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PAPER

Religion and body weight

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OBJECTIVES: Relationships between religion and body weight were examined in a US national sample.
METHODS: Data from the National Survey of Midlife Development in the United States (MIDUS), collected through telephone and postal questionnaires, were analyzed for 3032 adults aged 25–74.
RESULTS: Religious denomination was significantly related to higher body weight in men after accounting for socio-demographic controls. Conservative Protestant men had a 1.1 ± 0.45 higher body mass index (BMI) than those reporting no religious affiliation. Other religion variables that initially had significant relationships with greater body weight before adjusting for control variables became nonsignificant after smoking was controlled. No significant relationships between religion and body weight were present in women.
CONCLUSIONS: Religious denomination was related to body weight in men. Other dimensions of religiosity showing a relationship with higher BMI appeared to be because of the lower rates of smoking among more religious individuals.
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Introduction

Excess body weight is a global public health issue.[1–3] The most prevalent nutrition problem in many postindustrial societies,[4] obesity is rising in incidence, leading many to label the current weight patterns as an 'obesity epidemic'.[5,6] Obesity has physical consequences for morbidity[7,8,1] and social consequences such as stigmatization.[9,10] Thus, the quest for understanding body weight is expanding to seek new predictors. The current analysis examined a social factor that has received little previous attention in relation with body weight: religion.

The empirical evidence linking religion and health has grown substantially over the last decade to the extent that even the most skeptical scientists are taking seriously the myriad of literature identifying religion's association with better health.[11] Numerous longitudinal, multivariate studies[12–14] have found 'substantial positive effects of religious involvement on various... physical health outcomes, including mortality'[15] (p 373).

Body weight may be a mediator between religion and mortality,[14] with religion possibly serving as a protective factor against extreme overweight.[16,17] Religion may contribute to decreased body weight in several ways.

Stress or anxiety is related to higher body weight,[18–20] particularly in women.[21] Stress-induced eating can trigger onset and relapses of obesity and increase preferences for high fat and/or sweet foods.[18] Religion is a means through which some people counter and cope with stress,[22] and may decrease body weight through helping adherents cope with stressors.

Social support provided by religion may be another mechanism contributing to decreased body weight.[23,15,11] Social support predicted lower children's obesity risk in Denmark[24] and in the United States,[25] and the weight loss literature frequently cites social support as a critical component in successful long-term weight loss.[26,27] Religious social support may not only promote decreased body weight, but also provide the social support needed for weight loss and maintenance.[28]

Components of religious theology may also discourage obesity. In historical Catholicism, depriving the body of food was analogous to purity.[29] In Judaism, the human body is considered to be made in the image of God.[30] And among Conservative Protestants, the body is taught to be the 'temple of the Holy Spirit'.[31] Viewing one's body as made in the image of and the home of deity may promote good health and thus ideal body weight. Given the greater emphasis on good health through seeing the body as sacred, the religious may be more physically active than their less religious counterparts.[32,33] Since physical activity is associated with healthy weight and moderate weight loss—

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particularly long-term weight loss—increased activity of the religious may encourage lower body weight.[34–36] A religion viewing the body as sacred may also encourage a healthy diet: those with more frequent religious practice and attendance made healthier food choices as measured by breakfast, green vegetable, and fruit intake.[32] Further, certain denominations, such as Seventh Day Adventists, promote a vegetarian diet, which has been associated with lower body weight.[37]

Religion's relations with body weight has not been extensively examined. A few studies investigating the association between religion and health have only used body mass index (BMI) as a control in multivariate analysis.[12,13] Even fewer studies of religion have considered body weight and the mechanisms surrounding it as outcome measures. In two US community samples, denomination (Protestant *vs* Catholic) was not associated with obesity,[38] although Episcopalians were less obese than Lutherans in one sample.[39] However, it is uncertain whether the relationship between denomination and body weight was because of religion, ethnicity, or sampling differences. In a Dutch sample, men who attended church more than once a month had a lower BMI than those who attended church less than once a month,[40] but church members had significantly higher BMIs than nonchurch members and were more likely to be 20% overweight in a cross-sectional community sample.[41] Analysis of US National data found that those with more extensive religious practice tended to be more obese.[42] However, the measure of religious practice in that analysis included predominately sedentary activities (ie watching religious television) and thus could have been measuring inactivity more than religiosity. Given the dearth of research and mixed findings of studies about religion's relationship with body weight, this analysis sought to examine religion and body weight in greater depth.

Given the previous literature finding that religion is associated with better physical health[11–14] and overweight is associated with poor health,[7,8,1] we hypothesized that greater religiosity (religious practice, application, social support, identity, and commitment) is related to lower body weight, with psychosocial and health behaviors as mediators. We did not hypothesize religious denomination's relationship with body weight because the literature regarding religious denomination's connection with body weight is unclear. Demographic antecedents were hypothesized to influence, but not fully determine, the relationship between religion and weight. These hypotheses were examined in a US national data set.

