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Abstract

Obesity and obesity-related morbidity and mortality is an ongoing concern in developed countries. Religion is associated with reduced premature mortality and morbidity. However, the association between religion and obesity is unclear and unexplored in the general English population.

This cross-sectional study uses Health Survey for England 2012 data to investigate the association of religious affiliation and BMI. A representative sample of 7414 adults (16 years or older) were included. Waist to hip ratio (WHR) was measured in a smaller sample and was explored as a secondary outcome. Interviews were administered, questionnaires self-completed, height and weight was measured.

Sequential linear regression models were used to adjust for health behaviours.

Religious affiliation was associated with a 0.91kg/m^2 higher BMI. Some of this was explained demographically, but it was not accounted for by smoking status, alcohol consumption or physical activity level. Evidence of this association was strongest amongst those affiliated to a Christian religion. A significantly higher WHR was also seen in Christian and Sikh men.

English prospective studies measuring intrinsic religiosity and dietary energy are needed. Religious communities may need greater healthy weight promotion or benefit from tailored interventions built on their beliefs.

Keywords

Religion, BMI, WHR, Obesity, health survey for England

Introduction

Rising levels of obesity are an ongoing cause for concern in Western countries, not least in England. The prevalence of obesity in the UK in 2011 was 24% in men and 36% in women (Health Survey for England, 2011). Obesity increases the risk of all-cause mortality, ischaemic heart disease, stroke, diabetes mellitus, chronic obstructive pulmonary disease and many cancers (The Surgeon General, 2001). Obesity is associated with psychological stress and a bidirectional increased risk of depression (Luppino et al, 2010).

Systematic review evidence from many observational studies suggests that religion is associated with a reduced risk of all-cause mortality, reduced risk of cardiovascular disease, greater well-being and happiness, less depression and faster recovery from depression and in some studies a lower rate of cancer (Koenig et al, 2012). This may be mediated through lifestyle choices as those who are religious tend to smoke less and drink less alcohol. Among some religions these practices are considered sinful in scripture e.g. drinking alcohol is prohibited under Islamic dietary law.

However the association of religion with obesity is less clear. A systematic review of cross sectional and prospective cohort studies up to 2010 found 36 studies investigating the association between religion or spirituality and body weight. Of these, seven (19%) reported a lower body weight among those who associated themselves with a religion, 14 (39%) reported a higher body weight, two (6%) had mixed results and 13 (36%) found no association. Examination of the highest quality studies found that in cross sectional studies religious involvement was associated with a higher BMI, particularly among ethnic minorities, but in longitudinal studies there was no association (Koenig et al, 2012). All these studies were in the US, except one in the Netherlands which found no association. They all adjusted for demographic variables and health behaviours.

Two of the cross-sectional studies carried out in the US explored the mediating effect of smoking status on the association between religion and BMI (Gillum, 2006; Kim et al, 2003). In both these studies the magnitude of the coefficient was reduced and the association was no longer significant after adjustment for smoking status. This suggested the association was sufficiently explained

because there were fewer smokers, who tend to weigh less (Lycett et al, 2011), in those affiliated to a religion.

Nonetheless the higher prevalence of obesity in those who are religious has resulted in efforts to tailor interventions to meet the needs of the religious communities. As such, in the US, weight loss programmes which incorporate a religious element have been developed. These have been associated with greater weight loss than standard programmes (Parker et al, 2010), positive dietary change (Djuric et al, 2009), increased physical activity (Duro et al, 2010) and greater adherence to treatment (Reicks et al, 2004). Even among those who are not religious, those who overeat seem receptive to incorporating a spiritual element into treatment programmes (Ronal & Libman, 2003).

Such studies carried out in the England are lacking and the applicability of these findings to the English population needs to be determined. The Health Survey for England, 2012 provides data on religious affiliation, BMI, waist to hip ratio (WHR), physical activity level, alcohol consumption and smoking. This data (National Centre for Social Research and University College London, 2012) was used primarily to investigate the association between religious affiliation and BMI and whether any such an association was mediated by differences in health behaviour. A secondary analysis investigated the association between religious affiliation and WHR. Further investigation explored these associations according to religion/belief type although some of these categories contained only a small sample number of individuals.

Method

The 2012 Health Survey was commissioned by the Health and Social Care Information Centre and carried out by the Joint Health Surveys Unit of NatCen Social Research and the Department of Epidemiology and Public Health at UCL (University College London), full details of the methodology are described elsewhere (Craig & Mindell, 2012) and summarised below for the purposes of this analysis.

Study Design

The Health Survey for England (HSE) is a cross-sectional annual survey which is part of a programme of surveys commissioned by the Department of Health to provide data on the population's health, personal characteristics and health behaviour.

Population

The 2012 HSE was the twenty-second annual survey of health in England. The core sample was designed to be representative of the population living in private households in England. The sampling frame was the small user Postcode Address File (PAF). The sample was selected using multi-stage stratified probability sampling.

Firstly, a random sample of primary sampling units (PSUs), based on postcode sectors, was selected. Within each selected PSU, a random sample of 16 postal addresses was then drawn. The sample comprised 9,024 addresses selected at random in 564 postcode sectors. The PSUs were randomly allocated to the 12 months of the year so that each quarter provided a nationally representative sample.

Sampling took place over 12 months from January to December 2012, and fieldwork was completed in March 2013.

Weighting

Sixty-four percent of the sample of households took part. Data collection involved an interview, followed by a visit from a specially trained nurse for all those who agreed. A total of 8,291 adults were interviewed and 5,470 adults had a nurse visit.

