.03)**	.08 (.03)**	.04 (.03)	.06 (.03)	.67
Gender (0 = female, 1 = male)	1.19 (.72)	1.57 (.73)*	1.84 (.75)*	2.89 (.76)***	.47

Variable	Model 1	Model 2	Model 3	Model 4	Tests of Moderation (*p* values)
Education Level		−.16 (.23)	−.09 (.23)	.02 (.23)	.22
Income Status		−1.15 (.39)**	−1.07 (.39)**	−.89 (.39)*	.92
Lifetime Smoking			−1.04 (1.11)	−1.11 (1.10)	.56
Current Smoking			2.54 (1.28)*	2.44 (1.27)	.20
Physical Activity			−.59 (.14)***	−.58 (.14)***	.15
Calories per Day			.00 (.00)	.00 (.00)	.69
% Calories from Fat			.19 (.05)***	.18 (.05)***	.08
Alcohol Use (Past Year)			−.77 (.73)	−.73 (.73)	.60
Social Support				−.02 (.05)	.48
Depressive symptoms				.18 (.05)***	.13

*
  p<.05,

**
  p< .01,

***
  p<.001