Public Health Nutrition: 7(6), 773–781 DOI: 10.1079/PHN2004601

Religion, social support, fat intake and physical activity

Karen Hye-cheon Kim[1,*] and Jeffery Sobal[2]
[1]Department of Health Education and Health Behavior, University of North Carolina at Chapel Hill, 323B Rosenau Hall, CB #7440, Chapel Hill, NC 27599-7440, USA: [2]Cornell University, Ithaca, NY, USA

Submitted 19 August 2003: Accepted 8 January 2004

Abstract

Objective: Most research on diet and exercise has focused on these health behaviours as proximate causes of disease, rather than examine the context of how diet and exercise are developed and maintained. This study examined religion and social support in relationship to fat intake and physical activity.
Design, setting and subjects: Data from surveys of 546 adults aged 17–91 years, residing in one upstate New York county, were analysed.
Results: Most relationships between the multiple facets of religion, fat intake and physical activity were not statistically significant. After controlling for demographics and social support, Conservative Protestant women and women specifying an 'Other' religious affiliation reported higher fat intakes than did Catholic women. There were no relationships between religion and fat intake in men. In women, religious commitment was associated with greater moderate and vigorous physical activity, whereas in men, divine social support was associated with greater moderate physical activity. Social support did not substantially change the magnitude of the relationships between religion, diet and physical activity.
Conclusion: Overall, there were few relationships between religion, fat intake and physical activity, suggesting that in contemporary US society religion may play a small role in the context of how diet and exercise are developed and maintained. The limited range of religiosity in the sample, however, may have underestimated the role of religion. Significant relationships between religion and physical activity in women suggest that further research is needed to more clearly delineate religion's relationship with health behaviours.

Keywords
Religion
Fat
Diet
Exercise
Physical activity
Health

Research about diet and exercise's relationships with health has predominantly focused on these behaviours as proximate causes of disease, rather than examine the context of how these particular health behaviours are developed and maintained[1]. Proximate risk factors for health, such as diet and physical activity, can be contextualised by linking them with particular social institutions. An under-investigated social institution that may provide insights about health behaviours is religion.

Religion as a social institution encompasses a multi-faceted set of social organisations, norms, values and experiences that defines group members and their relationship to the larger society[2]. Religious groups use health behaviours as identifiers to distinguish their community from others. Judaism has Kosher food regulations[3], Islam uses Halal food guidelines[3], Seventh-Day Adventists encourage a lacto-ovo vegetarian diet[4] and the Church of Jesus Christ of Latter-day Saints (Mormon) prescribes a balanced diet and discourages excessive meat intake[2]. Apart from denominational prescriptions, general religiosity in the USA encompasses theological teachings about the body as a temple where God resides[5], which may also lead to the consumption of a healthier diet and increased physical activity. Broad teachings about the sacredness of the body may also further enforce specific religious health-behaviour guidelines[4]. Thus religion may directly shape diet and physical activity through specific theological teachings and indirectly through general teachings about the body and its relationship to God.

Religion may also influence diet and physical activity by providing social support, social networks and social control[6,7]. Religion offers venues for people of like values, interests and activities to interact, enabling adherents to form larger social networks and receive greater social support[8]. In national[9], elderly[6], college student[10] and African American samples[11], religion was related to greater emotional support, larger network size and better perceived support. Religion has also been proposed to promote health-related socialisation[12], with the church serving as a context for promoting, developing and maintaining health behaviours such as diet and exercise[13].

Social support is associated with diet[14–16] and physical activity[17,18]. Social support may influence health behaviours by offering models for lifestyle change, resources to help individuals develop and maintain healthy behaviours, and social controls over behaviour[14,19]. Thus

*Corresponding author: Email kkim@email.unc.edu

religion's relationship with diet and physical activity may be mediated by social support.

Social support, diet and physical activity

A review of the literature on social support and dietary change concluded that social support could 'play a significant role in helping people undertake or maintain healthy changes in their diets'[14]. In samples of the elderly, different aspects of social support (network density, perceived support) have been related to intakes of fat, salt and sugar[15], fibre and fruit[16], and vitamins and minerals[20]. While these studies used various measures of diet[16]and multiple measures of social support[15,16], the external validity of these predominantly rural, elderly white samples is limited and the cross-sectional design of some of these studies does not clarify whether social support causes changes in diet[15,20,21]. Relationships between social support and diet may also be more pronounced in the elderly[22]. Given the increased risk of social isolation among the elderly and its subsequent effect on diet, age-associated differences may occur in social support's connection with diet[20,23,24]. Social support from religion, in this case, may better enable the religious – particularly the older religious – to practise positive health behaviours.

General and specific measures of social support have been related to increased physical activity in adults[25,26], college students[22,27] and older adults[28]. Particularly in adult women and older adults, there is evidence that this relationship between social support and physical activity is causal, with social support predicting physical activity. However, the literature is less clear about the direction of causality for men[25,26]. These studies used self-reported physical activity and various measures of social support, but more valid and comprehensive measures would more clearly delineate social support's relationship with physical activity. Given these limitations, however, these studies suggest that increased levels of general social support from religion may facilitate increased physical activity among certain samples (particularly women and older adults) who are more religious.

