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Catherine A. Forestell

Andrea M. Spaeth

Stephanie A. Kane

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Research report

To eat or not to eat red meat. A closer look at the relationship between restrained eating and vegetarianism in college females [☆]

Catherine A. Forestell*, Andrea M. Spaeth, Stephanie A. Kane

Psychology Department, The College of William & Mary, P.O. Box 8795, Williamsburg, VA 23185-8795, USA

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ABSTRACT

Previous research has suggested that vegetarianism may serve as a mask for restrained eating. The purpose of this study was to compare the dietary habits and lifestyle behaviors of vegetarians ($n = 55$), pesco-vegetarians ($n = 28$), semi-vegetarians ($n = 29$), and flexitarians ($n = 37$), to omnivores ($n = 91$), who do not restrict animal products from their diets. A convenience sample of college-age females completed questionnaires about their eating habits, food choice motivations, and personality characteristics. Results indicated that while vegetarians and pesco-vegetarians were more open to new experiences and less food neophobic, they were not more restrained than omnivores. Rather semi-vegetarians; those who restricted only red meat from their diet, and flexitarians; those who occasionally eat red meat, were significantly more restrained than omnivores. Whereas food choices of semi-vegetarians and flexitarians were motivated by weight control, vegetarians and pesco-vegetarians' food choices were motivated by ethical concerns. By focusing specifically on semi-vegetarian and flexitarian subgroups, more effective approaches can be developed to ensure that their concerns about weight loss do not lead to unhealthy or disordered eating patterns.

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Introduction

Greater emphasis on healthy lifestyles, which include a well-balanced diet, has led to increased interest in vegetarian diets over the past few decades (American Dietetic Association & Dietitians of Canada, 2003). As of 2009, approximately 3.4% of the US population (i.e., between 6 and 8 million individuals) indicated that they did not consume meat, poultry, or seafood, and approximately 1% of the adult population indicated that they were vegan (The Vegetarian Resource Group, 2009). Various groups have made claims that attest to the benefits associated with the exclusion of animal products from diets for all stages of the life cycle, including during pregnancy, lactation, infancy, childhood, and adolescence (Craig & Mangels, 2009). Indeed, a well-planned vegetarian diet can meet current recommendations by providing essential nutrients and lowering levels of saturated fat, and cholesterol (American Dietetic Association & Dietitians of Canada, 2003).

It has been postulated that for some individuals, vegetarian eating patterns may be motivated by weight control (Gilbody, Kirk, &

Hill, 1999). This has been supported by findings demonstrating that vegetarians have a higher rate of disordered eating than non-vegetarians (Klopp, Heiss, & Smith, 2003; Lindeman, Stark, & Latvala, 2000). Other findings suggest that dietary restraint and weight control are primary reasons identified by high school and college students for eliminating items such as meat and other animal products from their diet (Gilbody et al., 1999; Janelle & Barr, 1995; Klopp et al., 2003; Perry, McGuire, Neumark-Sztainer, & Story, 2001). Thus, some researchers have concluded that vegetarianism may provide a socially acceptable means to avoid certain foods in order to control body weight (Kadambari, Cowers, & Crisp, 1986; Klopp et al., 2003).

However, not all research has supported the relationship between dietary restraint and vegetarianism. Studies have found that samples of college-age vegetarians did not differ from their non-vegetarian counterparts on a range of measures that are associated with eating disorders such as laxative use, meal skipping, body mass index (Klopp et al., 2003), or on eating disturbance measures (Fisak, Peterson, Tantleff-Dunn, & Molnar, 2006) such as the Eating Attitudes Test (EAT; Garner, Olmsted, Bohr, & Garfinkel, 1982) and the Eating Disturbance Inventory (EDI; Garner, Olmsted, Bohr, & Garfinkel, 1982). Further, research suggests that the relationship between vegetarianism and dieting may only be present among certain groups of people. For example, some studies have found that adolescent vegetarians who have strong feminist views are more likely to be restrained eaters than their non-vegetarian

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* Corresponding author.

E-mail address: caforestell@wm.edu (C.A. Forestell).

counterparts (Bas, Karabuduk, & Kiziltan, 2005; Fisak et al., 2006; Greene-Finestone, Campbell, Evers, & Gutmanis, 2008; Martins, Pliner & O'Conner, 1999).

