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Title

Differences between vegetarian and omnivorous yoga practitioners – results of a nationally representative survey of US adult yoga practitioners

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Highlights

- The prevalence of vegetarianism is more than 6 times higher in yoga users than in the general population
- Vegetarian yoga users more often use meditation and perceive yoga more as a holistic practice than non-vegetarian yoga users
- Vegetarian yoga users also more often use yoga as a therapy for a specific health complaint than non-vegetarian yoga users

ABSTRACT

Background: To examine the prevalence of vegetarianism among yoga practitioners, and to explore differences and similarities between yoga practitioners who also use vegetarian diet and those who do not.

Design and setting: Using cross-sectional data from the 2012 National Health Interview Survey (NHIS) (N=34,525), weighted frequencies for 12-month prevalence of vegetarian diet use among yoga practitioners were analyzed. Logistic regression analyses were used to analyze sociodemographic and clinical predictors of vegetarian diet use.

Results: A total of 1.7 million US yoga practitioners have used a vegetarian diet in the past 12 months (8.3%), compared to 2.7 million non-yoga practitioners (1.3%). Yoga practitioners who were aged between 30 and 64 years as compared to being 29 years or younger were more likely to have used a vegetarian diet in the past 12 months; while those being in a relationship (OR=0.64), overweight (OR=0.54), smoking (OR 0.64) or having private health insurance (OR=0.59) were less likely. Vegetarian diet practitioners more often included meditation as part of their yoga practice and more often chose yoga because it had a holistic focus, and was perceived to treat the cause and not the symptoms of their health complaint.

Conclusions: Yoga practitioners following a vegetarian diet seem to embrace yoga more as a lifestyle than as a therapy.

Abbreviations

CAM: complementary and alternative medicine

CI: confidence interval

M: mean

NHIS: National Health Interview Survey

OR: odds ratio

SD: standard deviation

US: United States

Keywords: Diet; nutrition; vegan; vegetarian; yoga

1. BACKGROUND

The practice of Yoga, with its roots in ancient Indian culture and philosophy, has gained increased popularity in the West. Recent nationally representative estimates from the United States (US) indicate current lifetime and 12-month prevalence rates of yoga practice of 13.2% and 8.9%, respectively (1). Notably, the one-year prevalence of yoga use has shown a linear increase over 10 years based on US national survey data from 2002, over 2007, to 2012 (2). Similarly, the lifetime prevalence of yoga use in Germany has been estimated to be 15.1% (3).

The practice of yoga may take many forms involving various physical and energy or spiritual elements (4). As such, yoga cannot easily be seen separated from its perception as a health-related practice, and thus yoga is often referred to as a mind-body-practice within the field of complementary and alternative medicine (CAM), now also often referred to as complementary and integrative health (CIH) (5). Yoga as a spiritually rooted system promotes a lifestyle based on the practice of 'non-violence' (6), which may infer ethical considerations for the yoga practitioner that can also affect decisions about eating habits and food choices. This is one potential reason as to why yoga practitioners who fully embrace yoga's spiritual roots may prefer a vegetarian diet over an omnivorous or meat diet.

Vegetarianism, sometimes referred to as plant-based nutrition, is a broad term that captures a range of dietary patterns, such as vegan diets. The 2016 statement of the US Academy of Nutrition and Dietetics refers to a vegetarian diet as a diet free of all flesh food, which varies from one that incorporates dairy products (lacto-vegetarianism) or eggs (ovo-vegetarianism), to one that avoids all flesh, dairy and egg foods and sometimes honey (veganism) (7).

Research has indicated that a significant proportion of yoga practitioners, ranging from approximately 10% to 50%, may be categorized as vegetarians (8). Repeated use of yoga might influence the lifestyles of yoga practitioners, such as choosing vegetarianism, which may

be even more prevalent in practitioners with a longer history of yoga practice (9). Long-term yoga practice also may be indicative of yoga practitioners using additional CAM therapies for health needs (10). On the other hand, practitioners who perceive and use yoga more as a form of exercise, relaxation technique, or leisure, might be less likely to include a vegetarian or vegan lifestyle into their yoga practice.