Religion and diet

The literature on religion's relationship with diet is sparse. Religion and diet have been examined in studies of denomination and general religiosity. Some religious groups have dietary laws and guidelines[2]. Hassidic Jewish sects reported different nutrient intakes from general populations[29]. Catholics reported different diets from Protestants[30]. These studies used detailed measures of diet to bring greater clarity to the under-examined relationships of religion and diet. However, possible confounders like socio-economic status were not adjusted, so it is unclear whether these observed differences were due to denomination or other factors.

Few studies have examined general religiosity's relationship with dietary intake. Among religious samples, religiosity was associated with 'healthful nutrition' among the Greek Orthodox[31] and healthier nutritional practices (without controls) in a sample of predominantly Mormons[32]. In other samples, religion was related to healthier eating practices[33], food choice[34] and nutrient intake[35]. In contrast, nutritional practices like fruit and vegetable intake and limiting sweet and junk foods were not related to seeing the body as a manifestation of God or with seeing the body as sacred among university students (Mahoney A, Carels RA, Pargament K, Wachholtz A, Leeper LE, Kaplar M, *et al*. The sanctification of the body and behavioral health patterns of college students, unpublished manuscript, 2002). This scarce literature suggests a tentative relationship between religion, diet and nutrition. However, the external validity of these studies is limited to their select samples, and their cross-sectional designs do not elucidate the direction of causality between religion and diet. The limited measurements of religion also do not fully conceptualise different aspects of religion that may work concurrently in relationship with diet.

Religion and physical activity

Religion's relationships with physical activity have also not been thoroughly examined. Weekly attendance to religious services was associated with becoming physically active in adults followed for 30 years, after controlling for demographics and self-reported health[36]. Different aspects of religiosity (attendance, importance, denomination, theology and growth) were related to greater exercise frequency in adolescents[33], college students (Mahoney *et al*., unpublished) and working adults[32]. However, many of these studies examined religion's relationship with physical activity through bivariate correlations, not adjusting for demographics. For example, Mormons attending church weekly were more likely to engage in vigorous exercise than those attending church less than once a week, but this relationship became insignificant when demographics were controlled[37]. In contrast to research showing religion's relationship with increased exercise, greater use of religious coping was associated with decreased exercise among adults[38]. Thus, existing literature about religion and physical activity is meagre and ambiguous, in part because potential confounders were typically not examined. Different aspects of religion may also play different roles in their relationship to physical activity.

Hypotheses

Given that the relationships between religion, diet and physical activity are unclear, this study sought to examine associations between religion and these health behaviours in greater depth. Social support was examined as a mediator in the relationships between religion and health behaviours. Based on previous literature, it was hypothesised that greater religiosity would be related to a healthier diet, defined as having a lower percentage of

https://doi.org/10.1079/PHN2004601 Published online by Cambridge University Press

energy from fat and higher levels of physical activity. Specifically, negative aspects of religion – negative religious coping and negative congregation support – were expected to be related to decreased physical activity and a greater percentage of energy from fat. It is unclear from prior research how denomination would be related to diet and physical activity. Relationships between religion and individual health behaviours were hypothesised to be mediated by social support.

Methods

Sample

Sixty religious congregations in one upstate New York county were identified and available for sampling, and were categorised by denomination as 'Catholic', 'Conservative Protestant', 'Mainline Protestant' and 'Other'[39]. Four congregations from each denomination were randomly selected, and parishioners were randomly selected from each religious group. To maximise the diversity of religious groups in the 'Other' denomination, all groups categorised as 'Other' were asked to participate in the study. After obtaining permission from religious group leaders, 280 questionnaires were mailed to Catholic church members, 244 to Conservative Protestant church members, 179 to Mainline Protestant church members, and 188 distributed to those in the 'Other' denomination.

The 'Non-religious', defined as atheists, agnostics or having no religious preference, were recruited through a community list-serve, a local food co-operative, acquaintances and other contacts. A total of 62 in the 'Non-religious' group were asked to participate in the study. This project was approved by the University Institutional Review Board (IRB), University Committee on Human Subjects (UCHS).

Mailings

Potential respondents were recruited using a series of mailings[40]. From questionnaires that were mailed directly to the respondent, the response rate was 65%. Of 619 questionnaires received, 50 cases from one 'Other' denomination congregation were excluded because of unrepresentative selection by the religious leader, and 23 'Non-religious' food co-operative members were excluded because of unrepresentative selection. Thus 546 cases were available for analysis.

Measures

Religion and religiosity

Religion was conceptualised as three broad components: Behavioural, Subjective and Functional[39,41]. The behavioural component included religious denomination, attendance and religious application; the subjective component included religious identity and commitment; and the functional component included religious coping and religious social support through congregation and divine support.

Based on previous research[42], religious denomination for this analysis was grouped into five categories: Catholic, Conservative Protestant, Mainline Protestant, Other and Non-religious. Respondents were asked their religious denomination to confirm whether they were correctly sampled from their respective religious denominations.

Religious attendance was assessed through a single-item measure: 'How often do you usually attend religious/spiritual services?'

Religious application was assessed by asking how often respondents asked themselves what their religious or spiritual beliefs suggest they should do in making daily life decisions.