It is possible that these inconsistent findings are in part a result of variation in the composition of vegetarian samples. Vegetarianism is a broad term that encompasses a range of food avoidance and selection patterns that differ primarily in the extent to which animal products are included in the diet. At one extreme are vegans who include only foods derived from plants, such as vegetables, fruits, legumes or dried beans and peas, grains, seeds, and nuts, and avoid all animal products, including dairy and eggs in their diets. Lacto-vegetarians and ovo-vegetarians are less extreme in their food choices than vegans in that they include dairy products, or eggs, respectively, in their diets. Other groups of "vegetarian-oriented" individuals include pesco-vegetarians who additionally eat fish, and semi-vegetarians, who avoid red meat, but include fish, poultry, and sometimes pork in their diets. Thus, although all vegetarian (i.e., vegan, lacto- and ovo-vegetarians) and vegetarian-oriented (pesco- and semi-vegetarian) individuals restrict red meat from their diets, the degree to which they avoid animal products varies along a continuum. While those who are concerned about health may be less restrictive, those who have strong ethical or philosophical reasons for avoiding animal products tend to adopt more restrictive forms of vegetarianism, such as veganism (Pollard, Steptoe, & Wardle, 1998; Rozin, Markwith, & Stoess, 1997).

Much of the research published to date has not investigated the differences between subgroups of vegetarian and vegetarian-oriented individuals. Rather this work has either focused only on vegans and lacto-vegetarians (e.g., Barr, Janelle, & Prior, 1994), or has sampled a heterogeneous sample of vegetarian and vegetarian-oriented individuals and compared them as a whole to non-vegetarians. *In one notable exception, Martins et al. (1999) investigated subgroups of vegetarians and found that for those females who had strong feminist values, more restrictive vegetarian eating patterns were associated with higher restraint scores.* Curtis and Comer (2006) failed to replicate these findings in a study in which they reported that vegans and lacto- and ovo-vegetarians had lower restraint scores than pesco- and semi-vegetarians. Although, Curtis and Comer's findings should be interpreted with caution, given their small sample size and the large age-range of their sample, they are consistent with work reported by Pollard et al. (1998) who found that those whose diets were low in red meat, were more likely than vegetarians or non-vegetarians with a standard diet to indicate that their food choices were motivated by weight control.

Previous research has also included a limited sample of non-vegetarians. For example, in some studies only non-vegetarians who reported eating red meat at least three times a week in addition to poultry or fish have been included (e.g., Greene-Finestone et al., 2008; Janelle & Barr, 1995). To a growing extent, this sample is not representative of non-vegetarians, many of whom choose to consume meat irregularly. For this group of "flexitarians", (as they are referred to in the popular press; Blatner, 2008), cutting back on meat, rather than abstaining completely, may be a practical compromise that is motivated by several reasons, such as cost, overall health, weight control, or ethical concerns (Blatner, 2008). Because previous studies have ignored this subgroup, or included them with other non-vegetarians who do not restrict their meat intake, it is unclear what factors motivate their food intake.

In summary, some studies have supported the hypothesis that vegetarianism may serve as a mask for restrained eating, while others have failed to find evidence of this relationship. This controversy may be a function of differences in the proportion of various vegetarian subgroups investigated, and variation in other extraneous variables, such as the length of time individuals have practiced

vegetarianism and various personal characteristics. Although previous research has investigated individual differences in characteristics such as feminism (Martins, Pliner, & O'Connor, 1999) and liberalism (White, Seymore, & Frank, 1999), little work has addressed whether vegetarian and vegetarian-oriented individuals differ in personality, or food-related measures such as food neophobia. Given that food neophobia is known to be negatively associated with the personality characteristic of openness to new experiences, as well as the frequency of consumption of fruits and vegetables and healthy diets in general (Schickenberg, van Assema, Brug, & de Vries, 2008), it is of interest to determine whether food neophobia and personality factors, such as openness, are related to vegetarian and vegetarian-oriented eating patterns. Thus, the present study was designed to determine whether differences in eating and dieting patterns and personality characteristics exist between subgroups of vegetarian, vegetarian-oriented, and non-vegetarian university students, and what factors they consider when choosing foods by using the Food Choice Questionnaire developed by Steptoe, Pollard, and Wardle (1995). We hypothesized that vegetarian-oriented subgroups (i.e., pesco-vegetarians, semi-vegetarians) and non-vegetarians who only occasionally eat red meat (i.e., flexitarians) would consider weight control when choosing their foods, and would have higher restraint scores than those non-vegetarians who never restrict red meat (hereafter referred to as omnivores). Whereas vegetarians (i.e., vegans, lacto- and ovo-vegetarians), whose eating habits are more likely to be motivated by ethical and philosophical reasons rather than weight control (cf. Pollard et al., 1998), were hypothesized to be less neophobic, more open to new experiences, and have restraint scores that would not differ from omnivores.