Selection weights and non-response weighting was incorporated into the weighting strategy. This included calibration weighting to ensure that the weighted distribution of household members in participating households matched Office of National Statistics (ONS) 2011 mid-year population estimates for sex/age groups and strategic health authority (SHA) region.

As not all those interviewed went on to have a nurse visit, further adjustment was made to reduce non-response bias. A logistic regression model, with the outcome variable of whether or not a nurse visit was undertaken was fitted. The following covariates were included: age group by sex, household type, SHA, social class, smoking status, and general health. The weights for non-response to the nurse visit were calculated as the reciprocal of the predicted probability of a nurse visit being undertaken, estimated from the regression models. These weights were re-scaled so that the weighted sample size for the nurse visit was the same as the achieved sample size.

Data Collection

Interviews were administered using Computer-Assisted Personal Interviewing (CAPI). A questionnaire was self-completed and height and weight was measured. Full sets of written instructions, covering both survey procedures and measurement protocols, were provided for both interviewers and nurses.

Interviewers and nurses who had worked on the previous year's Health Survey attended a full-day of refresher training sessions. All new interviewers and nurses were accompanied by a supervisor during the early stages of their work to ensure that interviews and protocols were correctly followed. Routine supervision of 10% of the work of both interviewers and nurses was carried out subsequently.

Quality control measures were built into the survey at both data collection and subsequent stages to check on the quality of interviewer and nurse performance. Recalls to check on the work of both interviewers and nurses were carried out at 10% of productive households. The computer program used by interviewers had in-built checks for data outliers.

Height and weight measurements

Interviewers were fully briefed on the administration of the survey. They were given training, including a practice session, on measuring height and weight, and were required to pass an accreditation test for these measures before working on the study. Weight was measured on medically validated scales (SECA 877); an individual was asked to remove shoes, heavy outer

clothing (jackets and cardigans), heavy jewellery, loose change and keys. Height was measured without shoes using a stadiometer.

Measuring waist to hip ratio

All nurses were professionally qualified before joining the NatCen team. They attended a two-day training session where they received equipment training and were briefed on the specific requirements of the survey with respect to taking anthropometric measurements to obtain waist to hip ratio. The mean of two close measurements of both waist and hip circumference was used.

Religion

The questionnaire asked 'What is your religion or belief?' There were options of noreligion, Christian (Catholic), Christian (all other denominations including Church of England, Protestant), Buddhist, Hindu, Jewish, Muslim, Sikh and any other religion.

For the primary purpose of this analysis religion was reclassified into 'religious affiliation', a binary variable of ‘no religion/not affiliated’ to a religion or belief and ‘affiliated’ to a religion or belief.

Physical activity

The questions on physical activity were originally adapted from the ‘Allied Dunbar National Fitness Survey’. For HSE 2012, the questions covered physical activity during working hours, at home and in the garden, walking, planned exercise and sport. They related to frequency, time and intensity of physical activity over the past four weeks. Questions were also included sedentary behaviour, muscle-strengthening activity for adults and older adults, and balance and co-ordination for older adults. The answers to these questions where collated into a summary variable of low, medium and high activity level.

Smoking Status

The interviewer asked about current and past smoking habits, including whether the individual had smoked in the previous 7 days (self -reported seven day point prevalence abstinence). From these answers summary variables was derived. Smoking status was split into current regular cigarette

smoker, ex-regular cigarette smoker or never regular cigarette smoker. This categorisation was used in this analysis as it classified those who smoked a rare cigarette as never smokers, and such smoking is unlikely to influence weight. A long established comprehensive review of cross sectional studies shows consistent evidence that the BMI in smokers is lower than both never-smokers and ex-smokers (Klesges et al, 1989). This may be a consequence of the appetite suppressing effects of smoking (Myiata et al, 2001) and the higher metabolic rate in smokers (Filozof et al, 2004). A review of cross-sectional and prospective cohort studies shows the difference between BMI in ex-smokers compared to never-smokers is less clear, but suggestive of a higher BMI in male ex-smokers in particular (Lycett, 2012).

Alcohol

The interviewer asked questions about alcohol consumption. For the purpose of this analysis frequency and quantity of drinking alcohol was of most interest. These have previously been shown to have a different and an independent association with body weight, such that higher quantity is more likely to be associated with a higher BMI (Hellerstedt et al, 1990; Breslow & Smothers, 2005; Colditz et al, 1991), but greater frequency of alcohol consumption is more likely to be associated with a lower BMI (Tolstrup et al, 2008; Tolstrup et al, 2005; Mannisto et al, 1996).
Frequency of drinking was recorded as whether respondents drank alcohol or not and the number of drinking days in the last week. Quantity was established by asking about the type, volume and number of alcoholic drinks drunk on the heaviest day in the last seven. Individuals were presented with a list, containing ‘normal strength’ beer/stout/cider, ‘strong’ beer/stout/cider (‘strong’ was defined as at least 6% alcohol by volume), spirits/liqueurs, sherry/martini, wine and other. Volume was recorded in small/medium/large glasses, fractions of a bottle, pints, large and small cans and later translated into units (one unit of alcohol is 10ml by volume of pure alcohol).

The interviewer asked for specific brand names and clarification on volume as necessary. Low alcohol drinks were excluded.

Ethical Approval

Ethical approval for the 2012 survey was obtained from the Oxford Research Ethics

Committee (reference number 10/H0604/56).

Statistical Analysis

The association between BMI and religious affiliation

Linear regression models were used to investigate the association between BMI and religious affiliation. Model 1 was an unadjusted univariate model, model 2 was adjusted for potential confounders of age; gender; ethnicity; social class; mental well-being as measured by General Health Questionnaire 12 item score (GHQ-12 score); and an individual's non-response weighting. Model 3 also adjusted for smoking status, model 4 for the frequency and quantity of alcohol consumption, model 5 for physical activity level; these models allowed us to explore whether an association between weight and religion could be explained by differences in these health behaviours. Missing values were inputted using the sample mean.

