



## Research report

## Will the real vegetarian please stand up? An investigation of dietary restraint and eating disorder symptoms in vegetarians versus non-vegetarians

C. Alix Timko<sup>a,\*</sup>, Julia M. Hormes<sup>b</sup>, Janice Chubski<sup>a</sup>

<sup>a</sup> Department of Psychology, Towson University, Towson, MD 21252, USA

<sup>b</sup> Department of Psychology, University of Pennsylvania, Philadelphia, PA 19104, USA

## ARTICLE INFO

## Article history:

Received 4 March 2011

Received in revised form 5 February 2012

Accepted 7 February 2012

Available online 14 February 2012

## Keywords:

Vegetarianism  
Disordered eating  
Eating disorders  
Semi-vegetarian  
Meat avoidance

## ABSTRACT

Adherence to a vegetarian diet has been hypothesized to be a factor in the onset and maintenance of disordered eating behavior; however, evidence to support this assumption has been largely mixed. The two studies presented here sought to address the causes of inconsistent findings in previous research, including: small samples of true vegetarians, lack of appropriate operational definitions of “vegetarianism”, and uncertainty about the appropriateness of existing assessments of eating behaviors for semi-vegetarians. Study 1 assessed eating behaviors in the largest samples of confirmed true vegetarians and vegans surveyed to date, and compared them to semi-vegetarians and omnivores. Semi-vegetarians reported the highest levels of eating-related pathology; true vegetarians and vegans appeared to be healthiest in regards to weight and eating. Study 2 examined differences between semi-vegetarians and omnivores in terms of restraint and disordered eating and found little evidence for more eating-related pathology in semi-vegetarians, compared to omnivores. Semi-vegetarians’ higher scores on traditional assessments of eating behaviors appeared artificially inflated by ratings of items assessing avoidance of specific food items which should be considered normative in the context of a vegetarian diet. Findings shed light on the sources of inconsistencies in prior research on eating behaviors in vegetarians and suggest that semi-vegetarianism – as opposed to true vegetarianism or veganism – is the most likely related to disordered eating.

© 2012 Elsevier Ltd. All rights reserved.

## Introduction

“Vegetarianism” refers to a spectrum of inter-related food selection and food avoidance patterns (Beardsworth & Keil, 1993). Technically, ovo-vegetarians include eggs but no dairy products in their diet, lacto-vegetarians include dairy products but exclude eggs, and lacto-ovo vegetarians include both eggs and dairy products in their diet (Messina & Burke, 1997; Trautman, Rau, Wilson, & Walters, 2008). Semi-vegetarians restrict the type of meat they consume only to a certain extent, with some consuming only fish (pesco-vegetarian), some only poultry (pollo-vegetarian), and some consuming both fish and poultry (pesco pollo vegetarians). Finally, individuals who adhere to a vegan diet exclude all red meat, fish, poultry, dairy, and other animal-origin foods such as eggs from their diets, and generally also avoid non-edible animal products such as leather.

Although the popularity of vegetarian diets has varied over the centuries, the prevalence of vegetarianism is currently at an all time high (Amato & Partridge, 2008). The increased frequency of individuals adhering to a vegetarian diet has served as an impetus

for exploration into differences in behaviors and characteristics of those who chose a vegetarian diet versus those who do not. Specifically, the belief that a vegetarian diet could be used as a “socially acceptable” method to restrict intake and control weight has raised questions regarding the role of such a diet in the development or maintenance of disordered eating patterns or clinical eating disorders (Gilbody, Kirk, & Hill, 1999; Kadambari, Gowers, & Crisp, 1986; Klopp, Heiss, & Smith, 2003; O’ Connor, Touyz, Dunn, & Beumont, 1987; Perry, McGuire, Neumark-Sztainer, & Story, 2001; Sullivan & Damani, 2000; Trautman et al., 2008; Worsley & Skrzypiec, 1998).

The majority of research in this area has been cross-sectional in nature; with generally mixed findings regarding differences in eating attitudes and behaviors between vegetarian and non-vegetarians. Results of studies investigating differences in levels of dietary restraint between omnivores and those who eliminate some form of meat from their diet are especially inconsistent. Several studies find evidence for higher restraint scores in vegetarians (Barr, Janelle, & Prior, 1994; Gilbody et al., 1999; Trautman et al., 2008; Worsley & Skrzypiec, 1998), others suggest higher scores in non-vegetarians (Curtis & Comer, 2006; Janelle & Barr, 1995), and yet another set of studies fail to find any differences in dietary restraint between the two groups (Barr & Broughton, 2000; Fisak,

\* Corresponding author.

E-mail address: [a.timko@usp.edu](mailto:a.timko@usp.edu) (C.A. Timko).

Peterson, Tantleff-Dunn, & Molnar, 2006; Larsson, Klock, Astrom, Haugejorden, & Johansson, 2002). A possible explanation for these inconsistent findings is that there are major differences between semi-vegetarians and vegetarians (who are often combined into one group), with semi-vegetarians exhibiting more dietary restraint than vegetarians. This hypothesis is supported by findings that suggest that semi-vegetarians are twice as likely than true vegetarians to restrict their meat intake for weight concern reasons (Curtis & Comer, 2006; Perry et al., 2001).