Methods

Participants

Female participants (N = 240) were recruited from Introductory Psychology classes and the greater college community at The College of William & Mary. All participants either received a small monetary sum (\$10) or earned credit towards their Introductory Psychology course for participation in the study. Informed consent was obtained from each participant, and all experimental procedures were approved by the Protection of Human Subjects Committee at The College of William & Mary.

Procedure

Upon entering the lab, participants were invited to a quiet room where they were presented with a booklet that contained a demographic questionnaire that was followed by battery of standardized questionnaires described below. Approximately 1 year later, a subset of participants (i.e., the first 99 female participants in the study who indicated that they at least occasionally restricted the amount of red meat in their diets) was contacted again with an online questionnaire, which inquired about their current eating habits.

Questionnaires

Personality (NEO-FFI)

All but two participants completed the sixty-item version of the NEO-FFI questionnaire (McCrae & Costa, 2004), which measures five dimensions of personality: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. The test was developed for use with adult (17+) men and women without overt psychopathology. In total, the NEO-FFI has 60 items, with 12 items per factor. Participants indicated their responses on a

scale from 1 (strongly disagree) to 5 (strongly agree). Chronbach α ranged from .68–.86 and 3-month test–retest correlations ranged from .75 to .83. This scale has been validated by spouse and peer ratings and convergent and discriminant validity of this measure is also high as reported in McCrea and Costa (2004). For the current sample, Chronbach's α was greater than 0.74 for each of the personality dimension

Food frequency questionnaire (FFQ)

We interviewed participants to determine the frequency with which they ate a variety of fruits, vegetables, fish, and other animal products (Mullen, Krantzer, Grivetti, Schultz, & Meiselman, 1984). Food intake could be estimated using one of five categories: daily, weekly, monthly, yearly, and rarely/never. Respondents were asked to estimate the number of times per day, week, month, or year each item was consumed. Responses on this questionnaire have been shown to correlate significantly with actual intake data in college students ($r = 0.61, p < 0.001$).

Food neophobia (FN) and variety seeking (VS)

All except four participants completed a 10-item scale that measured their food neophobia (the propensity to approach or to avoid novel foods) and an 8-item scale that measured general neophobia (Pliner & Hobden, 1992). The food neophobia scale includes items such as "I don't trust new foods" or "I will eat almost everything", and has a 7-point bipolar rating scale. This measure has been shown to have good internal consistency (Chronbach $\alpha = .88$) and test–retest reliability (Pearson correlations range from 0.8–0.9). Consistent with this, the internal consistency of this measure was high for the current sample (Chronbach $\alpha = .89$). Additionally, an 8-item variety seeking scale was completed that measured the extent to which participants seek out food variety (Van Trijp & Steenkamp, 1992). Questions are answered on a five-point likert scale anchored from "completely agree" to "completely disagree". This measure has been shown to have good internal consistency (Chronbach $\alpha = .86$) and test–retest reliability ($r = 0.81$). For the current sample, Chronbach α was 0.91

Three factor eating questionnaire/eating inventory (TFEQ/EI)

All except two participants completed the Three-Factor Eating Questionnaire/Eating Inventory (Stunkard & Messick, 1985), which contains subscales for cognitive dietary restraint (the degree to which individuals cognitively restrain their food intake in order to lose or maintain their weight), disinhibition (the extent to which an individual perceives that their control of food intake diminishes in response to factors such as preloads of food and dysphoric emotions), and hunger. Internal consistency ($\alpha = .90$) and test–retest reliability ($r = .91$) have been shown to be adequate for this measure. Based on previous work (Barr et al., 1994) one of the statements on the hunger subscale was modified from "When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal" to "When I smell a chocolate cake baking or see a delicious cookie, I find it very difficult to keep from eating, even if I have just finished a meal", thereby making this question more suitable for vegetarians. Because this questionnaire is scored on a dichotomous scale, Kuder–Richardson Formula 20 (KR-20) was calculated for each of the subscales. These analyses revealed high levels of internal consistency for cognitive restraint (KR-20 = 0.94), disinhibition (KR-20 = 0.80), and hunger (KR-20 = 0.77) for the current sample

Eating attitudes test (EAT)