Religious commitment was assessed through one scale and two single-item questions. The religious commitment scale ($\alpha = 0.87$) was a sum of four categorical questions about how religious and spiritual respondents considered themselves, and how important they considered religion and spirituality to be in their lives[39]. The single-item religious commitment questions asked respondents whether they contributed a substantial amount of money to their congregation or to religious causes in the last year, and how many hours were spent on activities for religious or spiritual reasons[43].

Religious identity ($\alpha = 0.80$) was a continuous scale constructed from four single-item categorical variables[39]. An example question is 'How closely do you identify with being a member of your religious group?'

Religious coping was assessed through the Brief RCOPE, a 14-item scale that assesses positive religious coping ($\alpha = 0.94$) and negative religious coping ($\alpha = 0.81$)[44]. Respondents were told to think of a recent negative event in their life and asked to what extent they used a series of coping mechanisms.

Religious social support was comprised of divine social support and congregation social support. Divine social support was assessed through a single-item question and a continuous scale about prayer. The single item asked respondents how close their relationship with God was[45]. The prayer scale ($\alpha = 0.87$) was constructed by collapsing five questions on prayer that were scaled according to degrees of intimacy with the divine[46]. Two positive congregation social support items and two negative social support items were summed to assess positive congregation support ($\alpha = 0.81$) and negative congregation social support ($\alpha = 0.61$).

Health behaviours: fat intake and physical activity

Percentage of energy from fat was assessed through the National Cancer Institute's Quick Food Scan[47], based on frequency of intake of 16 foods.

Physical activity was assessed through moderate and vigorous activity items[48].

https://doi.org/10.1079/PHN2004601 Published online by Cambridge University Press

Social support

Social support was assessed by summing the seven-item perceived social support component of the Piedmont Health Survey ($\alpha = 0.82$)[49] plus two social interaction items from the National Survey of Midlife Development in the United States[48].

Demographics

Gender (male/female) and age (years) were determined from direct questions. Race was analysed as 'White' and 'Other'. Marital status was examined as 'Never married', 'Currently married' and 'Previously married.' Education categories were 'High school or less', 'Associates degree or some college', 'Bachelor's degree' and 'Graduate degree'. Employment status was assessed as working at a job or business or being a full-time student in the last three months.

Analysis

Frequencies were examined for all variables. If respondents answered less than half of the items of a given scale, the total score of that given scale was declared missing. Multivariate regressions were conducted using SAS 8.2 (SAS Institute, Cary, NC, USA) to examine religion's relationship with fat intake and physical activity. All regressions were conducted separately by gender because fat intake and physical activity differ markedly between men and women[50–52]. First, fat intake was regressed on the religion variables controlling for the appropriate demographics, then social support was added to the model to examine its potential as a mediator in the relationship between religion and fat intake. Second, religion's relationship with moderate physical activity was examined, then social support was added to the model. Third, religion's relationship with vigorous physical activity was examined, with and without social support in the model. All regressions controlled for age, race, education, marital status and employment.

Results

Frequencies

The average age of the sample was 42 years for men and 45 years for women, with the majority being white (Table 1). About half of the sample was married, and most of the sample was employed. There was a fairly balanced distribution between the four denominations, with a higher proportion of men reporting a Conservative Protestant denomination and a higher proportion of women reporting a Catholic denomination. Overall, the sample was very religious, and reported low use of negative religious coping and low reception of negative congregational support. Overall social support was relatively high. The sample reported high fat intake, with an estimated 46% of energy from fat for men and 43% for women, yet was also fairly active.

Regressions

Most religion variables were not significantly related with fat consumption when demographics were controlled. There were no relationships between any measures of religion and fat intake in men (Table 2). However, there were significant relationships between denomination and fat intake in women (Table 2), with those indicating a 'Conservative Protestant' or 'Other' religious denomination reporting higher estimated percentage of energy from fat than those indicating a 'Catholic' religious denomination. Adding social support to the model did not substantially change the relationship between religious denomination and fat intake in women (Table 2).

There were several significant relationships with religion when moderate physical activity was examined as the dependent variable (Table 3), although most religion variables were not significantly related to physical activity. In men, greater prayer was related to increased moderate physical activity; in women, giving more money to religion was related to increased moderate physical activity. Adding social support did not substantially alter these significant relationships between religion and moderate physical activity. Regressing vigorous physical activity against the religion variables yielded no significant relationships in men (Table 4). In women, more money given to religion was associated with increased vigorous activity, and social support did not affect this relationship between religion and vigorous physical activity.

Discussion

Conservative Protestant women, women specifying a religious affiliation of 'Other' and women indicating no religion reported higher estimated percentage energy from fat than women indicating a Catholic denomination, controlling for age, race, marital status, education and employment. With the exception of the non-religious, these relationships between denomination and fat intake remained significant when social support was added to the model. There were no relationships between religion and fat intake in men. This overall lack of significant relationships is consistent with previous research by Merrill and Thygerson[37] and Mahoney *et al.* (unpublished). However, there were some significant relationships between religion and fat intake by religious denomination among women. These denominational differences in dietary fat are consistent with Shatenstein *et al.*[29] and Mullen *et al.*[30].