When differences in restraint are found between groups, higher restraint scores in vegetarians are often interpreted as indications of disordered eating or maladaptive attitudes towards food; however, it can be hypothesized that higher scores are an artifact of the specific elimination of meat products from the diet, not restriction in general. Furthermore, it is possible that certain items on restraint scales are not relevant for vegetarians (e.g., related to eating red meat); therefore the restraint scales may not be valid measures of the construct in vegetarians (Fisak et al., 2006).

Beyond differences in restrained eating, researchers have postulated that vegetarianism may be a precursor to the development of an eating disorder. To date, two studies have attempted to determine causality in the relationships between vegetarianism and eating disorders via retrospective chart reviews of patients seeking treatment for eating disorders. In one study, out of 200 patients receiving treatment for anorexia nervosa, just under half were considered to be vegetarian (Kadambari et al., 1986). In another, out of 116 individuals with anorexia, just over half of the patients claimed a vegetarian (defined in this particular study as not eating red meat) diet (O'Connor et al., 1987), yet only four of these individuals adhered to a vegetarian diet prior to the onset of the eating disorder. Across both of these retrospective reports, the majority of the women interviewed reduced their meat intake after the onset of the eating disorder (O'Connor et al., 1987), that is, the vegetarian diet was adopted *during or after* the development of the eating disorder. The adoption of a vegetarian diet after the onset of a disorder may indicate that rather than being a causal factor, a vegetarian diet may play a maintenance role in eating disorders pathology.

Given the wide variety of reasons for choosing a vegetarian diet (e.g., health, weight control, ethics), it is unlikely that vegetarianism is in and of itself enough to be a risk factor for developing an eating disorder. However, choosing a vegetarian diet *for the purposes of weight control* might play a role in the etiology of disordered eating. In prior studies, combined groups of vegetarians and semi-vegetarians who chose a reason other than weight concerns (e.g., ethical/political reasons, health concerns, religious reasons, or taste preferences) had significantly lower levels of dietary restraint than semi-vegetarians who chose weight concerns as their reasons for restricting consumption of meat (Curtis & Comer, 2006). True vegetarians were also less likely to participate in healthy and unhealthy weight control behaviors than semi-vegetarians (Perry et al., 2001). Thus, it may be that it is not vegetarianism *per se* that leads to disordered eating, but rather a partial restriction of meat (semi-vegetarian) for the purposes of weight control, possibly in combination with other risk factors related to the development of eating disorders. Full vegetarianism may, as has been noted, play more of a role in the maintenance of the disorder.

The fact that findings regarding the role of restricted meat consumption in the onset or maintenance of disordered eating have been quite mixed may be due not only to the reasons for the restriction, but also to problems with the operational definition of “vegetarian.” In the majority of studies investigating meat restriction, vegetarianism is defined as eliminating red meat; however, this does not reflect a true vegetarian diet (which would also eliminate all fish and poultry) but rather what is more

accurately described as a *semi-vegetarian* diet (Gilbody et al., 1999; Kadambari et al., 1986; Klopp et al., 2003; O'Connor et al., 1987; Trautman et al., 2008; Worsley & Skrzypiec, 1998). Few studies have looked at true vegetarianism or even veganism, with the largest published true vegetarian sample consisting of twenty individuals (Curtis & Comer, 2006), and the largest vegan sample of a mere eight participants (Janella & Barr, 1995). In most studies vegetarians and semi-vegetarians are combined in the “vegetarian” group due to low sample sizes (e.g., Fisak et al., 2006). Thus, the majority of research reports that find differences between “vegetarians” and non-vegetarians use a mixed sample of semi-vegetarians and true vegetarians.

The studies described herein are a first step in attempting to address some of the inconsistencies and difficulties with previous research on the relationship between disordered eating and vegetarianism and seek to lay the groundwork for more specific hypotheses in this area. Specifically, the current studies were designed to examine differences that exist between true vegetarians, semi-vegetarians, and omnivores in a large sample and using strict operational definitions to allow for more accurate investigation of between-group differences. The utility of traditional assessments of disordered eating patterns in meat restrictors was also evaluated.

## Study 1

This first study was conducted in order to clarify the correlates of a true vegetarian diet by accurately categorizing levels of vegetarianism and assessing any differences between groups on measures traditionally employed in research on vegetarianism. It was hypothesized that vegans and vegetarians would have healthier attitudes towards food and less eating pathology than semi-vegetarians. Measures of general health (e.g., exercise, anxiety, and depression) were also included as those who adhere to a semi-vegetarian diet may be more depressed and less invested in being healthy than omnivores (Perry et al., 2001).

## Method

All methods were reviewed and approved by the Institutional Review Board at Towson University and the University of Pennsylvania.