All but two participants completed this 26-item self-report measure for eating disorders (Garner et al., 1982). Total scores (ranging from 0–53) are derived as a sum of three factor scores: (F1) dieting–the degree of avoidance of fattening foods and preoccupation with

being thinner; (F2) bulimia and preoccupation with food; and (F3) oral control–the degree of self-control around food and the perception of pressure from others to gain weight. Participants who scored 20 or above are considered to have "abnormal eating behaviors" and those scoring below 20 are considered to have "normal eating behaviors." Internal consistency reliability coefficients for these subscale scores ranged between 0.70 and 0.88 (Doninger, Enders, & Burnett, 2005) and has good test–retest reliability with coefficients ranging from .84 to .89 (Banasiak, Wertheim, Koerner, & Voudouris, 2001; Carmona & Moss, 1984). For the current sample, Chronbach's α was 0.81

Food choice questionnaire (FCQ)

This questionnaire (Stepptoe et al., 1995) was completed by all participants and consists of 36 items designed to assess the reported importance of health, convenience, price, sensory appeal, natural content, mood, familiarity, ethical concern, and weight control. Participants indicated to what degree statements about food choices were important to them (ranging from 1–Not at all important to 4–very important). Examples of statements included in this questionnaire include "It is important to me that the food I eat on a typical day... is low in fat" (weight control), "is not expensive" (price), "is packaged in an environmentally friendly way" (ethical concern), and "makes me feel good" (mood). The FCQ was shown to have adequate internal consistency (with Chronbach $\alpha \geq .70$) and the factors have adequate test–retest reliability ($r > .71$; Steptoe et al., 1995).

General eating habits (GEH)

All participants were asked to choose one of the following seven categories that best characterized their eating behavior: 1. vegan; 2. lacto-vegetarian; 3. ovo-vegetarian; 4. pesco-vegetarian; 5. semi-vegetarian; 6. flexitarian; and 7. omnivore. Each of the categories were defined (e.g., a flexitarian is someone who occasionally eats red meat, eats all white meat, seafood, eggs, dairy products, fruits, vegetables, and grains) to help participants accurately define their eating habits. Those who identified themselves as being vegetarian or vegetarian-oriented, by choosing categories 1–5 indicated how long they had restricted animal products from their diets. All participants also reported their weight and height, and for a subset of participants ($n = 95$) we additionally measured their weight at the end of the study.

Follow-up online questionnaire

One year after they were initially tested, we contacted all of the vegetarian and vegetarian-oriented participants ($n = 79$) and flexitarians ($n = 20$) who participated during the first 24 months of the study with an online questionnaire. They were asked to complete the GEH, in which they were asked to indicate which of seven categories (as described above) best described their eating habits. They were also asked to indicate whether over the previous year they had a university meal plan, and if so, how they thought eating at the university cafeterias affected their eating patterns, if at all.

Statistical analyses

As a manipulation check we determined the frequency with which the vegetarian, vegetarian-oriented, and non-vegetarian participants reported eating fish, poultry, pork, and red meat in the FFQ. For 14 individuals (approximately 6% of the sample), reports of food consumption were not consistent with their classification on the GEH questionnaire. Of these, seven classified themselves as pesco-vegetarian, but reported eating chicken ($n = 6$) and beef ($n = 1$), two classified themselves as lacto-ovo-vegetarian, but reported eating fish, and the remaining five classified themselves as semi-vegetarians, but reported eating red meat occasionally ($n = 3$), or reported that they ate fish but no meat

($n = 2$). These individuals were reclassified accordingly which is reflected in Table 1.

A series of one-way analyses of variance were conducted to determine whether subgroups differed on demographic, personality, and eating habit (e.g., restraint, disinhibition, and food neophobia) measures. For the FCQ scores, a multivariate analysis of variance was conducted to test whether scores on the FCQ varied as a function of vegetarian subgroup. All significant univariate and multivariate effects were further probed with post hoc tests using Bonferroni adjusted alpha levels to determine whether the subgroups differed from the omnivore subgroup, which in this study was considered a control group.

For the follow-up analyses we divided vegetarian, vegetarian-oriented, and flexitarian participants into three categories: those who maintained their eating habits; those who became more restrictive; and those who became less restrictive since they were last tested, by comparing their initial reported classification on the GEH to their reported classification one year later. We then conducted a series of analyses to determine whether there were differences between the subgroups in the maintenance of their eating patterns, and whether those who became less restrictive over the course of the year differed from the others in their initial food motivations.