Regarding religion's relationship with physical activity, greater religious commitment (giving money to religion) was related to greater moderate and vigorous physical activity in women. For men, prayer was related to increased moderate physical activity. Social support did not change the magnitude of these significant relationships. Religion's relationship with greater physical activity is consistent with Wallace and Forman[33] and Mahoney

https://doi.org/10.1079/PHN2004601 Published online by Cambridge University Press

Table 1 Frequencies†

Variable	Men ($n = 193$)	Women ($n = 353$)
Demographics		
Age (years)	42 ± 20.8	44 ± 20.5
Race/ethnicity (white)**	74	85
Education*		
High school or less	16	16
Associates degree or some college	27	33
Bachelor's degree	20	24
Graduate degree	37	26
Married*		
Never married	38	33
Married	56	52
Previously married	7	15
Employed (yes)*	82	73
Independent variables		
Denomination**		
Conservative Protestant	36	24
Mainline Protestant	19	21
Catholic	21	35
Other	18	14
No religious preference	6	6
Religious attendance (1 = never, 6 = once a week or more)	4.9 ± 1.2	4.7 ± 1.3
Religious application (1 = low, 4 = high)	3.4 ± 0.7	3.4 ± 0.7
Religious commitment		
Religious commitment (1 = low, 4 = high)**	3.5 ± 0.6	3.4 ± 0.7
Money given to religion (1 = low, 4 = high)	3.0 ± 0.9	2.8 ± 1.0
Hours given to religion	5.6 ± 6.8	6.2 ± 12.6
Religious identity (1 = low, 4 = high)	3.2 ± 0.7	3.2 ± 0.7
Religious coping		
Positive religious coping (1 = low, 4 = high)	2.9 ± 0.9	2.9 ± 0.9
Negative religious coping (1 = low, 4 = high)	1.3 ± 0.4	1.3 ± 0.5
Congregation social support		
Positive congregation support (1 = low, 4 = high)	2.7 ± 0.8	2.7 ± 0.9
Negative congregation support (1 = low, 4 = high)	1.4 ± 0.6	1.4 ± 0.5
Divine social support		
Relationship with God (1 = low, 7 = high)	5.2 ± 1.4	5.3 ± 1.5
Pray to God (yes)	95	94
Prayer (1 = low, 4 = high)	2.9 ± 0.8	2.8 ± 0.8
Psycho-social variable		
Social support (1 = low, 3 = high)*	2.6 ± 0.3	2.7 ± 0.3
Dependent variables		
Percentage energy from fat**	46.0 ± 11.6	42.9 ± 12.1
Moderate physical activity (1 = never, 6 = several times a week or more)	5.3 ± 1.1	5.3 ± 1.2
Vigorous physical activity** (1 = never, 6 = several times a week or more)	4.5 ± 1.7	4.1 ± 1.8

† Values are expressed as mean ± standard deviation or %.
Significant differences by gender: *, $P < 0.05$; **, $P < 0.01$.

et al. (unpublished), but not with Steffen *et al.*[38], whose only measure of religion was religious coping. Perhaps different aspects of religion work concurrently in relationship to physical activity.

It is unclear why those with certain denominations have different fat intakes, and why only particular aspects of religion were related to physical activity. Conservative Protestants hold ideological, family and political attitudes distinct from those of mainstream American culture and other religions. For instance, Conservative Protestants are generally more supportive of traditional gender roles and have selective tendencies towards greater intolerance[53]. These distinct attitudes may extend to dietary practices as well, producing different food cultures, cooking and preparation norms, and meal patterns. The greater fat intake of the non-religious and those in the 'Other' religious group may also stem from their marginality in mainstream society.

In women, the consistent relationship between religious commitment and exercise in both moderate and vigorous activity could illustrate women who participate in more church-related and other activities, some of which could include physical activity in the form of active church projects, church-based recreation and sports, and volunteer activities. Another possible explanation is that those women who give financially to their religion may be wealthier, and thus have greater resources and opportunities to exercise. The lack of an income measure in the data precludes the direct testing of this hypothesis, although controlling for education should have accounted

https://doi.org/10.1079/PHN2004601 Published online by Cambridge University Press

Table 2 Regression of fat intake on religion†

	Men		Women	
	Social support not controlled	Social support controlled	Social support not controlled	Social support controlled
Denomination‡				
Conservative Protestant	0.49 (2.7)	0.81 (2.7)	5.4 (2.0)**	5.4 (2.0)**
Mainline Protestant	2.1 (3.0)	2.2 (3.0)	−0.02 (2.1)	−0.13 (2.1)
Other	4.4 (3.3)	4.8 (3.3)	4.7 (2.2)*	4.8 (2.2)*
No religious preference	−0.38 (3.4)	−0.83 (3.4)	5.7 (2.9)*	5.2 (2.9)
Religious attendance	−0.37 (0.72)	−0.32 (0.71)	−0.19 (0.54)	−0.10 (0.55)
Religious application	0.34 (1.1)	0.59 (1.2)	0.65 (0.96)	0.90 (0.99)
Religious commitment				
Scale	1.2 (1.4)	1.2 (1.4)	0.17 (1.3)	0.24 (1.3)
Money given to religion	−0.72 (1.3)	−0.43 (1.3)	−0.12 (0.94)	0.14 (0.97)
Hours given to religion	−0.09 (0.16)	−0.10 (0.16)	−0.02 (0.05)	−0.02 (1.1)
Religious identity (1 = low, 4 = high)	−0.52 (1.3)	−0.30 (1.3)	−0.21 (1.0)	0.02 (1.1)
Religious coping				
Positive	0.55 (1.1)	0.74 (1.1)	0.09 (0.90)	0.25 (0.93)
Negative	0.83 (2.2)	−0.03 (2.4)	0.51 (1.5)	0.37 (1.6)
Congregation social support				
Positive	0.73 (1.3)	1.2 (1.4)	0.59 (0.83)	0.84 (0.87)
Negative	−2.3 (1.5)	−2.3 (1.5)	−0.09 (1.5)	−0.04 (1.5)
Divine social support				
Relationship with God	1.1 (1.1)	1.1 (1.2)	0.04 (0.85)	0.18 (0.85)
Pray to God (yes)	−2.9 (6.1)	−2.8 (6.0)	−5.5 (4.0)	−5.8 (4.0)
Prayer scale	−0.09 (1.8)	0.09 (1.8)	2.2 (1.3)	2.3 (1.4)