Methods
Data
Data from the National Survey of Midlife Development in the United States (MIDUS) were analyzed. A cross-sectional study conducted in 1995, MIDUS consisted of two parts: a telephone survey and a mailed questionnaire. Households were selected with random digit dialing and then one adult per household was randomly selected. The sample was nationally representative of the English-speaking, noninstitutionalized US population ages 25–74 with telephones.

The MIDUS telephone interview lasted approximately 40 min, and those respondents were subsequently mailed a written questionnaire. The response rate for completing both parts of the survey was 61%, producing 3032 respondents. Missing values for the religion variables were treated as missing for the current analysis.

Independent variables
Religion is a complex, multidimensional construct, and there is not a consensus about how religion should be conceptualized and measured. Prior literature[43,44] and relevance to the study's hypotheses were considered in deciding how religion was conceptualized in the present study. The religion items in the MIDUS data were grouped into six categories: denomination, practice/attendance, application, identification, subjective commitment/importance, and religious social support.

Denomination questions asked respondents what their religious preference was, and for this analysis the denominations were collapsed to maximize a meaningful interpretation of denomination's possible relationship with body weight. Given the considerations of previous researchers,[45,46] religious denomination for this analysis was grouped into six categories: Catholic, Conservative Protestant, Mainline Protestant, Jew, Other, and No Religious Preference.

Religious Practice is a standard component of religiosity that is often analyzed.[43,47] MIDUS respondents were asked to choose from five categories describing how often they attend religious or spiritual services, with higher scores indicating greater religious practice.

Religious Application was assessed by asking respondents how often they asked themselves what their religious or spiritual beliefs suggest they should do in making daily life decisions, with higher scores indicating stronger religious application.

Religious Social Support was assessed through the question, 'How often do you seek religious comfort', with four response categories ranging from 'never' to 'often'.

Religious Identity ($\alpha = 0.84$) was a continuous multi-item measure constructed from four single-item categorical variables. An example of these questions is, 'How important do you think it is for people of your religion to marry other people who are the same religion.' Higher scores indicated stronger religious identity.

Religious Commitment ($\alpha = 0.88$) was a sum of four questions about how religious and spiritual respondents considered themselves, and how important they considered religion and spirituality to be in their lives. Higher scores indicated greater commitment.

Dependent variable

Weight and height were self-reported in the questionnaire and used to calculate BMI. The accuracy of self-reported weight and height is generally seen as adequate for survey research.[48–50] Excluding the cases with missing values and implausible outliers, the total BMI sample size available for the weighted analysis was 2882.

Body weight was also conceptualized as weight categories, where overweight was signified by a BMI greater than 25, and obese as a BMI of greater than 30.[1] The category 'underweight' (BMI of less than 18.5) was not analyzed because there were too few cases (36 women and 5 men) to offer sufficient statistical power for a separate analysis.

Demographic variables

Demographics of gender, age, socioeconomic status, race/ethnicity, marital status, region, and geographic density were assessed.[51] Using the mean income of gender, marital status, education, age, employment, and race, missing values for income were imputed.[52,53] Cases where income was imputed were not significantly related to BMI.

Health behavior variables

Physical activity was assessed through two continuous scales: moderate ($\alpha = 0.86$) and vigorous activity ($\alpha = 0.86$). Self-reported activity has been found to correlate highly with direct measures of activity.[54,55]

Drinking was assessed through a six category variable as number of drinks per month, whereas smoking was assessed as 'smoking now' or 'not regularly smoking now'. Self-reported alcohol consumption and smoking status are considered to be adequately reliable and valid for epidemiological analyses.[56–59]

Psychosocial variables

Perceived social support was assessed by two scales: Family ($\alpha = 0.79$) and friends ($\alpha = 0.86$). Each continuous scale was created by summing five questions, for example, 'How much do members of your family (friends) really care about you?' Higher scale values indicated greater support. If respondents answered at least 60% of the family or friends support scales, the remaining items of each scale were imputed using the mean value of gender, age, and marriage.[52]

Perceived stress was measured in four domains: work stress, home stress, financial stress, and number of stressors. Each continuous index was constructed to indicate the extent to which respondents perceived *high* stress.[60] Perceived stress questions included, 'Did you have any serious ongoing problems getting along with someone at work', 'At home, how often do they have too many demands made of you,' and 'How difficult is it for you (and your family) to pay your monthly bills?' The work, home, and financial indexes were then added to form a total stress index, with a higher score indicating greater perceived stress. To measure the number of stressors, respondents were asked whether they themselves or members of their families experienced problems in the last year, including chronic disease, frequent minor illnesses, and emotional problems.