Results

Participant characteristics

As shown in Table 1, of the 240 participants, approximately half indicated that they did not consume red meat. Because of the small sample sizes of the vegetarian subgroups (i.e., 14 vegans, 6 lacto-vegetarians, and 35 lacto/ovo-vegetarians) and lack of between-group differences, these subgroups were combined for all further

analyses. Overall, the sample consisted of 79% Caucasian, 12% Asian, 6% African American, and 3% mixed (more than one race) and of these, 5.2 percent were Hispanic or Latino. There were no differences in the racial and ethnic composition of any of the subgroups, nor did they differ on any of the other demographic variables measured (Table 1).

None of the vegetarians, pescos-, or semi-vegetarians ate red meat, while those who identified themselves as non-vegetarians (i.e., flexitarians and omnivores) consumed approximately 2–3 servings of red meat per week. Within this group of non-vegetarians, compared to omnivores, flexitarians less frequently ate red meat (1.5 ± 0.2 vs. 2.6 ± 0.2 times/week, $t(126) = 2.9$, $p < 0.01$) and pork (0.6 ± 0.2 vs. 1.1 ± 0.1 times/week, $t(126) = 2.2$, $p < 0.02$). With the exception of vegetarians, who abstained from eating fish, the remaining subgroups ate fish approximately once a week (overall mean = 1.0 ± 0.1 times/week). Similarly, while vegetarians and pescos-vegetarians did not eat chicken, the other subgroups ate chicken approximately 2–5 times/week (i.e., semi-vegetarians: 2.7 ± 0.6 omnivores: 4.5 ± 0.4 times/week; $F(2, 154) = 2.7$, $p = 0.07$).

Comparisons of vegetarian, pescos-, semi-vegetarian, and flexitarian subgroups to omnivores

As shown in the Table 1, there were main effects of subgroup for openness ($F(4, 234) = 8.3$, $p < 0.01$, $\eta^2 = .12$), variety seeking ($F(4, 232) = 4.6$, $p < 0.01$, $\eta^2 = .07$), and food neophobia ($F(4, 232) = 3.4$, $p < 0.01$, $\eta^2 = .06$). Post hoc analyses revealed that vegetarians and pescos-vegetarians were more open to new experiences, variety seeking, and less food neophobic than regular omnivores (all $ps < 0.012$). As highlighted in Fig. 1, there was also a main effect of restraint ($F(4, 233) = 3.8$, $p < 0.01$, $\eta^2 = .06$). Whereas vegetarians and pescos-vegetarians did not differ from omnivores in their level of restraint ($p > 0.4$), semi-vegetarians ($p < 0.001$) and flexitarians ($p < 0.013$) were more restrained than omnivores. Moreover, as

Table 1
Characteristics of female vegetarians and Non-vegetarians (% or mean \pm SEM).