† Values represent unstandardised regression coefficients (standard errors); each regression model controlled for age, race, education, marriage and employment.
‡ 'Catholic' is the reference category for denomination.
Significant differences by gender: *, $P < 0.05$; **, $P < 0.01$.

Table 3 Regression of moderate physical activity on religion†

	Men		Women	
	Social support not controlled	Social support controlled	Social support not controlled	Social support controlled
Denomination‡				
Conservative Protestant	−0.29 (0.22)	−0.32 (0.22)	−0.00 (0.21)	−0.01 (0.20)
Mainline Protestant	0.05 (0.20)	0.07 (0.22)	0.20 (0.17)	0.21 (0.17)
Other	0.02 (0.23)	−0.00 (0.22)	0.20 (0.18)	0.19 (0.18)
No religious preference	−0.00 (0.27)	0.06 (0.27)	−0.03 (0.26)	0.04 (0.24)
Religious attendance	−0.03 (0.05)	−0.03 (0.05)	0.08 (0.05)	0.07 (0.05)
Religious application	0.01 (0.10)	−0.02 (0.10)	0.17 (0.09)	0.14 (0.09)
Religious commitment				
Scale	−0.08 (0.11)	−0.08 (0.11)	−0.08 (0.10)	−0.09 (0.10)
Money given to religion	0.06 (0.09)	0.02 (0.09)	0.22 (0.08)**	0.19 (0.08)*
Hours given to religion	−0.01 (0.01)	−0.01 (0.01)	−0.00 (0.01)	−0.00 (0.01)
Religious identity (1 = low, 4 = high)	−0.03 (0.10)	−0.08 (0.10)	0.08 (0.10)	0.05 (0.10)
Religious coping				
Positive	0.01 (0.09)	−0.03 (0.09)	0.01 (0.08)	−0.02 (0.08)
Negative	−0.14 (0.21)	0.00 (0.22)	−0.19 (0.15)	−0.15 (0.16)
Congregation social support				
Positive	−0.11 (0.11)	−0.18 (0.11)	0.07 (0.07)	0.04 (0.07)
Negative	0.11 (0.15)	0.14 (0.14)	−0.16 (0.13)	−0.16 (0.13)
Divine social support				
Relationship with God	−0.15 (0.08)	−0.15 (0.08)	0.04 (0.08)	0.03 (0.08)
Pray to God (yes)	−0.40 (0.37)	−0.43 (0.37)	−0.21 (0.34)	−0.15 (0.34)
Prayer scale	0.34 (0.15)*	0.31 (0.14)*	0.06 (0.12)	−0.08 (0.12)

† Values represent unstandardised regression coefficients (standard errors); each regression model controlled for age, race, education, marriage and employment.
‡ 'Catholic' is the reference category for denomination.
Significant differences by gender: *, $P < 0.05$; **, $P < 0.01$.

for this possibility to some extent. These women could also be more ritualistic, regularly giving money and consistently making physical activity a priority in their lives.

The relationship between prayer and moderate physical activity in men may be a marker of being active in everyday activities and not vigorous physical activity. Alternatively, this particular relationship could have been

https://doi.org/10.1079/PHN2004601 Published online by Cambridge University Press