Social selection vs social causation: size discrimination analysis

Relations between religion and weight may involve bidirectional causality.[61,62] Social causation may occur when religious involvement influences weight through religious activities and beliefs that are a part of peoples' lives. Alternatively, social selection may occur when weight shapes religious involvement where people who are fatter or thinner are differentially included or excluded in religious organizations and activities. To consider the direction of causality between religion and body weight, differential participation of individuals in religious groups and activities was examined by testing whether people who report experiencing discrimination on the basis of their weight or height were more or less religious.

Analyses

Frequencies were examined for all variables, then multiple regression using PROC SURVEYREG from SAS 8.2 was conducted to test religion's relation with BMI. Since the etiology of body weight differs greatly between men and women,[63] separate regressions were conducted by gender. Sampling weights were used in all regression analyses to provide nationally representative results.[64]

A series of regression models were run to test the relations between religion and weight. Religion variables were each entered separately in assessing their relation to BMI because the complex nature of religion is such that different dimensions of religion have different pathways in their effects on health.[23,65] BMI was regressed on the demographic variables to account for demographic variation in BMI. Then, controlling for demographics, BMI was regressed on religion variables in Model 1. To test the role of health behaviors as a mediator between religion and BMI, health behaviors were added in Model 2. In Model 3, psychosocial variables were added to the religion—BMI model to examine their potential roles as mediators. Model 4 examined religion's relation with BMI after taking into account demographics, health behaviors, and psychosocial factors.

Logistic regressions using PROC LOGISTIC were also conducted for all models with the categorical variables of overweight and obesity. Demographics were controlled in all logistic regression analyses.

Results

Frequencies

Slightly more women than men were in the sample, the average age for both women and men was 47, and the majority of the sample was white (Table 1). Over half of the women and men had at least some college education, with men more likely to have a college education. Women's reported average household annual income was over $40 000, and men's was over $50 000. Most of the sample was married, and represented the different regions of the United States. About a third of respondents were from large Metropolitan Areas. The sample represented the US population with the exception of education and income, which were higher than the 1995 national average.[66]

Most of the sample was either Catholic or Protestant, and a slightly greater proportion of men than women specified their religious preference to be either agnostic, atheist, or of no religious preference. Women reported an overall greater

Table 1 Weighted frequencies

Variable	Mean or percent	
	Men (n=1471)	Women (n=1561)
Demographics		
Age (y)	45 ± 12.5	45 ± 14.3
Race/ethnicity (white)	83%	82%
Education		
Some grade-high school	13%	14%
High school graduate	36%	40%
Some college	24%	26%
College graduate or more	28%	20%
Income ($)[a]	51 487 ± 33 063	41 928 ± 34 694
Marital status (married)	74%	64%
Region		
New England and Mid-Atlantic	19%	17%
East North Central and West North Central	26%	29%
West North Central, South Atlantic, and East South Central	34%	36%
Mountain and Pacific	21%	18%
City Size (21 largest Metropolitan Areas)	34%	35%
Independent variables		
Denomination		
Catholic	26%	24%
Conservative Protestant	32%	38%
Mainline Protestant	22%	23%
Jewish	2%	2%
Other	5%	6%
No Religious Preference	12%	7%
Religious practice (1=never, 5=≥1/wk)	2.6 ± 1.3	2.9 ± 1.4
Religious social support (1=low, 4=high)	2.5 ± 1.1	3.1 ± 1.1
Religious application (1=low, 4=high)	2.5 ± 1.1	2.9 ± 1.1
Religious commitment (1=low, 4=high)	2.9 ± 0.7	3.1 ± 0.7
Religious identity (1=low, 4=high)	2.5 ± 0.8	2.8 ± 0.9
Health behavior variables		
Drinking (>three drinks/week)	55%	24%
Currently smoking (yes)	25%	24%
Moderate activity (0=low, 13.5=high)	4.5 ± 4.7	4.7 ± 5.0
Vigorous activity (0=low, 13.5=high)	6.2 ± 5.0	8.8 ± 5.1
Psycho-social variables		
Friend support[a] (1=low, 5=high)	3.8 ± 0.7	4.1 ± 0.8
Family support[a] (1=low, 5=high)	4.1 ± 0.7	4.3 ± 0.7
Total stress[a] (0=low, 10=high)	6.8 ± 0.9	6.8 ± 1.0
Number of stressors (out of 10)	2.5 ± 2.7	3.2 ± 3.3
Dependent variable		
BMI	27 ± 4.3	27 ± 6.7
Overweight	46%	28%
Obese	21%	23%

[a]Imputed.

religiosity than men, especially in the religious social support item and the importance of religiosity and spirituality items.