Descriptive statistics of BMI, health behaviour and different religious categories

Bar charts were plotted to display BMI and health behaviour across the different religious categories to allow for visual inspection.

The association between BMI and different religious categories

Two models were used to investigate this association, an unadjusted univariate model and a model fully adjusted multivariate model.

The association between WHR and religious affiliation

Linear regression models were repeated to investigate the association between WHR and religious affiliation. Analysis for WHR was carried out separately in men and women as the healthy range differs by gender.

Descriptive statistics of WHR and different religious categories

Bar charts were plotted to display WHR across the different religious categories in men and in women. An unadjusted and an fully adjusted linear regression model tested whether the difference

between WHR in those from different religions was significantly different to the WHR of those with no religious affiliation.

Results

Descriptive characteristics

There were 8291 people in the survey, 11% of the sample had a missing value for religion, so 7414 were included in the analysis. There were no marked differences between the characteristics of the total sample and those who provided data on religion (Table 1). Of the 7414 people, 5180 (70%) were affiliated to a religion and 2234 (30%) were not. Those affiliated to a religion were older, had a higher BMI, drank less alcohol than those not affiliated to a religion. A lower proportion of those affiliated to a religion smoked, were in routine/manual occupations and had higher levels of physical activity. A higher proportion were Black, Asian and female (Table 1). To account for these differences, characteristics were entered into our multivariable regression analysis as described in the methods section above.

The association of religious affiliation with BMI

Unadjusted regression analysis showed those who were affiliated to a religion had a significantly higher mean (95% CI) BMI of 0.91 (0.72, 1.20)kg/m^2 than those not affiliated to a religion (model 1, Table 2). Demographical characteristics of age, gender, social economic class and ethnicity; GHQ-12 score and adjusting for weighting for non-response accounted for 38% of this association. This was demonstrated by a reduction in the coefficient for religious affiliation from 0.91 to 0.60 (0.31, 0.85)kg/m^2 which remained statistically significant ($p<0.001$) (model 2, Table 2).

Additional adjustment for smoking status (model 3, Table 2), frequency and quantity of alcohol consumed (model 4, Table 2) and physical activity level (model 5, Table 2) had very little influence on the coefficient of religion with BMI. After adjustment this coefficient remained statistically significant ($p<0.001$) and clinical important such that those who were affiliated to a religion had a 0.58kg/m^2 higher BMI than those not affiliated to a religion.

BMI and health behaviours in different religious categories

BMI was higher in those affiliated to the Christian religion and lower in those who described themselves as Buddhist (Figure 1). Looking at the pattern of health behaviours (smoking (Figure 2), physical activity level (Figure 3), frequency of drinking alcohol (Figure 4), quantity of alcohol consumed (Figure 5) in the different religious categories, these did not visibly appear to consistently mirror the differences in BMI.

Comparing BMI of those not affiliated to a religion, with those in different religious categories, showed that there a significantly higher BMI in Christians and a significantly lower BMI in Buddhists. These associations remained after adjustment for confounding factors (Table 3) such that being Catholic was associated with a mean 0.45kg/m^2 95% CI (0.01, 0.77) higher BMI than having no religion. Being of another Christian denomination was associated with a mean 0.68kg/m^2 95% CI (0.40, 0.95) higher BMI than having no religion. While being Buddhist was associated with a mean 1.86kg/m^2 95% CI (-3.49, -0.23) lower BMI than having no religious belief, however the small number of Buddhist's in this sample (n=33) and wide confidence intervals suggests this estimate may be imprecise.

The association between WHR and religious affiliation

In women, those who were affiliated to a religion had a statistically significantly higher WHR [0.015 95% CI (0.011, 0.019) (model 1, Table 4)] than those without a religious affiliation. However after adjustment for confounding factors and health behaviours this was no longer significant (model 2, Table 4).

In men, those who were affiliated to a religion had a statistically significantly higher WHR [0.021 95% CI (0.017, 0.025) (model 1, Table 5)] than those without a religious affiliation. Adjustment for confounders reduced the size of this association (model 2, Table 5), further adjustment for health behaviours did not influence this coefficient any further so did not explain the association (models 3-

5, Table 5).However the fully adjusted coefficient remained significant at 0.009 95% CI (0.005, 0.013) (model 5, Table 5).

WHR in different religious categories

The mean WHR for females (Figure 6) and males (Figure 7) in each religious category compared to those with no religion was only significantly higher, after adjusting for confounders, in men who were either Catholic (0.007 95%CI (0.001, 0.012)), Christian (0.010 95%CI (0.006, 0.015), or Sikh (0.050, 0.023, 0.078). Although there were only 17 Sikh men which contributed to this data.

Discussion

Those affiliated to a religion had a 0.91kg/m^2 higher BMI than those not affiliated to any religion. After adjustment for demographic variables (0.60kg/m^2) this association remained significant, further adjustment for health behaviours had little impact on this association resulting in 0.58kg/m^2 higher BMI in those affiliated to a religion. Therefore the difference in health behaviours (smoking status, alcohol consumption and physical activity) between those affiliated and those not affiliated to a religion did not account for this association.

Splitting the sample into different religious beliefs resulted in significant associations for Christians who had the highest BMI compared to those without a religion (+0.68kg/m^2), Catholics also had a higher BMI (+0.45kg/m^2) and Buddhists had a lower BMI (-1.86kg/m^2) although the sample of Buddhists was small and confidence intervals wide suggesting an imprecise estimate.