The aim of this study was to examine the prevalence of vegetarianism among yoga practitioners, as well as explore potential differences and similarities between yoga practitioners who choose a vegetarian diet and those who do not. Through a secondary analysis of the 2012 National Health Interview Survey (NHIS), sociodemographic characteristics, practice patterns, as well as reasons for and perceived benefits of using yoga were compared between vegetarian and non-vegetarian yoga practitioners.

2. MATERIAL AND METHODS

This analysis was based on a nationally representative survey monitoring the health of the US population in 2012 (National Health Interview Survey, NHIS; <https://www.cdc.gov/nchs/nhis/>). For this analysis, data from the Family Core, the Sample Adult Core, and the Adult Complementary and Alternative Medicine questionnaire were used. Only those respondents who had used yoga in the past 12 months were selected for detailed analyses.

The Family Core and the Sample Adult Core collected data regarding participants' socio-demographic characteristics including age, gender, ethnicity, region, marital status, education, annual household income and self-perceived general health status. The Adult Complementary and Alternative Medicine (CAM) questionnaire collected data on the use of a number of interventions including special diets.

Prevalence of vegetarian diet use was determined with the following question: *Have you EVER used any of the following special diets for two weeks or more for health reasons: vegetarian, including vegan?* Those who answered 'Yes' were presented with an additional question asking whether they also had used a vegetarian diet during the past 12-months.

The prevalence of yoga practice was queried with the question: *Have you EVER practiced yoga?* Those who answered 'Yes' were presented with an additional question regarding the use of yoga in the past 12-months: *DURING THE PAST 12 MONTHS, did you practice yoga for yourself?* Those who had practiced yoga in the past 12 months (the sample) were further queried about whether they attended yoga classes or received formal yoga training; the number of yoga classes they attended, the costs associated with yoga classes; and the use of breathing exercises and/or meditation as part of their yoga practice. Further questions concerned reasons for yoga practice; the medical conditions yoga was used for (a total of 88 possible conditions); disclosure of yoga use to their personal health care provider and reasons for non-disclosure; perceived benefits of yoga use, and information sources about yoga.

2.1 Statistical Analyses

A total of 42,366 households were eligible and 34,525 adults provided data on complementary medicine use (response rate: 79.7%) (11). Overall, 33,402 (78.8%) adults responded to the questions on yoga use, with 2,974 (8.9%) reporting to have used yoga within the past 12 months. Population-based estimates were calculated using weights calibrated to the 2010 census-based population estimates for age, gender, and ethnicity of the US civilian non-institutionalized population.

The 12-month prevalence of vegetarian diet use among yoga practitioners was analyzed descriptively, as were details on yoga use, reasons for yoga practice and outcomes. Results were reported as means and standard deviations, medians and ranges, weighted frequencies and distributions as appropriate. Socio-demographic characteristics were compared between those yoga practitioners who had used a vegetarian diet within the last 12 months and those yoga practitioners who had not using chi square tests. Independent predictors of vegetarian diet use in the past 12 months were identified using multiple logistic regression analysis. The following socio-demographic predictors were considered: age (categories: 18-29; 30-39; 40-49; 50-64, 65 or older), gender (categories: female; male), ethnicity (categories: non-Hispanic White; Hispanic; African American; Asian; Other), region (categories: West; Northeast;

Midwest; South), marital status (categories: not in relationship; in relationship), education (categories: less than college; some college or more), and annual household income (categories: less than \$20,000; \$20,000 to \$34,999; \$35,000-\$64,999; \$65,000 or more). Additionally, health-related factors such as general health status (categories: excellent or very good; good; fair or poor), body mass index (categories: 18.5-25; <18.5; 25-30; 30 or more), health behaviors such as smoking (categories: non-smoker, smoker), alcohol consumption (categories: alcohol abstainer; light drinker; regular or heavy drinker), and exercise behavior (categories: low level exerciser, moderate level exerciser, high level exerciser); chronic medical conditions/diseases (categories: no chronic condition; one chronic condition; two chronic conditions; three and more chronic conditions); health insurance (categories: no health insurance; public health insurance; private health insurance) were also used as potential predictors.

A backward stepwise procedure with a likelihood-ratio-statistic p-value of ≤ 0.05 was chosen, and adjusted odds ratios with 95% confidence intervals were calculated. Only those variables associated with vegetarian diet use at a p-value of ≤ 0.005 (chi-square test) were included in the regression analyses. Statistical analysis was performed using the Statistical Package for Social Sciences software (IBM SPSS Statistics for Windows, release 22.0. Armonk, NY: IBM Corp.).