Over half of the men (56%) reported drinking alcohol more than three drinks a week, compared to only 25% of women. Nearly, a quarter of the sample currently smoked. On average, MIDUS respondents reported engaging in relatively low moderate activity, with women reporting greater moderate and vigorous activity levels than men. The sample reported higher levels of vigorous activity than moderate activity.

Women reported higher friend and family support compared to men. Although the total stress levels between men and women were comparable, women reported a higher number of stressors. The mean BMI for both women and men was 27, and nearly 60% of the sample was classified as either overweight or obese.

Regression analyses

When BMI was regressed on the demographic variables of age, race, education, income, marital status, city size, and region, the results for women and men were consistent with those found in the existing social epidemiology of obesity literature.[10,51]

Controlling for demographics, the religion variables were then included in regression models as the independent variable, with BMI as the continuous dependent variable (Model 1). For men, a significant relationship of BMI with denomination existed, with Conservative Protestants and Mainline Protestants having higher BMIs than those indicating no religious preference, agnosticism, or atheism. Conservative Protestant men were about 1.13 BMI units (~5 lb) heavier than the reference group of no religious preference, whereas Mainline Protestants were 0.93 BMI units heavier compared to the reference group (Model 1 of Table 2). There were also significant relationships of BMI with Religious

Social Support (0.27), Religious Application (0.26), and Religious Identity (0.11), with more religious men reporting higher BMIs. For women, no significant relationships of religious variables to BMI were present (Model 1 of Table 3).

To examine possible mediating effects of health behaviors in the relationship between religion and BMI in men, drinking, smoking, and activity were included in regression models (Model 2 of Table 2). With the addition of health behaviors, the relationship between the denomination of Mainline Protestant and BMI was no longer significant for men, whereas the association between the denomination of Conservative Protestant and BMI remained significant, although it decreased in strength (Model 2 of Table 2). With these health behavioral mediators, the relationships of Religious Social Support and Religious Application to body weight became nonsignificant for men, whereas Religious Identity's relationship with BMI remained relatively unchanged. In partitioning out how each individual health behavior affected religion's relationship with BMI for men, adding smoking alone to the model resulted in the decreased magnitude and nonsignificance of the religion variables in their relation to BMI, whereas the other health behavior variables had little influence when entered alone.

The psychosocial variables of social support and stress were also examined as potential mediators (Model 3). For men, adding psychosocial measures appeared to magnify religion's relationship with BMI, either increasing the magnitude of the effects or making some formerly not significant terms significant. The relationship of BMI to religious attendance, religious commitment, and the denomination of Catholicism became significant for men, whereas the relationship of body weight to the denomination of Conservative Protestant increased the relationships in magnitude and significance (Model 3 of Table 2). Cases where friend social support was imputed were highly significant ($P < 0.01$).

In the final model (Model 4), demographics, health behaviors, social support, and stress were included in

Table 2 Regression of religion on BMI—Men[a]

Religion variable	Model 1 controlling for demographics	Model 2 controlling for demographics+health behaviors	Model 3 controlling for demographics+social support+stress	Model 4 controlling for demographics+health behaviors+social support+stress
Denomination[b] (Catholic)	0.80 (0.44)	0.69 (0.43)	0.89 (0.45)*	0.77 (0.43)
Denomination (Conservative Protestant)	1.1 (0.46)*	0.98 (0.45)*	1.3 (0.46)**	1.1 (0.45)*
Denomination (Mainline Protestant)	0.93 (0.43)*	0.67 (0.43)	1.1 (0.43)*	0.78 (0.43)
Denomination (Jewish)	1.7 (0.99)	1.2 (0.95)	1.8 (1.0)	1.3 (0.96)
Denomination (Other)	0.97 (0.73)	0.98 (0.70)	1.0 (0.73)	1.0 (0.69)
Religious attendance	0.20 (0.11)	0.14 (0.11)	0.21 (0.11)*	0.14 (0.11)
Religious social Support	0.27 (0.12)*	0.21 (0.11)	0.25 (0.12)*	0.17 (0.11)
Religious commitment	0.08 (0.04)	0.08 (0.04)	0.09 (0.05)*	0.08 (0.04)
Religious application	0.26 (0.12)*	0.18 (0.12)	0.24 (0.12)	0.14 (0.12)
Religious identity	0.11 (0.04)**	0.09 (0.04)*	0.11 (0.04)**	0.09 (0.04)

*$P < 0.05$.
**$P < 0.01$.
[a]Cells represent unstandardized regression coefficients (s.e.).
[b]'No religious preference' is the reference category for denomination.