After adjustment with confounding variables WHR was significantly higher in men, most notably Christian men (+0.01) and Sikh men (+0.05), although the sample of Sikh men was small.

This was a large representative sample of the English population with non-response accounted for by weighting, and no notable differences between those who completed the question on religion and those who didn't. Weight, height and WHR were measured accurately according to a detailed protocol and quality checks were carried out regularly, however measures of religion and behaviour had their limitations.

The measure of religion used in this study was religious affiliation, this is only one dimension of religion and does not measure the level of religious engagement or the importance religion plays in a person's life. For example, no distinction can be made between those who are affiliated to a religion in name only and those who are intrinsically religious. Intrinsic religiosity defines a deeper level of religious engagement where religion influences personal decisions, drives behaviour and provides a strong sense of attachment to the divine. Such dimensions would need to be measured with the 10-item Hoge intrinsic Religiosity scale (Hoge, 1972) and would provide a more robust measure with which a dose response association could be explored. Different results may have been found if these different religious dimensions had been measured. A study in the Australian population found a higher BMI was associated with religious affiliation, but a lower BMI, in women, was associated with religious importance (Kortt & Dollery, 2012). Nonetheless this present study is the first study to explore any association of religion with BMI in the general English population. The findings here are consistent with high quality cross sectional studies in the US population which show religion, measured in a variety of ways, is associated with higher BMI (Koenig et al, 2012).

Data on smoking status, alcohol, and physical activity was collected by self-report. For reasons of social acceptance individuals may have recorded a more healthy behaviour profile than they actually had, this may have been more pronounced if some of these behaviours were discouraged in the religious community they were affiliated to. However this was a broad health survey with no specific emphasis on religion and this is unlikely. In addition, smoking less and drinking less alcohol among those who are religious is a common and consistent finding across many studies worldwide, particularly in religions where these practices are prohibited. A systematic review, up to 2010, of observational studies has reported that 122 out of 135 (90%) studies, and 100% of the most rigorous of these, show that religion is associated with less smoking (Koenig et al, 2012). Likewise 86% (282 out of 327) of observational studies and 90% of those with the best research designs report less alcohol use associated with religion (Koenig et al, 2012).

The association between physical activity and religion is less clear; of 37 studies 68% report greater activity with religion and 16% report less, across the best quality studies, findings are equivocal (Koenig et al, 2012). The cross sectional study reported here found a lower level of physical activity

in those religiously affiliated but this did not explain the difference in BMI. The coefficients for the association of physical activity on weight per se are consistent with expectations, that higher levels of physical activity are associated with lower BMI; this provides some confidence for the physical activity measure used here.

Well-designed studies are needed to explore whether differences in dietary energy mediate this association. It has been hypothesised overindulgence (while not advocated) is being overlooked as 'the lesser evil' in many religions. Alcohol excess and smoking may either be prohibited or socially unacceptable in these communities but rich food may continue to be celebrated, as a result those who engage with religion may feel more justified in eating more as they neither smoker nor drink alcohol (Cline & Ferraro, 2006).

As the study reported here is cross-sectional, it cannot provide any suggestion of whether religion or higher BMI comes first, and as such cannot be used to determine cause and effect, but it provides sufficient evidence for further exploration. Studies, particularly in the UK, with measures of religion that incorporate scales of intrinsic, as well as extrinsic, religiosity are needed to better understand the association of religion with BMI and whether a dose response relationship exists. Prospective cohort studies are needed to establish the direction of this association; do those who are more religious gain more weight or do those who struggle with weight gain find solace and acceptance in religion? If those who are more religious gain weight the role of diet needs to be explored by measuring dietary energy intake in particular. Those in religious communities may need greater health promotion regarding weight or may benefit from tailored interventions which are built on their beliefs.

The strongest evidence from this study shows a higher BMI in those affiliated to the Catholic and other Christian denominations, and a higher WHR in Christian and Sikh men. There has already been a large successful project, to improve the diet, through targeting social cooking in Gardwaras. Targeting Christian communities in England i.e. through church-based interventions may also be of particular importance. Church-based weight management interventions for the African-American communities have been particularly successful in the US. Both those which are faith-based, adding a spiritual dimension by including bible study, prayer, journaling and spiritual themes, and those which

are faith-placed have been shown to be effective through a systematic review of randomised controlled trials and cohort studies (Lancaster et al, 2014). Such faith–based models, tailored to those affiliated to a Christian religion in particular, should be explored further for the English population.

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535 Table 1. Descriptive characteristics of sample