Table 4 Regression of vigorous physical activity on religion†

	Men		Women	
	Social support not controlled	Social support controlled	Social support not controlled	Social support controlled
Denomination‡				
Conservative Protestant	−0.38 (0.37)	−0.44 (0.37)	−0.10 (0.27)	−0.10 (0.27)
Mainline Protestant	−0.08 (0.37)	−0.09 (0.37)	0.33 (0.27)	0.33 (0.27)
Other	−0.07 (0.38)	−0.10 (0.37)	0.11 (0.34)	0.10 (0.34)
No religious preference	0.51 (0.36)	0.60 (0.37)	0.10 (0.41)	0.13 (0.41)
Religious attendance	0.02 (0.10)	0.01 (0.10)	−0.04 (0.08)	−0.05 (0.08)
Religious application	0.05 (0.18)	−0.01 (0.18)	−0.14 (0.13)	−0.16 (0.13)
Religious commitment				
Scale	−0.21 (0.19)	−0.23 (0.20)	−0.32 (0.17)	−0.33 (0.17)
Money given to religion	0.14 (0.14)	0.08 (0.14)	0.25 (0.12)*	0.24 (0.12)*
Hours given to religion	−0.00 (0.02)	−0.00 (0.02)	0.00 (0.01)	0.00 (0.01)
Religious identity (1 = low, 4 = high)	−0.15 (0.15)	−0.23 (0.15)	−0.16 (0.15)	−0.18 (0.15)
Religious coping				
Positive	−0.01 (0.13)	−0.08 (0.12)	−0.10 (0.12)	−0.12 (0.12)
Negative	−0.47 (0.32)	−0.27 (0.33)	0.03 (0.18)	0.06 (0.18)
Congregation social support				
Positive	−0.04 (0.15)	−0.20 (0.15)	0.11 (0.11)	0.11 (0.11)
Negative	−0.02 (0.22)	0.05 (0.20)	0.02 (0.19)	0.02 (0.19)
Divine social support				
Relationship with God	0.11 (0.15)	0.11 (0.15)	−0.17 (0.12)	−0.18 (0.12)
Pray to God (yes)	−0.75 (0.70)	−0.80 (0.72)	−0.05 (0.61)	−0.01 (0.61)
Prayer scale	−0.08 (0.20)	−0.14 (0.20)	0.10 (0.18)	0.09 (0.18)

† Values represent unstandardised regression coefficients (standard errors); each regression model controlled for age, race, education, marriage and employment.
‡ 'Catholic' is the reference category for denomination.
Significant differences by gender: *, $P < 0.05$.

due to type I error, since the relationship between prayer and physical activity did not extend to vigorous physical activity.

Most surprising was the lack of an effect of social support on relationships between religion, fat intake and physical activity. Although existing literature shows a link between religion and social support, as well as between social support and health behaviours, these relationships were not substantial in this particular sample. The low number of non-religious in the sample limited the range of religiosity, which decreased the ability to examine the full range of religious involvement and detect significant differences. The range of religiosity in the sample was also further limited because the sample was comprised predominantly of church members. The results presented here represent relationships between religion and health behaviours in a fairly religious sample. Perhaps using a sample that is not predominantly religious could reveal more significant relationships between religion, social support, fat intake and physical activity.

Besides the restricted range of religiosity in the sample, several limitations must be kept in mind in interpreting the study's results. The cross-sectional design cannot provide strong evidence about the direction of causality: eating higher-fat foods and increased involvement in physical activity may lead to increased religiosity. A longitudinal study could better establish whether religion causes changes in fat consumption or physical activity. Given that multiple aspects of religion were examined separately in their relationship to fat intake and physical activity, not adjusting for multiple hypothesis testing may have also showed significant results between religion and health behaviours when they were due to chance alone[54]. However, adjusting for multiple hypothesis testing using a Bonferonni procedure or another technique would be an over-adjustment, especially given the high correlations between the religion variables[54]. Bonferonni adjustments were not conducted, but multiple *P*-values are shown for readers to permit them to make their own decisions about interpreting *P*-values[55]. The health behaviour measures' brief assessment of fat intake and physical activity may have limited sensitivity in examining relationships between religion and health behaviours compared with a more comprehensive measure. Other measures of nutrition would be useful, such as fruit and vegetable intake, to examine religion's relationship with aspects of nutrition in addition to fat intake. Furthermore, despite attempts to sample the non-religious in a variety of ways, the external validity of this study is limited to church members in one county in upstate New York.

Given these limitations, this study provides new information about relationships between religion and health behaviours by assessing religion as multifaceted and complex, and by specifically examining religion's relationship with physical activity and fat intake, controlling for appropriate demographics. Most prior studies reporting relationships between religion and health behaviours did not specifically examine religion's relationship to physical activity and fat intake as outcome

https://doi.org/10.1079/PHN2004601 Published online by Cambridge University Press

variables, used simple conceptualisations and assessments of religion, and/or did not control for appropriate demographics.

Taking into account the current study's weaknesses and strengths, the results suggest that future researchers examining fat intake and physical activity should not expect religion, as conceptualised in this paper, to play a considerable role in a fairly religious sample in predicting these health behaviours. Further studies of samples with a wider range of religiosity and more comprehensive measures of diet and physical activity need to be conducted to more definitively delineate religion's role. Examining different aspects of religion beyond religious support, coping and similar constructs may also clarify religion's relationship with diet and physical activity. Future studies tapping into specific doctrinal beliefs (e.g. the body as the 'temple of God') may reveal more potent religious variations in fat intake and physical activity. Some congregations' collective social activity surrounding food and food roles, particularly in women, may also reveal relationships between religion and diet. Religion may also support cultural food norms of particular communities, including the southern United States and some non-Southern African American communities, where consumption of foods prepared with high-fat ingredients is common[56]. Given that social contexts such as religion play an important part in shaping health behaviours, understanding what aspects of particular contexts are influential is important to encourage healthful behaviours and prevent illness.

Acknowledgements

The authors thank the Division of Nutritional Sciences at Cornell University for financial support in part from a Small Research Grant and in part from National Institutes of Health Training Grant DK07158.