3. RESULTS

A total of 1.7 million US adult yoga practitioners have used a vegetarian diet in the past 12 months (8.3%), compared to 2.7 million non-yoga practitioners (1.3%). This equals 1.7 million (39.4%) adult vegetarian diet users who also have practiced yoga, compared to 19.2 million (8.6%) non-vegetarian diet users who have practiced yoga.

Predictors for having used a vegetarian diet in the past 12 months are presented in table 1. Yoga practitioners aged between 30 and 64 years, as compared to being 29 years or younger,

were more likely to have used a vegetarian diet; while those in a relationship (OR=0.64), overweight (OR=0.54), smoking (OR 0.64) or with private health insurance (OR=0.59) were less likely to have used a vegetarian diet in the past 12 months.

Differences in yoga practice among omnivores and vegetarians can be found in table 2. About half of yoga practitioners received formal yoga training, with higher number of yoga classes attended by vegetarian diet users. Twice as many yoga classes among vegetarian diet users were covered by insurance, with two thirds reporting full cover. Non-vegetarian diet users had a lower prevalence of full insurance coverage; however, an additional 40% of subjects had at least partial coverage, compared to none of the vegetarian diet users. The out-of-pocket cost of yoga was substantially larger in the vegetarian user group, with nearly double the average costs paid per visit. Vegetarian users also more frequently reported having bought self-help books or materials than non-vegetarian diet users. Table 2 indicates that vegetarian diet users also more frequently used a variety of information sources on yoga, including the internet, books, magazines or newspapers, scientific articles and health food stores. Yogic practice included yogic breathing exercises for 91.8% and 89.5%, and yogic meditation for 72.2% and 53.4% of vegetarian diet users and non-vegetarian diet users, respectively.

Yoga was considered one of the three most important CAM therapies for 37.83% of non-vegetarian yoga practitioners, and for 29.79% of vegetarian yoga practitioners. Among those for which yoga was among the top three complementary medicine interventions used, a high percentage indicated to have used it for general wellness or disease prevention (78.5% non-vegetarian vs. 89.4% vegetarian), to improve energy (65.5% vs. 83.7%) and for athletic or sports performance (48.5% vs. 59.0%), with higher rates reported amongst vegetarian diet users (see table 3).

Yoga practice motivated the vast majority of yoga practitioners to exercise more regularly (65.9% non-vegetarian vs. 72.3% vegetarian), eat healthier (46.6% vs. 59.2%), and eat more organic food (22.2% vs. 46.8%). As a result, yoga practice subjectively helped to reduce stress (84.4% vs. 92.2%), improve overall health (80.7% vs. 84.3%), give participants a sense of

control over their health (56.6% vs. 70.1%), and make participants feel better emotionally (65.2% vs. 80.3%) (table 3).

Overall, yoga was used for a specific health problem by 16.3% (non-vegetarian) and 31.0% (vegetarian), with the majority being back pain or problems (26.6% vs. 22.3%), frequent stress (10.6% vs. 12.2%), joint pain or conditions (9.2% vs. 10.5%) and arthritis (9.7% vs. 13.8%). Vegetarian yoga practitioners also reported using yoga for neurological problems (12.0%), but only 1.6% of non-vegetarian yoga practitioners did. Yoga practitioners reported that yoga had helped them a great deal (49.1% vs. 59.8%), or at least some (29.8% vs. 40.2%) with their condition.

Respondents reported using a variety of interventions for their health problem, including prescription medication (37.1% non-vegetarian vs. 46.8% vegetarians), over-the-counter medication (29.5% vs. 33.4%), and physical therapy (21.5% vs. 26.4%). Surgery was reported by a minority of non-vegetarian respondents (5.6%), but more frequently by vegetarian yoga practitioners (13.4%).

Those who used yoga reported that it was mainly used because it was natural (60.9% non-vegetarian vs. 80.9% vegetarian), they thought it would help in combination with medical treatment (75.8% vs. 77.0%), and because it focused on the whole person (69.8% vs. 82.2%). Compared to non-vegetarians, vegetarian yoga practitioners reported to use yoga much more frequently because medical treatments were too expensive (15.0% vs 24.7%), medical treatments did not work for the specific health problem (21.0% vs 41.8%), or because it treats the cause and not just the symptom (43.3% vs 61.2%) (table 3).