		Not affiliated to a religion (n=2234) ((WHR)n=1460)		Affiliated to a religion (n=5180) ((WHR)n=3485)		Total sample with data on religion (n=7414)		Total sample (n=8291)	
		mean	(SD)	mean	(SD)	Mean	(SD)	mean	(SD)
BMI (kg/m^2)		26.62	(5.20)	27.70	(5.35)	27.38	(5.33)	27.36	5.32
age (years)		41.8	(17.2)	53.5	(18.0)	50.0	(18.9)	50.1	(18.8)
Alcohol units drunk on heaviest day, in last 7 days		7.2	(6.6)	5.4	(5.2)	6.0	(5.8)	6.0	(5.8)
Number of days consuming alcohol in last 7 days		2	(2)	2	(2)	1.9	(2.2)	1.9	(2.2)
GHQ-12 score		1.5	(2.7)	1.5	(2.8)	1.47	(2.74)	1.47	(2.75)
Waist/hip ratio (WHR)	Women	0.82	(0.07)	0.84	(0.07)	0.83	(0.07)	0.83	(0.07)
	Men	0.92	(0.07)	0.95	(0.07)	0.94	(0.07)	0.94	(0.07)
		% frequency		% frequency		% frequency		% frequency	
Smoking status:	current smoker	24.5		16.2		18.7		18.9	
	ex-smoker	24.6		26.7		26.1		26.1	
	never-smoker	50.9		57.1		55.2		54.9	
Social status:	routine/manual occupation	38.2		40.5		34.4		34.6	
	intermediate occupation	25.8		25.8		25.8		26.0	
	managerial/professional occupation	36.0		33.7		39.8		39.4	
Drinks alcohol	Yes	83.9		75.0		77.4		76.4	
	No	16.1		25.0		22.2		23.6	
Ethnicity:	White	95.2		87.5		89.9		89.1	
	Mixed ethnic group	1.6		1		1.2		1.2	
	Black or Black British	0.8		3.2		2.5		2.6	
	Asian or Asian British	2.1		7.5		5.9		6.2	
	Any other ethnic group	0.3		0.6		0.5		0.6	
Gender:	Women	51.3		41.1		55.8		55.6	
	Men	48.7		58.9		44.2		44.4	
Physical activity level:	Low	27.3		36.6		33.8		35.0	
	Medium	29.3		31.3		30.6		29.9	
	High	43.3		32.2		35.6		35.0	

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Table 2. Linear regression analysis for the association between religious affiliation and BMI

Model		Regression Coefficients	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	P value	P value for R^2 change (between models)
1	(Constant)	26.688	26.491	26.885		
	Religious affiliation	0.962	0.723	1.202	<0.001	
2*	(Constant)	26.251	25. 602	26.900		<0.001
	Religious affiliation	0.601	0.305	0.852	<0.001	
3*	(Constant)	25.973	25.309	26.638		<0.001
	Religious affiliation	0.604	0.351	0.855	<0.001	
	Ex-smoker (ref category: smoker)	0.982	0.663	1.301	<0.001	
	Never-smoker	0.286	0.008	0.564	0.043	
4*	(Constant)	25.565	24.868	26.262		<0.001
	Religious affiliation	0.596	0.347	0.846	<0.001	
	Whether drink alcohol	-0.0.31	-0.316	0.255	0.834	
	Frequency of drinking (days in last 7)	-0.207	-0.261	-0.154	<0.001	
	Level of drinking (units drunk on heaviest day in last 7)	0.82	0.058	0.107	<0.001	
5*	(Constant)	26.803	25.985	27.620		<0.001
	Religious affiliation	0.579	0.331	0.827	<0.001	
	Medium physical activity level (ref category: low)	-0.502	-0.764	-0.240	<0.001	
	High physical activity level	-1.455	-1.714	-1.195	<0.001	

*adjusted for age, gender, ethnicity, social class, GHQ-12 score, non-response weighting,

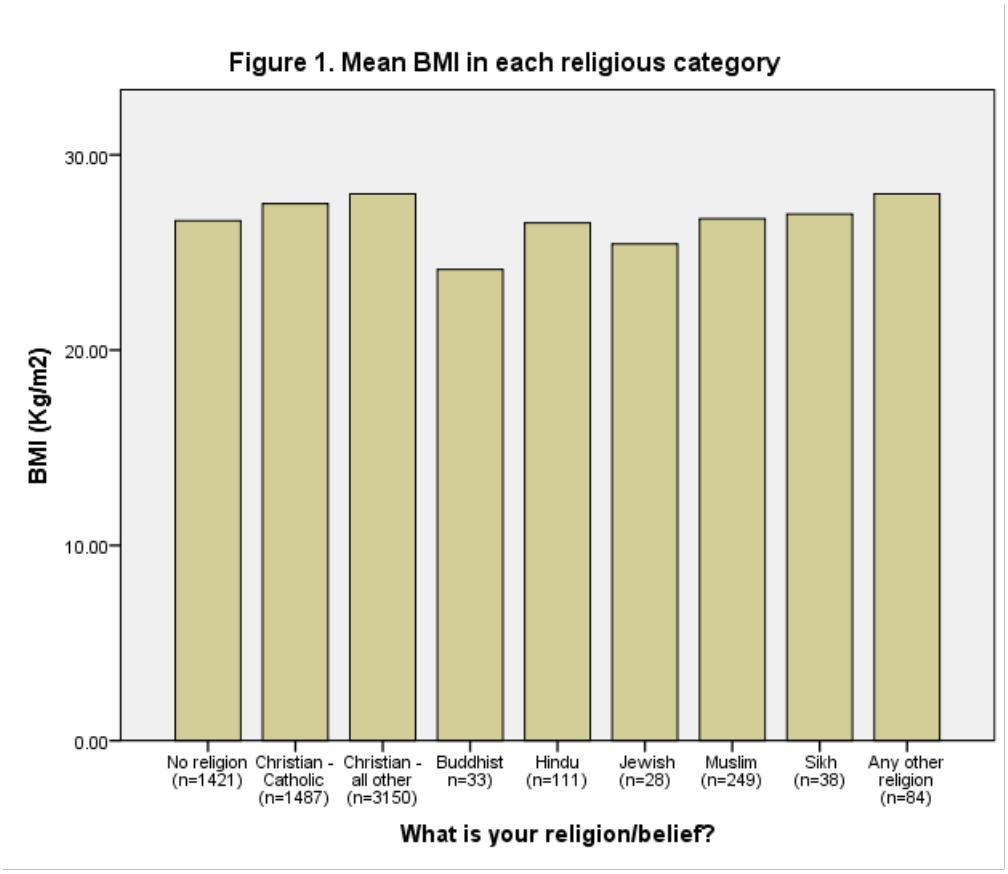
Figure 1. Mean BMI in each religious category
BMI (Kg/m2)
30.00
20.00
10.00
0.00
No religion (n=1421)
Christian - Catholic (n=1487)
Christian - all other (n=3150)
Buddhist n=33)
Hindu (n=111)
Jewish (n=28)
Muslim (n=249)
Sikh (n=38)
Any other religion (n=84)
What is your religion/belief?