References

1 Link BG, Phelan J. Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior* 1995; **36**: 80–94.
2 Shatenstein B, Ghadirian P. Influences on diet, health behaviours and their outcome in select ethnocultural and religious groups. *Nutrition* 1998; **14**: 223–30.
3 Regenstein JM, Chaudry MM. Kosher and Halal laws with an emphasis on important issues when considering fruit and vegetable coating. In: Gennadios A, ed. *Protein-Based Films and Coatings*. Boca Raton, FL: CRC Press, 2003; 601–20.
4 Fraser GE. Diet as primordial prevention in Seventh-Day Adventists. *Preventive Medicine* 1999; **29**: S18–23.
5 Duckro PN, Magaletta P, Wolf A. Health behaviors in religious communities. In: Gochman DS, ed. *Handbook of Health Behavior Research III: Demography, Development, and Diversity*. New York: Plenum Press, 1997; 305–22.
6 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. *American Journal of Geriatric Psychiatry* 1997; **5**: 131–44.
7 Ellison CG, Levin JS. The religion–health connection: evidence, theory, and future directions. *Health Education & Behavior* 1998; **25**: 700–20.
8 Ellison CG, George LK. Religious involvement, social ties, and social support in a southeastern community. *Journal for the Scientific Study of Religion* 1994; **33**: 46–61.
9 Bradley DE. Religious involvement and social resources: evidence from the data set 'Americans' Changing Lives'. *Journal for the Scientific Study of Religion* 1995; **34**: 259–67.
10 Kirkpatrick LA, Shillito DJ, Kellas SL. Loneliness, social support, and perceived relationships with God. *Journal of Social and Personal Relationships* 1999; **16**: 513–22.
11 Brome DR, Owens MD, Allen K, Vevaina T. An examination of spirituality among African American women in recovery from substance abuse. *Journal of Black Psychology* 2000; **26**: 470–86.
12 Brown JD. Body and spirit: religion, spirituality, and health among adolescents. *Adolescent Medicine* 2001; **12**: 509–23.
13 Hardert RA, Dowd TJ. Alcohol and marijuana use among high school and college students in Phoenix, Arizona: a test of Kandel's socialization theory. *International Journal of Addictions* 1994; **29**: 887–912.
14 Kelsey K, Earp JL, Kirkley BG. Is social support beneficial for dietary change? A review of the literature. *Family & Community Health* 1997; **20**: 70–82.
15 Silverman P, Hecht L, McMillin JD. Social support and dietary change among older adults. *Ageing and Society* 2002; **22**: 29–59.
16 Murphy PA, Prewitt TE, Bote E, West B, Iber FL. Internal locus of control and social support associated with some dietary changes by elderly participants in a diet intervention trial. *Journal of the American Dietetic Association* 2001; **101**: 203–8.
17 Stahl T, Rutten A, Nutbeam D, Bauman A, Kannas L, Abel T, *et al*. The importance of the social environment for physically active lifestyle – results from an international study. *Social Science & Medicine* 2001; **52**: 1–10.
18 Patterson I, Chang M. Participation in physical activities by older Australians: a review of the social psychological benefits and constraints. *Australasian Journal of Ageing* 1999; **18**: 179–85.
19 Salazar AJ, Becker SL, Daugherty V. Social support and smoking behavior: the impact of network composition and type of support on cessation and relapse. *Southern Communication Journal* 1994; **59**: 153–67.
20 McIntosh WA, Shifflett PA, Picou JS. Social support, stressful events, strain, dietary intake, and the elderly. *Medical Care* 1989; **27**: 140–53.
21 Terborg JR, Hibbard J, Glasgow RE. Behavior change at the worksite: does social support make a difference? *American Journal of Health Promotion* 1995; **10**: 125–31.
22 Steptoe A, Wardle J, Fuller R, Holte A, Justo J, Sanderman R, *et al*. Leisure-time physical exercise: prevalence, attitudinal correlates, and behavioral correlates among young Europeans from 21 countries. *Preventive Medicine* 1997; **26**: 845–54.
23 Amarantos E, Martinez A, Dwyer J. Nutrition and quality of life in older adults. *Journal of Gerontology: Series A* 2001; **56A**(Special Issue II): 54–64.
24 Drewnowski A, Evans WJ. Nutrition, physical activity, and quality of life in older adults: summary. *Journal of Gerontology: Series A* 2001; **56A**(Special Issue II): 89–94.
25 Sallis JF, Hovell MF, Hofstetter CR. Predictors of adoption and maintenance of vigorous physical activity in men and women. *Preventive Medicine* 1992; **21**: 237–51.
26 Parks SE, Housemann RA, Brownson RC. Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States.