Table 3 Regression of religion on BMI—women[a]

Religion variable	Model 1 controlling for demographics	Model 2 controlling for demographics+health behaviors	Model 3 controlling for demographics+social support+stress	Model 4 controlling for demographics+health behaviors+social support+stress
Denomination[b] (Catholic)	(−) 0.48 (0.74)	(−) 0.48 (0.74)	−0.42 (0.74)	(−) 0.47 (0.74)
Denomination (Conservative Protestant)	0.34 (0.74)	0.11 (0.76)	0.38 (0.74)	0.12 (0.76)
Denomination (Mainline Protestant)	0.22 (0.77)	0.04 (0.78)	−0.75 (1.0)	(−) 0.61 (1.0)
Denomination (Jewish)	(−) 0.98 (0.99)	(−) 0.80 (1.0)	0.42 (0.78)	0.20 (0.78)
Denomination (Other)	(−) 0.39 (0.93)	(−) 0.47 (0.92)	−0.32 (0.92)	(−) 0.43 (0.91)
Religious attendance	0.04 (0.14)	(−) 0.09 (0.14)	0.14 (0.14)	(−) 0.01 (0.14)
Religious social Support	0.25 (0.16)	0.14 (0.16)	0.25 (0.16)	0.12 (0.16)
Religious commitment	0.11 (0.07)	0.04 (0.08)	0.08 (0.07)	0.04 (0.07)
Religious application	0.25 (0.18)	0.14 (0.17)	0.24 (0.17)	0.10 (0.17)
Religious Identity	0.03 (0.06)	(−) 0.04 (0.06)	0.06 (0.06)	(−) 0.02 (0.06)

[*]$P<0.05$.
[**]$P<0.01$.
[a]Cells represent unstandardized Regression Coefficients (s.e.).
[b]'No Religious Preference' is the reference category for denomination.

examining religion's relation with BMI. Compared to the model controlling for demographics and health behaviors for men, including both health behaviors and psychosocial variables did not significantly change the unstandardized regression coefficients, although adding the psychosocial variables slightly attenuated health behaviors' mediating effects and made religious identity's relationship with BMI not significant (Model 4 of Table 2). The denomination of Conservative Protestant remained significantly related to BMI in these models for men. The mean BMI of Jewish men compared to men of no religious preference was high, although not significantly different.

To examine whether religion's relationship with higher BMI among men was associated with overweight or obesity, logistic regressions using PROC LOGIT were conducted, with overweight vs others and obesity vs others as the outcomes. No significant relationships were present for any of the models for overweight and obesity, suggesting that religion variable relationships exist for average weight for the whole population, not just making some people more extreme in body weight. Similarly, there were no significant associations between religion variables and overweight or obesity for women.

Social selection vs social causation analysis
To address the direction of causality in the religion–body weight relation, bivariate and multivariate logistic analyses were conducted with the height–weight discrimination variable as the dependent variable and the religion items as the independent variables. The multivariate analysis controlled for age, income, race, education, marital status, region, and city size. The religion variables were each entered separately in the logistic analysis and all analyses were conducted separately by gender. If body weight caused religion, that is, if religion draws in those who are heavier

rather than causes its adherents to become heavier, then significant differences would be expected to be present. For both the bivariate and multivariate analyses, none of the religion variables were significantly related to the height and weight discrimination question. This suggests that relations between religion and body weight are primarily religion influencing weight (social causation) rather than weight influencing religion (social selection).

Discussion
In this analysis, Conservative Protestant men were approximately 5 lb heavier than those men indicating no religious preference after controlling for demographics, health behaviors, social support, and stress. Assuming that those indicating a Conservative Protestant affiliation were more likely to be members of a church than those indicating no religious preference, these results are consistent with Lapane et al's[41] conclusions that church members are heavier than nonchurch members. The lack of statistical significance of those indicating a Jewish denomination to body weight may have been because of the small number of Jewish men in the sample. Further studies need to be conducted to clarify whether Judaism is associated with body weight in men.

Measures of religion other than denomination were not associated with body weights of men or women, once health behaviors were controlled. Unlike Baecke et al[40] and Ferraro,[42] no relationship was found between religious attendance and body weight, although those studies did not control for health behaviors. In this analysis, other religiosity measures associated with body weight in men were reduced by controlling for health behaviors, particularly smoking.

The magnifying effect of the psychosocial variables on the religion–body weight connection suggests that social sup-

port and stress could operate as moderators.[67] However, the interactions between religion and social support, and religion and stress were not significant, suggesting that the psychosocial variables were not moderators in the religion-body weight relationship.[67] Thus, it is not clear how social support and stress fit—if at all—into religion's relationship with body weight. Given that the psychosocial variables did not substantially change religion's relationship to body weight, perhaps social support and stress are not important factors in the religion–body weight connection.