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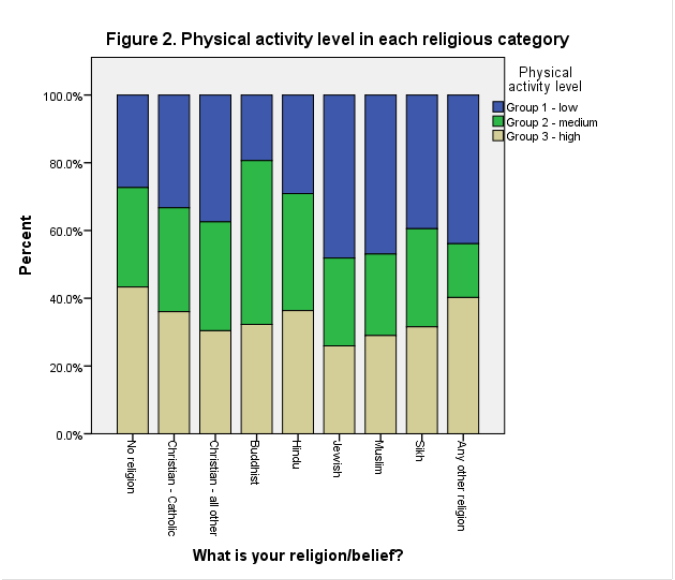
Figure 2. Physical activity level in each religious category
Physical activity level
Group 1 - low
Group 2 - medium
Group 3 - high
Percent
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
No religion
Christian - Catholic
Christian - all other
Buddhist
Hindu
Jewish
Muslim
Sikh
Any other religion
What is your religion/belief?

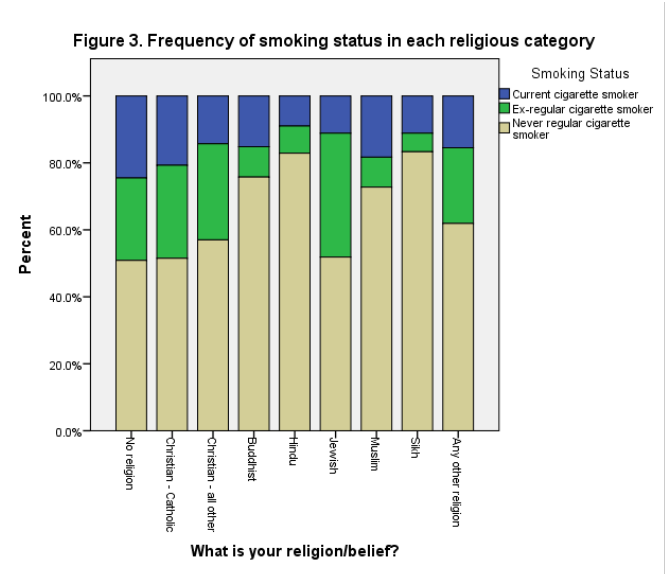
Figure 3. Frequency of smoking status in each religious category
Smoking Status
Current cigarette smoker
Ex-regular cigarette smoker
Never regular cigarette smoker
Percent
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
No religion
Christian - Catholic
Christian - all other
Buddhist
Hindu
Jewish
Muslim
Sikh
Any other religion
What is your religion/belief?

Figure 4. Quantity of alcohol drunk in each religious category

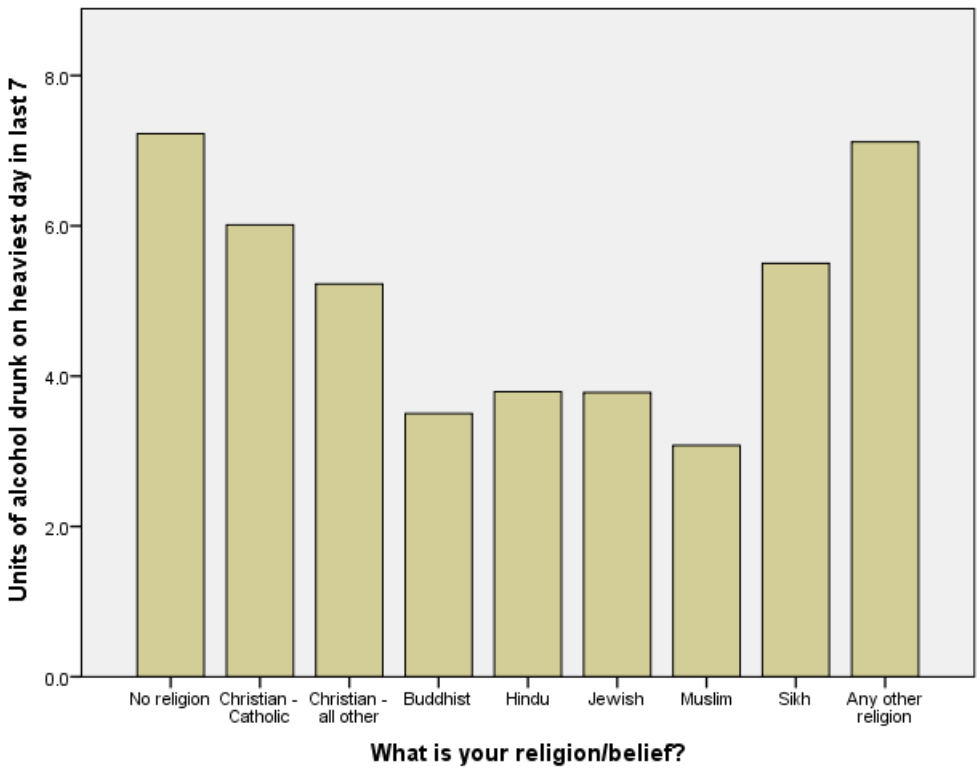

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Figure 5. Frequency of drinking alochol in each religious category