	Vegetarian	Pescos-vegetarian	Semi-vegetarian	Flexitarian	Omnivore
Sample size	55	28	29	37	91
Age (years)	19.42 \pm .15	19.75 \pm .41	19.62 \pm .59	18.51 \pm .16	19.10 \pm .36
BMI	21.44 \pm .30	22.29 \pm .51	24.90 \pm .55	22.70 \pm .61	22.17 \pm .31
Family income (% >\$75,000)	60.38%	62.50%	74.07%	79.41%	67.90%
Smokes cigarettes (% yes)	5.45%	7.14%	6.90%	5.41%	2.20%
Drinks alcohol (% yes)	61.81%	71.43%	65.52%	54.05%	53.33%
Length of time as a vegetarian (years)	6.53 \pm 0.70	4.01 \pm 0.68	7.12 \pm 0.91	N/A	N/A
Personality inventory (NEO-FFI)					
Neuroticism	35.25 \pm 1.30	32.89 \pm 1.59	32.86 \pm 1.63	34.97 \pm 1.41	32.71 \pm 0.89
Extroversion	40.84 \pm 1.22	43.36 \pm 1.35	45.45 \pm 1.49	44.62 \pm 1.18	43.42 \pm 0.73
Openness	46.18 \pm 0.74*	47.50 \pm 0.93*	40.90 \pm 1.18	42.11 \pm 1.23	41.36 \pm 0.80
Agreeableness	45.96 \pm 0.86	47.89 \pm 1.18	45.69 \pm 1.22	45.92 \pm 0.97	45.54 \pm 0.78
Conscientiousness	43.53 \pm 1.08	45.04 \pm 1.28	48.34 \pm 1.05	45.57 \pm 1.28	46.41 \pm 0.77
Variety seeking	30.00 \pm 0.81*	30.74 \pm 0.95*	26.68 \pm 1.06	26.95 \pm 1.08	26.37 \pm 0.74
Food neophobia	27.04 \pm 1.45*	25.33 \pm 1.88*	33.31 \pm 1.62	30.25 \pm 2.01	31.84 \pm 1.26
General neophobia	23.69 \pm 1.28	23.81 \pm 1.83	24.38 \pm 1.66	24.58 \pm 1.54	24.90 \pm 0.89
Food choice					
Convenience	13.56 \pm 0.44	13.54 \pm 0.65	13.12 \pm 0.57	14.14 \pm 0.64	13.28 \pm 0.39
Natural content	8.07 \pm 0.31*	8.50 \pm 0.42*	8.29 \pm 0.37*	6.97 \pm 0.35	6.41 \pm 2.22
Health	17.87 \pm 0.47	18.25 \pm 0.58	19.07 \pm 0.68	17.81 \pm 0.64	16.49 \pm 0.42
Weight control	7.13 \pm 0.32	8.50 \pm 0.41	9.21 \pm 0.44*	8.76 \pm 0.41*	7.57 \pm 0.25
Sensory appeal	10.56 \pm 0.26	10.57 \pm 0.62	10.79 \pm 0.47	10.65 \pm 0.40	11.68 \pm 0.24
Price	9.04 \pm 0.33	8.96 \pm 0.36	8.29 \pm 0.46	8.62 \pm 0.41	8.66 \pm 0.25
Familiarity	5.20 \pm 0.32*	5.00 \pm 0.30*	6.04 \pm 0.40	6.59 \pm 0.42	6.47 \pm 0.26
Mood	14.11 \pm 0.51	13.04 \pm 0.74	14.32 \pm 0.63	14.70 \pm 0.68	15.18 \pm 0.47
Ethical concern	5.56 \pm 0.26*	5.86 \pm 0.41*	5.04 \pm 0.33	4.16 \pm 0.22	4.14 \pm 0.14
Eating Attitudes Test (EAT)					
Dieting	9.37 \pm 0.98	11.79 \pm 1.95	12.84 \pm 1.47	11.84 \pm 1.48	11.31 \pm 1.39
Bulimia	3.94 \pm 0.42	3.68 \pm 0.80	3.97 \pm 0.65	3.78 \pm 0.47	4.64 \pm 0.31
Oral control	3.39 \pm 0.45	4.50 \pm 0.98	4.38 \pm 0.54	3.89 \pm 0.43	5.14 \pm 0.63
Total score	16.70 \pm 1.53	19.96 \pm 3.44	21.19 \pm 2.34	19.51 \pm 2.05	2.51

* Significantly different from omnivores, $p < 0.05$ (with Bonferroni correction).

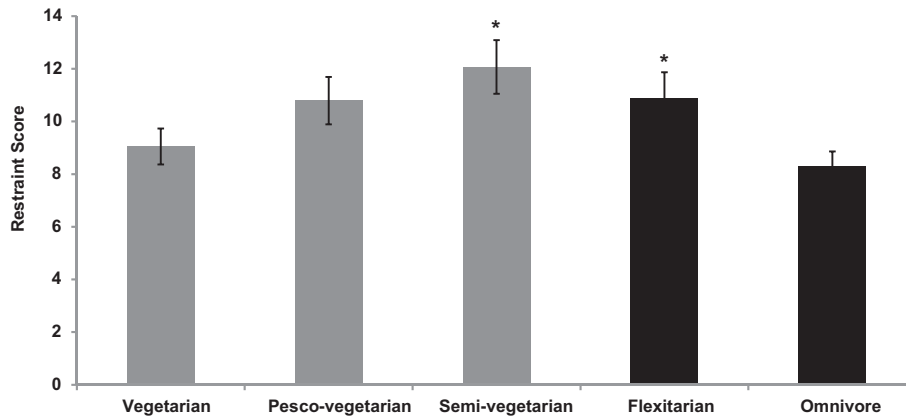


Fig. 1. Mean restraint scores (± SEM) as measured by the TFEQ/EI for each of the vegetarian and vegetarian-oriented subgroups (gray bars) and non-vegetarian (black bars) subgroups during the initial test.

vegetarian and vegetarian-oriented individuals became more restrictive of animal products, their restraint scores decreased ($r(112) = -0.25, p < 0.01$). No significant group differences were observed in levels of disinhibition, hunger, or for any of the subscales of the EAT ($ps > 0.25$).