Although the magnitude of religion's relationship with body weight is small, the significance of the relationship offers new insight into the etiology of body weight. Given the cross-sectional nature of this study, the direction of causality could not be clearly established. However, the analysis of height–weight discrimination and religiosity measures supports the hypothesis that religion causes increased body weight in men.

Several limitations existed in this study. The cross-sectional design limits conclusions about the direction of causality.[61] Only a longitudinal study could more definitively show that religion causes body weight, although the social selection vs social causation analysis addressed this concern to some extent. Missing values and nonresponse could have biased the results, although the imputation and weighting attempted to account for those factors. The lack of a dietary intake measure leaves open the possibility that part of the unexplained variance attributed to religion could have been because of diet. The self-report nature of the measures could have also missed unexplained variance not captured by the measures because they were not precise enough, that is, religion's relationship with body weight could have been because of residual bias from the demographic variables. However, the magnitude of the denomination coefficient in men suggests that it is probably not because of residual bias. Cultural differences may have also interacted with religion to result in different relations between religion and weight, although controlling for race reduces that possibility. Religious individuals could have been more or less truthful[68,69] and thus report different body weights than the less religious. Given that the MIDUS data did not include veracity measures and the lack of literature examining the relation between religion and truthfulness, it is unclear to what extent, if any, validity of self-reported religion and weight affected these results.

Finding no relation between religion and BMI among women was surprising, especially given that women are generally more religious than men.[15] However, most surprising was religion's positive association with higher BMI in men. Given the abundance of literature showing religion's positive effect on health status, religion correlating with better physical health[11–15] and greater body weight[41,42] appears to be inconsistent, since being overweight is associated with poorer health.[1–3,7,8] Concurrent with our findings that increased BMI in religious men did not affect obesity risk, the heavier body weight of the religious may not be a strong risk factor for poor health. The risk of higher BMIs among religious men may also be countered by positive health behaviors, such decreased smoking and drinking, through religion serving as a social control for better health.[70]

How religion is related to greater BMI in men, however, remains unclear. Perhaps religion, through offering meaning, acts as a stabilizing institution to protect against extreme underweight and overweight. Future research examining religious meaning as an independent and mediating variable in the religion–body weight connection may more completely delineate how religion is associated with higher BMI in men.

References

1 World Health Organization. *Obesity: preventing and managing the global epidemic*. Report of a WHO consultation on Obesity, Geneva, 3–5, June 1997. World Health Organization: Geneva; 1998.
2 Popkin BM, Doak CM. The obesity epidemic is a worldwide phenomenon. *Nutr Rev* 1998; **56**: 106–114.
3 Sobal J. Commentary: globalization and the epidemiology of obesity. *Int J Epidemiol* 2001; **30**: 1136–1137.
4 Dickerson VM. Focus on primary care: evaluation, management, and treatment of obesity in women. *Obstet Gynecol Surv* 2001; **56**: 650–663.
5 Mokdad AH. The continuing epidemics of obesity and diabetes in the United States. *JAMA* 2001; **286**: 1195–1200.
6 Doll HA, Petersen SE, Stewart-Brown SL. Obesity and physical and emotional well-being: associations between body mass index, chronic illness, and the physical and mental components of the SF-36 Questionnaire. *Obes Res* 2000; **8**: 160–170.
7 Ferraro KF, Booth TL. Age, body mass index, and functional illness. *J Gerontol* 1999; **54**: S339–S348.
8 Aronne LJ. Epidemiology, morbidity, and treatment of overweight and obesity. *J Clin Psychiatry* 2001; **62**(Suppl 23): 13–22.
9 Khaodhiar L, McCowen KC, Blackburn GL. Obesity and its comorbid conditions. *Clin Cornerstone* 1999; **2**: 17–31.
10 Sobal J, Devine C. Social aspects of obesity: influences, consequences, assessments, and interventions. In: Dalton S (ed). *Overweight and weight management. The health professional's guide to understanding and practice*. Aspen Publishers: Gaithersburg, MD; 1997. pp 312–331.
11 Ellison CG, Levin JS. The religion–health connection: evidence, theory, and future directions. *Health Educ Behav* 1998; **25**: 700–720.
12 Strawbridge WJ, Cohen RD, Shema SJ, Kaplan GA. Frequent attendance at religious services and mortality over 28 years. *Am J Public Health* 1997; **87**: 957–961.
13 Hummer RA, Rogers RG, Nam CB, Ellison CG. Religious involvement and U.S. adult mortality. *Demography* 1999; **36**: 273–285.

476

14 McCullough ME, Hoyt WT, Larson DB, Koenig HG. Religious involvement and mortality: a meta-analytic review. *Health Psychol* 2000; **19**: 211–222.

15 Sherkat DE, Ellison CG. Recent developments and current controversies in the sociology of religion. *Annu Rev Sociol* 1999; **25**: 363–394.