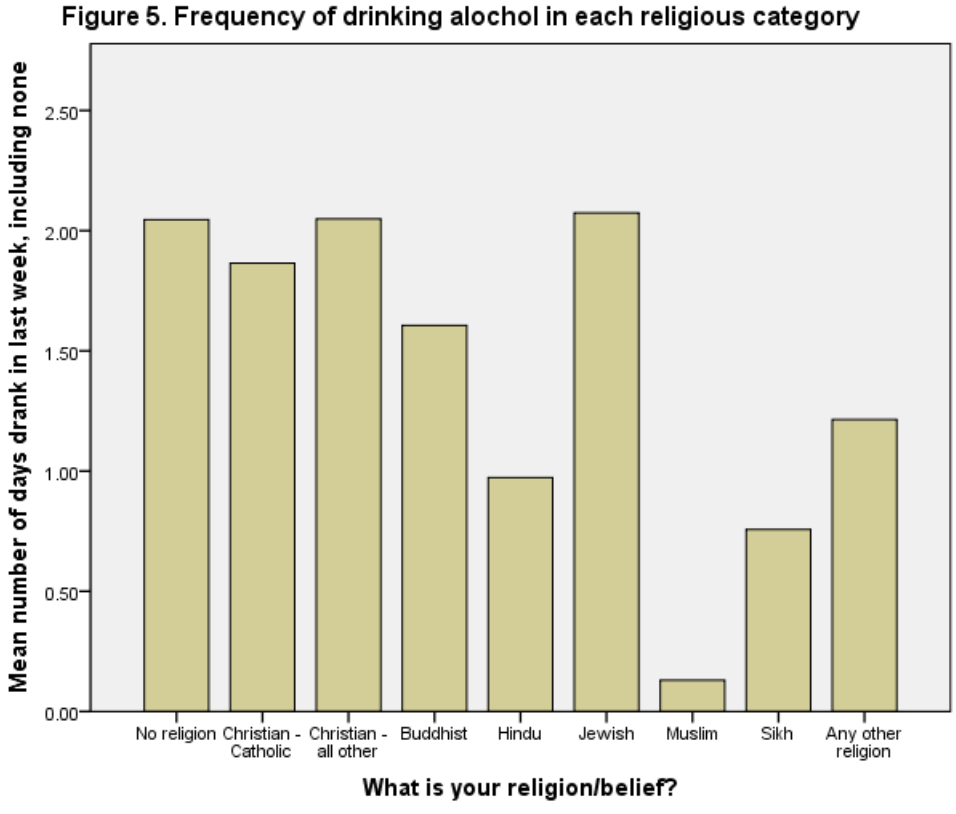

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Table 3. Linear regression analysis for the association between different beliefs and BMI

		Regression Coefficients	95% Confidence Interval		P value
			Lower Bound	Upper bound	
Fully adjusted* model	(Constant)	26.206	25.415	26.996	
	catholic	0.452	0.0137	0.766	<0.001
	Other Christian	0.675	0.403	0.947	0.005
	Buddhist	-1.861	-3.493	-0.228	<0.001
	Hindu	0.650	-0.423	1.722	0.025
	Jewish	-1.437	-3.187	0.312	0.235
	Muslim	0.563	-0.299	1.355	0.107
	Sikh	0.943	-0.656	2.542	0.164
	Other	0.833	-0.192	1.259	0.248

*adjusted for age, gender, ethnicity, social class, GHQ-12 score, non-response weighting, alcohol (whether drinker, frequency of drinking, level of drinking) and physical activity level.

Table 4. Linear regression analysis for the association between religious affiliation and WHR in women

Model		Regression Coefficients	95% Confidence Interval		P value	P value for R^2 change (between models)
			Lower Bound	Upper Bound		
1	(Constant)	0.824	0.820	0.827		
	Religious affiliation	0.015	0.011	0.019	<0.001	
2*	(Constant)	0.786	0.780	0.792		<0.001
	Religious affiliation	0.003	-0.001	0.007	0.126	

*adjusted for age, gender, ethnicity, social class, GHQ-12 score, non-response and interview weighting, alcohol (whether drinker, frequency of drinking, level of drinking) and physical activity level.