Multiple comparisons of the subgroups on their food choice motivations revealed main effects of natural content ($F(4, 233)=9.1, p < 0.01, \eta^2 = .13$), familiarity ($F(4, 233) = 4.4, p < 0.01, \eta^2 = .07$), ethical concern ($F(4, 233) = 10.9, p < 0.01, \eta^2 = .16$), and weight control ($F(4, 233) = 5.7, p < 0.01, \eta^2 = .09$). Post hoc analyses indicated that omnivores considered natural content to be less important in determining their food choices than the vegetarians and vegetarian-oriented subgroups (all $ps < 0.01$). Omnivores also rated familiarity as more important than vegetarians ($t(143) = 3.1, p < 0.01$) and pesco-vegetarians ($t(116) = 3.0, p < 0.01$) whereas they rated ethical concern less important than vegetarians ($t(143) = 3.1, p < 0.01$) and pesco-vegetarians ($t(116) = 5.1, p < 0.01$). Consistent with the restrained eating findings reported above, semi-vegetarians ($t(116) = 3.2, p < 0.01$) and flexitarians ($t(125) = 2.5, p < 0.012$) rated weight control as significantly more important than omnivores. Vegetarians and pesco-vegetarians did not differ from omnivores in their ratings of weight control ($p > 0.25$).

Maintenance of eating patterns

Seventy-three of the 99 female participants who were contacted one year after initial testing responded to our online questionnaire. Of these 57 had been vegetarian or vegetarian-oriented during initial testing. All of these individuals reported that they had continued with some form of vegetarian or vegetarian-oriented eating pattern, and 14% reported that they had become more restrictive of animal products since the initial test. At the time of the online questionnaire, 28 reported that they were vegetarian (i.e., either vegan, lacto- or lacto-ovo-vegetarian), 17 were pesco-vegetarians, 12 were semi-vegetarians, and 16 were flexitarian. Compared to those who had originally classified themselves as vegetarian or vegetarian-oriented, significantly more of the flexitarians (37%) indicated that they had become more restrictive of animal products by adopting some form of vegetarianism ($\chi^2(2) = 4.4, p < 0.04$).

Fifty-four of the respondents indicated that they had been on a university meal plan over the previous year.

Of these, approximately 39% indicated their vegetarian eating habits had been affected by the limited selection and quality of

the food in the dining halls, while 50% indicated that their eating habits had not been affected. The remaining 11% indicated that they had consumed more vegetarian options over the previous year because the dining hall provided more variety than at home. However, changes in vegetarian eating habits did not differ as a function of these perceptions.

Participants who became more restrictive of animal products over the previous year were more likely to indicate during the initial session that their food choices were influenced by weight control ($\chi^2(4) = 9.3, p = 0.05$). Although there were no differences in their original restraint scores, those who became more restrictive had marginally lower hunger scores compared to those who became less restrictive of animal products ($M = 4.2$ vs. $M = 6.5, t(24) = 1.80, p = 0.08$). The degree to which other influences, such as moral, health, environmental, palatability, religion, or parents affected their food choices over the previous year did not differ between those who had become more or less restrictive, or had maintained their eating habits (all $ps > 0.05$).

Discussion

The purpose of this study was to examine and compare the dietary habits and lifestyle behaviors of college-age vegetarian, vegetarian-oriented, and non-vegetarian females, whose eating habits were defined by the extent to which they restricted animal products from their diets. Analyses indicated that semi-vegetarians were more cognitively restrained than omnivores. These findings, which are consistent with Curtis and Comer (2006), suggest that vegetarians who are more restrictive of animal products in their diets are less restrained than semi-vegetarians. In addition to semi-vegetarians, we also found that a subset of non-vegetarians; flexitarians, who reported that they occasionally restricted their intake of red meat, were more restrained than omnivores. Consistent with their restraint scores, semi-vegetarians and flexitarians reported that they were more concerned about weight control and less concerned about animal welfare than the other subgroups of female vegetarians. Thus, female semi-vegetarians and flexitarians, differ from vegetarians and omnivores respectively, not only in their eating patterns, but also in their dietary motivations.