Journal of Epidemiology and Community Health 2003; **57**: 29–35.
27 Leslie E, Owen N, Salmon J, Bauman A, Sallis JF, Lo SK. Insufficiently active Australian college students: perceived personal, social, and environmental influences. *Preventive Medicine* 1999; **28**: 20–7.
28 Chogahara M, Cousins SO, Wankel LM. Social influences on physical activity in older adults: a review. *Journal of Aging and Physical Activity* 1998; **6**: 1–17.
29 Shatenstein B, Ghadirian P, Lambert J. Nutritional intakes and some health-related behaviours in ultra-orthodox (Hassidic) Jewish sects in Montreal. *International Journal of Food Sciences and Nutrition* 1993; **44**: 105–21.
30 Mullen K, Williams R, Hunt K. Irish descent, religion and food consumption in the west of Scotland. *Appetite* 2000; **34**: 47–54.
31 Chliaoutakis JE, Drakou I, Gnardellis C, Galariotou S, Carra H, Chliaoutaki M. Greek Christian Orthodox ecclesiastical lifestyle: could it become a pattern of health-related behavior? *Preventive Medicine* 2002; **34**: 428–35.
32 Waite PJ, Hawks SR, Gast JA. The correlation between spiritual well-being and health behaviors. *American Journal of Health Promotion* 1999; **13**: 159–62.
33 Wallace JM Jr, Forman TA. Religion's role in promoting health and reducing risk among American youth. *Health Education & Behavior* 1998; **25**: 721–41.
34 Neumark-Sztainer D, Story M, Perry C, Casey MA. Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. *Journal of the American Dietetic Association* 1999; **99**: 929–34, 937.
35 McIntosh WA, Shifflett PA. Dietary behavior, dietary adequacy, and religious social support: an exploratory study. *Review of Religious Research* 1984; **26**: 158–75.
36 Strawbridge WJ, Shema SJ, Cohen RD, Kaplan GA. Religious attendance increases survival by improving and maintaining good health behaviors, mental health, and social relationships. *Annals of Behavioral Medicine* 2001; **23**: 68–74.
37 Merrill RM, Thygerson AL. Religious preference, church activity, and physical exercise. *Preventive Medicine* 2001; **33**: 38–45.
38 Steffen PR, Hinderliter AL, Blumenthal JA, Sherwood A. Religious coping, ethnicity, and ambulatory blood pressure. *Psychosomatic Medicine* 2001; **63**: 523–30.
39 Kim KH, Sobal J, Wethington E. Religion and body weight. *International Journal of Obesity and Related Metabolic Disorders* 2003; **27**: 469–77.
40 Dillman DA. *Mail and Internet Surveys: The Tailored Design Method*. United States: John Wiley and Sons, 2000.
41 Jacobson CK. Religiosity and prejudice: an update and denominational analysis. *Review of Religious Research* 1998; **39**: 264–72.
42 Steensland B, Park JZ, Regnerus MD, Robinson LD, Wilcox WB, Woodberry RD. The measure of American religion: toward improving the state of the art. *Social Forces* 2000; **79**: 1–28.
43 Fetzer Institute Report/National Institute on Aging Working Group. *Multidimensional Measurement of Religious/Spirituality for Use in Health Research*. Kalamazoo, MI: Fetzer Institute Report/National Institute on Aging Working Group, 1999.
44 Pargament KI, Smith BW, Koenig HG, Perez L. Patterns of positive and negative religious coping with major life stressors. *Journal for the Scientific Study of Religion* 1998; **37**: 710–24.
45 Poloma MM, Gallup GH Jr. *Varieties of Prayer: A Survey Report*. Philadelphia, PA: Trinity Press International, 1991.
46 Poloma MM. The effects of prayer on mental well-being. *Second Opinion* 1993; **18**: 37–51.
47 Thompson FE, Kipnis V, Subar AF, Schatzkin A, Potischman N, Kahle L, *et al*. Performance of a short instrument to estimate usual dietary intake of percent calories from fat. *European Journal of Clinical Nutrition* 1998; **52**: S63.
48 Brim OG, Baltes PB, Bumpass LL, Cleary PD, Featherman DL, Hazzard WR, *et al*. *National Survey of Midlife Development in the United States (MIDUS), 1995–1996* [computer file], 1996, ICPSR version. Available at http://www.icpsr.umich.edu:8080/ICPSR-STUDY/02856.xml
49 Landerman R, George LK, Campbell RT, Blazer DG. Alternative models of stress buffering hypothesis. *American Journal of Community Psychology* 1989; **17**: 625–42.
50 Baghurst KI, Baghurst PA, Record SJ. Demographic and dietary profiles of high and low fat consumers in Australia. *Journal of Epidemiology and Community Health* 1994; **48**: 26–32.
51 Livingstone MBE, Robson PJ, McCarthy S, Kiely M, Harrington K, Browne P, *et al*. Physical activity patterns in a nationally representative sample of adults in Ireland. *Public Health Nutrition* 2001; **4**(5A): 1107–16.
52 Kaplan MS, Newsom JT, McFarland BH, Lu L. Demographic and psychosocial correlates of physical activity in late life. *American Journal of Preventive Medicine* 2001; **21**: 306–12.
53 Woodberry RD, Smith CS. Fundamentalism et al: Conservative Protestants in America. *Annual Review of Sociology* 1998; **24**: 25–56.
54 Keselman HJ, Cribbie R, Holland B. The pairwise multiple comparison multiplicity problem: an alternative approach to familywise and comparisonwise type I error control. *Psychological Methods* 1999; **4**: 58–69.
55 Sobal J. Health concerns of young adolescents. *Adolescence* 1987; **22**: 739–50.
56 Dirks RT, Duran N. African American dietary patterns at the beginning of the 20th century. *Journal of Nutrition* 2001; **131**: 1881–9.

https://doi.org/10.1079/PHN2004601 Published online by Cambridge University Press