597 Table 5. Linear regression analysis for the association between religious affiliation and WHR in men
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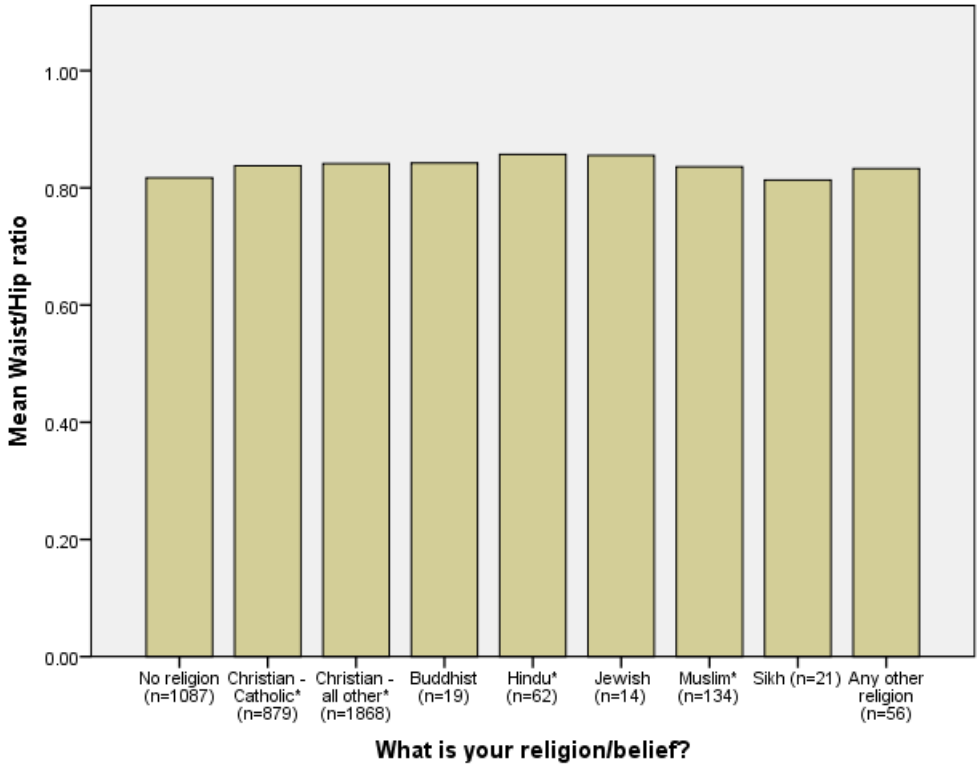
Model		Regression Coefficients	95% Confidence Interval Lower Bound	Upper Bound	P value	P value for R^2 change (between models)
1	(Constant)	0.923	0.920	0.927		
	Religious affiliation	0.021	0.017	0.025	<0.001	
2*	(Constant)	0.876	0.870	0.882		<0.001
	Religious affiliation	0.009	0.005	0.013	<0.001	
3*	(Constant)	0.885	0.878	0.892		<0.001
	Religious affiliation	0.009	0.005	0.013	<0.001	
	Ex-smoker (ref category: smoker)	<0.001	-0.005	0.005	0.922	
	Never-smoker	-0.013	-0.017	-0.008	<0.001	
4*	(Constant)	0.885	0.875	0.895		<0.012
	Religious affiliation	0.009	0.005	0.013	<0.001	
	Whether drink alcohol	-0.002	-0.007	0.003	0.450	
	Frequency of drinking (days in last 7)	-0.001	-0.002	<0.001	0.130	
	Level of drinking (units drunk on heaviest day in last 7)	<0.001	<0.001	0.001	0.108	
5*	(Constant)	0.906	0.895	0.917		<0.001
	Religious affiliation	0.009	0.005	0.013	0.005	
	Medium physical activity level (ref category: low)	-0.012	-0.017	-0.008	<0.001	
	High physical activity level	-0.020	-0.025	-0.016	<0.001	

599 *adjusted for age, gender, ethnicity, social class, GHQ-12 score, non-response and interview weighting,

Figure 6. Female mean WHR in religious category



*p<0.005 unadjusted model only

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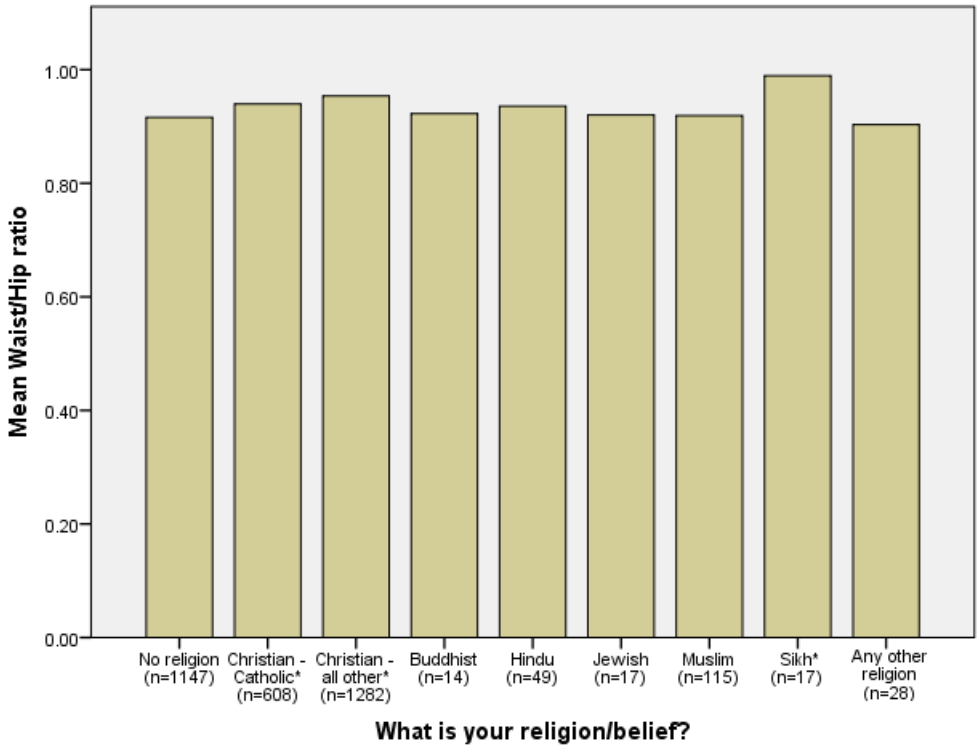
Figure 7. Male mean WHR in religious categories



*p<0.005 Adjusted model

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