The use of yoga was mainly recommended by friends (41.8% non-vegetarian vs. 44.6% vegetarian) or family (20.4% vs. 20.4%), and disclosed to the personal health care provider in one third of cases (32.9% vs. 37.2%). The majority of those who did not disclose the use of yoga did so because their provider had not asked (56.6% vs. 60.3%), they thought that the provider did not need to know (45.0% vs. 54.0%), or because they did not use it at the time (24.0% vs. 27.3%). Only a very small percentage was worried about negative reactions (0.8%

vs. 4.0%) or being discouraged by their provider (0.0% vs. 0.9%). All in all, a large percentage indicated that the use of yoga was very important for maintaining their health and well-being, with a lower rate reported among non-vegetarians than vegetarians (35.2% vs. 57.7%) (table 3).

4. DISCUSSION

This research sheds further light on the profile of US yoga practitioners by drawing comparisons between practitioners that follow a vegetarian diet and those that follow a non-vegetarian diet. The research highlights distinct differences between the two cohorts, with vegetarian yoga users more likely to be older, not in a relationship, normal or underweight, a non-smoker, without private health insurance, and investing more in formal yoga training (in terms of number of classes attended and out-of-pocket costs), than non-vegetarian yoga users. There were also notable differences between yoga practitioners following a vegetarian diet versus a non-vegetarian diet with regards to reasons for yoga use, perceived outcomes of yoga, clinical indications of yoga use, reasons for non-disclosure of yoga use, and information seeking behavior.

The findings point toward a high prevalence of vegetarian diet among yoga practitioners, with several factors likely to explain these findings. Fundamentally, vegetarianism is an integral part of many forms of yoga (12). This is certainly evident among yoga practitioners in the US, where the rate of vegetarianism has been reported as four times that of the general US population (8). Pilot research has also demonstrated high rates of orthorexia nervosa (or a fixation on righteous eating) among yoga practitioners in Spain, particularly among those that are vegetarian (13). Collectively, these factors almost certainly contribute to a culture of vegetarianism in yoga.

Vegetarian yoga practitioners also differed from non-vegetarian yoga practitioners in that they were more likely to incorporate yogic breathing exercises and yoga meditation into their yoga

practice relative to non-vegetarian yoga practitioners. This suggests that yoga practitioners following a vegetarian diet may be embracing yoga as a lifestyle – that is, adopting multiple components / limbs of yoga (such as postures [Asana], meditation [Dhyana], self-discipline [Niyama], breath control [Pranayama], and ethical standards [Yama] into their daily routine) - rather than just a single element. Lending support to this claim are the reasons for yoga use as identified by survey respondents, with more vegetarian yoga practitioners indicating that yoga motivated them to eat healthier, eat more organic food, exercise regularly and cut back on alcohol and tobacco use relative to non-vegetarian yoga practitioners. This profile is not dissimilar to users of complementary and alternative medicine (CAM) in general, who report a relatively higher rate of exercise and fruit and vegetable consumption than non-CAM users (14, 15).

Vegetarian yoga practitioners were also similar to users of CAM in that they were more likely to be middle-aged, non-smokers, and normal or underweight (14, 16). However, vegetarian yoga practitioners differed from CAM users in that they were less likely to have private health insurance (14). This finding is inconsistent with previous research, which has reported significantly higher rates of CAM use (including yoga) among privately insured populations (2). This might be explained by the fact that, while using vegetarian diet for health is generally considered a part of CAM, it is generally self-prescribed and used as self-care and therefore, is not covered by private health insurance.