Although female vegetarians and pesco-vegetarians were not more restrained than omnivores in their food intake, they were more open in their personalities, more variety seeking, and less food neophobic. This was not the case for any of the other subgroups. These results are not surprising; food neophobia is known to be negatively associated with openness, the consumption of fruits and vegetables, and the likelihood of having a healthy diet

(Schickenberg et al., 2008). For women, openness and food neophobia appear to be influenced by an overlapping set of genetic factors (Knaapila et al., 2011). Whether these women are also genetically predisposed to become vegan or lacto-ovo-vegetarians is a topic for further investigation.

Given that college marks the beginning of an important transition from adolescence to emerging adulthood for many individuals (Arnett, 2000) this may be a particularly important context in which to study eating patterns of subgroups of vegetarian and vegetarian-oriented individuals. As children move into adolescence they seek to establish a unique identity, and often struggle with pressures to conform to a cultural ideal of physical beauty (Story, 1984). For some, vegetarianism may serve as an eating pattern that allows them to control their weight while concealing disordered eating behaviors from their parents during adolescence (Robinson-O'Brien, Perry, Wall, Story, & Neumark-Sztainer, 2009). However, as they move away from home, they experience a change in social context, increased freedom, and independence in their food choices. As a result, the motivations for maintaining a vegetarian eating style may change for vegetarian subgroups once they reach young adulthood (Fisak et al., 2006, Perry et al., 2002). For this reason, it is important not to generalize previous findings that suggest that adolescent vegetarians may be prone to eating disorders to college-age students. In the current study, most of the students became vegetarians before they entered college, either as children or adolescents, however it is unclear as to whether their motivations for maintaining a vegetarian lifestyle changed after they entered college.

Although it was beyond the scope of this study to track the progression of participants' eating patterns over the long term, we contacted a proportion of vegetarian, vegetarian-oriented and flexitarian females one year after their initial test to determine the stability of their eating habits. Of the 74% of female participants who responded to our online questionnaire, most of the vegetarian and vegetarian-oriented individuals had either maintained or become somewhat less restrictive of their consumption of animal products; none however had become flexitarians or regular omnivores. Of course it is possible that these results are skewed by response bias. For example, a high proportion of those who did not respond may have become omnivores. Approximately a third of flexitarians became more restrictive of their intake of animal products, adopting a vegetarian lifestyle. It is possible that weight-related concerns motivated the flexitarians to become more restrictive of animal products, given that a higher proportion of the individuals who became more restrictive had originally indicated that their eating habits were motivated to a large extent by weight-related concerns. Further research that investigates the progression of eating patterns within this subgroup will help identify those who are at high-risk for developing unhealthy weight control strategies.

A limitation of the current study was that the sample did not include male vegetarians. Because males typically have lower restraint scores than females and a smaller proportion of vegetarians are male relative to non-vegetarians, it is important to analyze males and females separately when comparing restraint scores of vegetarians and non-vegetarians to reduce bias. More research is needed in order to better understand how subgroups of male vegetarians differ in their eating and lifestyle characteristics. Further research should also strive to recruit larger samples of vegetarian subgroups in order to investigate potential differences between their food choice motivations.

It appears that semi-vegetarians and flexitarians specifically, may be more likely to experiment with restriction of animal products as a form of weight control than vegetarians and pesco-vegetarians. Previous research has shown that in general vegetarians are generally more health conscious, leaner (Sabaté, Lindsted, Harris, & Sanchez, 1991), and less likely to develop diabetes (e.g.,

Snowdon & Phillips, 1985) than non-vegetarians. For those who adopt vegetarian diets later in life, overall nutrition improves (Turner-McGrievy, Barnard, & Scialli, 2007). Thus, it appears that those who follow well-planned vegetarian diets, which are relatively low in saturated fat, generally don't need to lose weight. As a result, responsible vegetarian diets may actually help protect against eating disorders (Barnard & Levin, 2009). The degree to which semi-vegetarians and flexitarians in the current study followed a balanced healthful diet is unknown. It is possible that these individuals may not be as health conscious, as vegetarians and pesco-vegetarians who avoid poultry and red meat (Larsson, Klock, Åström, Haugejorden, & Johansson, 2002).

Although some flexitarians and semi-vegetarians may eventually progress to a more restrictive vegetarian eating style that is less focused on weight control, it is possible that others may be at risk for developing unhealthy weight control strategies or eating disorders. With this in mind, development of programs that teach vegetarian adolescents and young adults how to maintain healthy and well-balanced diets may be an effective approach for producing healthful changes to vegetarian dietary patterns over the long-term.

Uncited references

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