16 Allison DB, Moonseong H, Fontaine KR, Hoffman DJ. Body weight, body composition and longevity. In: Bojorntorp P (ed). *International textbook of obesity*. John Wiley and Sons: New York; 2001. pp 31–48.

17 Troiano RP, Frongillo EA, Sobal J, Levitsky DA. The relationship between body weight and mortality: a quantitative analysis of combined information from existing studies. *Int J Obes Relat Metab Disord* 1996; **20**: 63–75.

18 Epel E, Lapidus R, McEwen B, Brownell K. Stress may add bit to appetite in women: a laboratory study of stress-induced cortisol and eating behavior. *Psychoneuroendocrinology* 2001; **26**: 37–49.

19 Mellbin T, Vuille JC. Rapidly developing overweight in school children as an indicator of psychosocial stress. *Acta Paediatr Scand* 1989; **78**: 568–575.

20 Epel ES, McEwen B, Seeman T, Matthews K, Castellazzo G, Brownell KD, Bell J, Ickvics JR. Stress and body shape: stress-induced cortisol secretion is consistently greater among women with central fat. *Psychosom Med* 2000; **62**: 623–632.

21 Laitinen J, Ek E, Sovio U. Stress-related eating and drinking behavior and body mass index and predictors of this behavior. *Prev Med* 2002; **34**: 29–39.

22 Mickley JR, Carson V, Soeken KL. Religion and adult mental health: state of the science in nursing. *Issues Ment Health Nurs* 1995; **16**: 345–360.

23 Koenig HG, Hays JC, George LK, Blazer DG, Larson DB, Landerman LR. Modeling the cross-sectional relationships between religion, physical health, social support, and depressive symptoms. *Am J Geriatr Psychiatry* 1997; **5**: 131–144.

24 Lissau I, Sorensen TIA. Parental neglect during childhood and increased risk of obesity in young adulthood. *Lancet* 1994; **343**: 324–327.

25 Gerald LB, Anderson A, Johnson GD, Hoff C, Trimm RF. Social class, social support and obesity risk in children. *Child Care Health Dev* 1994; **20**: 145–163.

26 Jeffery RW, Forster JL, Folsom AR, Luepker RV, Jacobs Jr DR, Blackburn H. The relationship between social status and body mass index in the Minnesota Heart Health Program. *Int J Obes Relat Metab Disord* 1989; **13**: 59–67.

27 Foreyt JP, Goodrick GK. Attributes of successful approaches to weight loss and control. *Applied Prev Psychol* 1995; **3**: 209–215.

28 Parham ES. Enhancing social support in weight loss management groups. *J Am Diet Assoc* 1993; **93**: 1152–1156.

29 Bynum CW. *Holy feast and Holy fast: the religious significance of food to medieval women*. University California Press: Berkeley, CA; 1987.

30 Coakly S. *Religion and the body*. Cambridge University Press: Cambridge; 1997.

31 Synnott A. Tomb, temple, machine and self: the social construction of the body. *Br J Sociol* 1992; **43**: 79–110.

32 Wallacce JM, Forman TA. Religion's role in promoting health and reducing risk among American youth. *Health Educ Behav* 1998; **25**: 721–741.

33 Merrill RM, Thygerson AL. Religious preference, church activity, and physical exercise. *Prev Med* 2001; **33**: 38–45.

34 Wing RR. Physical activity in the treatment of the adulthood overweight and obesity: current evidence and research issues. *Med Sci Sports Exerc* 1999; **31**(Suppl 11): S547–S552.

35 Votruba SB, Horvitz MA, Schoeller DA. The role of exercise in the treatment of obesity. *Nutrition* 2000; **16**: 179–188.

36 Saris WH. Exercise with or without dietary restriction and obesity treatment. *Int J Obes Relat Metab Disord* 1995; **19**(Suppl 4): S113–S116.

37 Maurer D. Too Skinny or Vibrant and Healthy? Weight management in the vegetarian movement. In: Sobal J, Maurer D (eds). *Weight issues. Fatness and thinness as social problems*. Aldine De Gruyter: New York, NY; 1999. pp 209–229.

38 Cohen S, Schwartz JE, Bromet EJ, Parkinson DK. Mental health, stress, and poor health behaviors in two community samples. *Prev Med* 1991; **20**: 306–315.

39 Goldblatt PB, Moore ME, Stunkard AJ. Social factors in obesity. *JAMA* 1965; **192**: 97–102.

40 Baecke JAH, Burema J, Frijters JER, Hautvast JGAJ, Wiel-Wetzels WAM. Obesity in young Dutch adults: I, socio-demographic variables and body mass index. *Int J Obes Relat Metab Disord* 1983; **7**: 1–12.