The health benefits of the vegetarian diet are well documented, with evidence of an association between vegetarian diet and reduced risk of chronic disease, including metabolic syndrome (17), ischaemic heart disease and cancer (18). A greater proportion of vegetarian yoga practitioners than non-vegetarian yoga practitioners in the current study reported using yoga for a specific health problem (including arthritis and neurological problems). In addition, vegetarian yoga practitioners were more likely to report the use of other therapies to manage the specific health condition, adding that medical treatment was expensive and ineffective in managing the condition. This could suggest that the simultaneous use of yoga and

vegetarianism may be driven by morbidity and disease burden. It might however also be explained by the finding that vegetarian yoga practitioners were less likely to have a private health insurance. Medical treatment might thus simply be too expensive for them so that other ways of treatment were explored. The higher rate of health information seeking behavior in this group lends support to this proposition. The causality for this association thus remains unclear. Notably, health was not the only key predictor of vegetarianism in yoga practitioners. The findings additionally suggest that this group may hold a view / philosophy of health that is different to non-vegetarian practitioners users, with the former more likely to choose yoga as it enabled one to practice on their own [thus supporting an internal locus of control], had a holistic focus, and was perceived to treat the cause and not the symptoms of their health complaint. The latter indicates that many vegetarian yoga practitioners were dissatisfied with the medical model, and to some extent, with medical treatments, with this group also more likely to choose yoga because of the cost, side effects and/or perceived ineffectiveness of medical treatments. This does not depart too far from the views of CAM users in general, who share similar pull (i.e. views of health) and push factors (i.e. concerns regarding the safety and effectiveness of Western medicine) (19, 20). This further supports the view that vegetarian yoga practitioners choose yoga not just as a 'treatment', but as a lifestyle choice.

Whilst this secondary analysis draws data from a large, nationally representative sample, there are some limitations to this research that should be given consideration in the interpretation of the findings. Firstly, the NHIS is a cross-sectional study; as such, the results can only suggest an association between variables, not causation. Secondly, the data collected for this survey was self-reported, and because of this, the presence of recall bias and measurement error cannot be excluded. Thirdly, since vegetarian yoga practitioners were older than non-vegetarian practitioners, some associations (such as higher likelihood of using yoga to treat a specific disease) might be mainly driven by age differences between groups. Lastly, the reasons for choosing vegetarianism were not explored; instead, there was an assumption that

yoga may have been a strong driver of vegetarianism, which may or may not have been the case.

5. CONCLUSIONS

Vegetarian diet is common among yoga practitioners, and yoga practitioners who follow a vegetarian diet differ from those who do not in terms of sociodemographic, health-related and psychological variables. Yoga practitioners following a vegetarian diet also seem to embrace yoga more as a lifestyle than as a therapy. Further in-depth investigation of reasons for use or non-use of vegetarian diet among yoga practitioners is needed as well as research on the combined health effects of yoga and vegetarianism.

Declarations

Ethics approval and consent to participate: The National Health Interview Survey was approved by the Research Ethics Review Board (ERB) of the National Center for Health Statistics. All participants provided informed consent to participate.

Competing interests: The authors declare that they have no competing interests.

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TABLES

Table 1: Predictors of vegetarian diet use among yoga practitioners as per logistic regression analysis. Odds Ratios (OR) and 95% confidence intervals (CI) for having used a vegetarian diet are presented.

	Vegetarian diet use (12 months) OR (95% CI)
Age	
18 to 29	Reference
30 to 39	1.62 (1.10; 2.39)
40 to 49	1.74 (1.14; 2.66)
50 to 64	2.19 (1.48; 3.23)
65 or greater	1.07 (0.57; 2.01)
Marital status	
not in relationship	Reference
in relationship	0.64 (0.48; 0.84)
BMI	
18.5 to 25	Reference
up to 18.5	1.01 (0.47; 2.20)
25-30	0.54 (0.37; 0.75)
30 and more	0.71 (0.49; 1.04)
Smoking	
Non smoking	Reference
Smoking	0.64 (0.41; 0.99)
Health insurance	

No insurance	Reference
Public health insurance	1.00 (0.57; 1.73)
Private health insurance	0.59 (0.41; 0.85)

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Table 2: Details of yoga formal training. M: mean, SD: standard deviation.