41 Lapane KL, Lasater TM, Allan C, Carelton RA. Religion and cardiovascular disease risk. *J Relig Health* 1997; **36**: 155–163.

42 Ferraro KF. Firm Believers? Religion, body weight, and well-being. *Rev Relig Res* 1998; **39**: 224–244.

43 De Vaus D, McAllister I. Gender differences in religion: a test of the structural location theory. *Am Sociol Rev* 1987; **52**: 472–481.

44 Jacobson CK. Religiosity and prejudice: an update and denominational analysis. *Rev Relig Res* 1998; **39**: 264–272.

45 Smith TW. Classifying Protestant denominations. *Rev Relig Res* 1990; **31**: 225–245.

46 Steensland B, Park JZ, Regnerus MD, Robinson LD, Wilcox WB, Woodberry RD. The measure of American religion: toward improving the state of the art. *Soc Forces* 2000; **79**: 1–28.

47 Chadwick BA, Garrett HD. Women's religiosity and employment: the LDS experience. *Rev Relig Res* 1995; **36**: 277–293.

48 Stewart AL. The Reliability and validity of self-reported weight and height. *J Chronic Dis* 1982; **35**: 295–309.

49 Stunkard AJ, Albaum BA. The accuracy of self-reported weights. *Am J Clin Nutr* 1981; **34**: 1593–1599.

50 Wing RR, Epstein LH, Ossip J, Laporte RE. Reliability and validity of self-report and observers' estimates of relative weight. *Addict Behav* 1979; **4**: 133–140.

51 Sobal J. Social and cultural influences on Obesity. In: Bojorntorp P (ed). *International textbook of obesity*. John Wiley and Sons: New York; 2001. pp 305–322.

52 Acock AC. Working with missing data. *Family Sci Rev* 1997; **10**: 76–102.

53 Lachman ME, Weaver SL. The sense of control as a moderator of social class differences in health and well-being. *J Pers Soc Psychol* 1998; **74**: 763–773.

54 Taylor CB, Coffey T, Berra K, Iaffaldano R, Casey K, Haskell W. Seven-day activity and self-report compared to a direct measure of activity. *Am J Epidemiol* 1984; **120**: 818–824.

55 Laporte RE, Montoye HJ, Caspersen CJ. Assessment of physical activity in epidemiologic research: problems and prospects. *Public Health Rep* 1985; **100**: 131–146.

56 Williams GD, Aitken SS, Malin H. Reliability of self-reported alcohol consumption in a general population survey. *J Stud Alcohol* 1985; **46**: 223–227.

57 Midanik LT. Validity of Self-reported alcohol use: a literature review and assessment. *Br J Addict* 1988; **83**: 1019–1029.

58 Williams GD, Proudfit AH, Quinn EA, Campbell KE. Variations in quantity-frequency measures of alcohol consumption from a general population survey. *Addiction* 1994; **89**: 413–420.

59 Navarro AM. Smoking status by proxy and self-report: rate of agreement in different ethnic groups. *Job Control* 1999; **8**: 182–185.

60 Kalton G. *Compensating for missing survey data*. Ann Arbor, MI: Survey Research Center, Institute for Social Research, University of Michigan, 1983.

61 Goldman N. Social factors and health: the causation-selection issue revisited. *Proc Natl Acad Sci USA* 1994; **91**: 1251–1255.

62 Waldron I, Hughes ME, Brooks TL. Marriage protection and marriage selection—prospective evidence for reciprocal effects of marital status and health. *Soc Sci Med* 1996; **43**: 113–123.

63 Sobal J, Stunkard AJ. Socioeconomic status and obesity: a review of the literature. *Psychol Bull* 1989; **105**: 260–275.

64 Keyes CLM, Ryff CD. Subjective change and mental health: a self-concept theory. *Soc Psychol Q* 2000; **63**: 264–279.

65 Koenig HG, Idler E, Kasl S, Hays JC, George LK, Musick M, Larson DB, Collins TR, Benson H. Religion, Spirituality, and medicine: a rebuttal to skeptics. *Int J Psychiatry Med* 1999; **29**: 123–131.

66 US Census Bureau. *Statistical abstract of the United States*, 115th edn. The National Data Book. Commerce Department, Economics and Statistics Administration, Census Bureau, Data User Services Division, Denver, Co 1995.

67 Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* 1986; **51**: 1173–1182.

68 Francis LJ, Pearson PR, Kay WK. Are religious children bigger liars? *Psychol Rep* 1983; **52**: 551–554.

69 Francis LJ, Pearson PR, Kay WK. Religiosity and lie scores: a question of interpretation. *Social Behav Personality* 1988; **16**: 91–95.

70 Benda B. Testing competing theoretical concepts: adolescent alcohol consumption. *Deviant Behav* 1994; **15**: 375–396.