	% of non-vegetarian yoga practitioners	% of vegetarian yoga practitioners
Took a class/received formal training, %	51.3	50.0
Knows the number of times of yoga classes, %	83.7	89.0
No. of yoga classes attended, M \pm SD (Median)	17.9 \pm 17.6 (10)	22.0 \pm 18.5 (15)
Costs of classes covered by insurance, %	4.9	9.3
All costs covered, %	54.1	63.4
Some costs covered, %	41.1	0.0
Knows the amount paid out of pocket, %	70.8	80.8
\$US paid in 12 months, M \pm SD (Median)	197.5 \pm 332.0 (80)	481.0 \pm 1342.8 (100)
\$US paid per visit, M \pm SD (Median)	17.4 \pm 27.6 (10)	32.9 \pm 6.1 (35)
Bought self-help books/material, %	22.7	28.3
\$US paid for books/material, M \pm SD (Median)	31.3 \pm 40.5 (20)	30.0 \pm 33.3 (20)

Table 3: Reasons for yoga practice, anticipated and experienced outcomes, disclosure of yoga use and information sources

Items	% of respondents	% of respondents
	non-vegetarian	vegetarian
	yoga practitioners	yoga practitioners
Reasons to use yoga		
For general wellness or general disease prevention	78.5	89.4
To improve energy	65.5	83.7
To improve immune function	28.1	49.6
To improve athletic or sports performance	48.5	59.0
To improve memory or concentration	29.1	52.8
Did using yoga motivate to ...		
Eat healthier	46.6	59.2
Exercise more regularly	65.9	72.3
Cut back or stop drinking alcohol	11.5	20.5
Cut back or stop smoking cigarettes	24.8	25.5
Eat more organic food	22.2	46.8
Did using yoga lead to ...		
Give a sense of control over health	56.6	70.1
Help to reduce stress level or to relax	84.4	92.4
Help to sleep better	57.1	74.6
Helps to feel better emotionally	65.2	80.3
Make it easier to cope with health problems	37.1	60.7
Improve overall health and make you feel better	80.7	84.3
Improve your relationships with others	38.9	47.0

Improve attendance at job or school	18.0	38.4
<hr/>		
How important was using yoga for maintaining health and well-being		
Very important	35.2	57.7
Somewhat important	49.1	34.9
Slightly important	13.4	6.6
Not at all important	2.2	0.7
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Used yoga for a specific health problem (top health problem)	16.3	31.0
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Specific health problems ^a :		
back pain or problem	26.6	22.3
frequent stress	12.2	10.6
joint pain or stiffness/other joint condition	10.5	9.2
arthritis	9.7	13.8
feeling anxious, nervous, or worried	9.7	6.9
muscle or bone pain	9.1	3.4
neck pain or problem	7.9	4.2
neurological problems	1.6	12.0
<hr/>		
Using yoga helped for specific health problem ^a ...		
A great deal	49.1	59.8
Some	40.2	29.8
Only a little	9.3	10.3
Not at all	1.4	0.0
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Has received the following for the specific health problem (for which yoga was used) ^a		

Prescription medication	37.1	46.8
OTC medication	33.4	29.5
Surgery	5.6	13.4
Physical therapy	21.5	26.4
Mental health counselling	12.1	20.7
<hr/>		
Yoga was used because ...		
Medical treatments were too expensive	15.0	24.7
Therapy combined with medical treatment would help	75.8	77.0
Medical treatments do not work for your specific health problem	21.0	41.8
Medications cause side effects	33.8	39.7
It can be practiced on your own	70.1	76.8
It is natural	60.9	80.9
It focuses on the whole person, mind, body, and spirit	69.8	82.2
It treats the cause and not just the symptoms	43.3	61.2
It was part of your upbringing	7.5	14.8
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Yoga was recommended by ...		
A medical doctor	6.2	10.6
A family member	20.4	20.4
A friend	41.8	44.6
A co-worker	10.5	11.7
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Yoga was disclosed to personal health care provider	37.2	32.9
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Yoga was not disclosed because ...		

Not used at the time	27.3	24.0
They discouraged use of it in the past	0.3	0.0
Being worried they would discourage it	0.9	0.0
Being concerned about a negative reaction	0.8	4.0
Didn't think they needed to know	45.0	54.0
They didn't ask?	60.3	56.6
Don't think they know as much about it as you do	4.9	12.4
They didn't give enough time to tell them	4.2	5.6
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Information sources on yoga		
The internet	26.7	39.5
Books, magazines, or newspapers	25.5	30.7
DVDs, videos, or CDs	31.4	27.9
Television or radio	11.5	13.5
Scientific articles	6.1	15.9
Health food stores	5.3	12.6

^aonly those practitioners were included in this analysis that had practiced yoga for a specific health problem