### Participants

Participants were recruited via several methods: from psychology department research pools of two urban universities, via flyers distributed to local health food stores, and through the internet. On the internet, the study was posted on general psychology study sites as well as on pages devoted to vegetarianism. Participants recruited via the former method were given either course credit or extra credit for their participation. Of the 714 individuals who began the questionnaires, 564 (78.99%) completed the survey. Seventy-two of the completers were excluded because they either did not provide their age or reported being younger than 18. Thus, 486 participants (68.07%) were considered completers. Of those 77.00% ( $n = 374$ ) were female and 23.00% ( $n = 111$ ) were male. The average age of participants was 24.90 ( $SD = 9.54$ ). The majority (69.50%,  $n = 338$ ) of participants were between 18 and 25 years old, 20.60% ( $n = 100$ ) were 25 to 39 years old, and 9.90% ( $n = 48$ ) were over the age of 40. Caucasians comprised 80.20% of the participants ( $n = 388$ ) with Asian/Pacific Islanders following with 8.30% ( $n = 40$ ). The remainder were African American (4.70%,  $n = 23$ ), Hispanic/Latino (3.10%,  $n = 15$ ), biracial (2.30%,  $n = 11$ ), and self-designated as “other” (1.40%,  $n = 7$ ). The average BMI was 24.02 ( $SD = 5.26$ ).

## Materials

Demographic information such as age, weight, height, ethnicity, dieting history, self report of vegetarian status, and length of time as a vegetarian was collected. Participants were asked to complete a detailed questionnaire (presented in a standardized order), including whether or not he or she adhered to a vegetarian diet. Those who answered in the affirmative were asked a number of other questions regarding the type of vegetarian diet, reasons for beginning and maintaining the diet, and length of time the diet has been followed.

### *Dutch eating behavior questionnaire (DEBQ)*

The DEBQ (van Strien, Frijters, Bergers, & Defares, 1986) is a 33-item measure using a five-point Likert-type scale (ranging from 0 = “never” to 4 = “very often”) with three subscales measuring emotional eating, external eating, and restrained eating. Higher scores on the restraint scale indicate more restrictive eating behaviors in general, and not restriction of a particular type of food. Reliability for each subscale in this sample was 0.95, 0.87, and 0.92, respectively.

### *Self-esteem scale (RSES)*

The RSES (Rosenberg, 1965) is a 10-item measure that uses a four-point Likert-type scale (ranging from 0 = “strongly agree” to 3 = “strongly disagree”) that assesses general self-esteem. Reliability for the RSES in this sample was high, with a Cronbach's alpha of 0.91.

### *Eating attitudes test-26 (EAT-26)*

The EAT-26 (Garner & Garfinkel, 1979) is a 26-item measure using a six-point Likert-type scale (ranging from 1 = “always” to 6 = “never”) with three subscales measuring dieting behaviors, bulimic behaviors, and oral control. This instrument has been shown to be a reliable and valid measure for determining risk of disordered eating in clinical and non-clinical samples. A total score of 20 or greater indicates a risk for an eating disorder. Cronbach's alpha for the total score in this sample was 0.90.

### *Depression, anxiety, and stress scale-21 (DASS)*

The DASS (Lovibond & Lovibond, 1995) is a 21-item measure used to measure negative emotional state and distinguish between the areas of depression, anxiety, and stress. It used a four-point Likert-type scale (ranging from 0 = “did not apply to me at all” to 3 = “applied to me very much, or most of the time”) and has demonstrated reliability and validity (Antony, Bieling, Cox, Enns, & Swinson, 1998). Cronbach's alpha for overall DASS scores in this study was 0.93.

### *Food acceptance and action questionnaire (FAAQ)*

The FAAQ (Juarascio, Forman, Timko, Butryn, & Goodwin, 2011) is a 10 item modification of the Acceptance and Action Questionnaire (Hayes, et al.) designed to tap into an individual's willingness to experience food cravings, and urges to eat. It is scored using a 7-point Likert-type scale (ranging from 1 = “very seldom” to 7 = “always true”). In this sample, Cronbach's alpha was 0.76.

### *Paffenbarger physical activity questionnaire (PPAQ)*

The PPAQ (Paffenbarger, Wing, & Hyde, 1978) measures physical activity via questions about everyday activities (e.g., walking,

taking the stairs) and moderate and intense exercise. It allows for the calculation of calories expended during a specific period of time. It has been shown to have good reliability and validity (Nowak et al., 2010).

### *Power food scale (PFS)*

The PFS (Lowe et al., 2009) is a 15-item measure that uses a five-point Likert-type scale (ranging from 0 = “don't agree at all” to 4 = “strongly agree”). This measure evaluates how the availability of food in the environment affects an individual's thoughts, feelings, and behaviors. It had a Cronbach's alpha of 0.93 in this sample.

### *Food frequency questionnaire*

The food questionnaire was created for the current study. It was based on the Food Frequency Questionnaires (FFQ) used by Osler and Heitmann (1996) and was designed to query retrospectively the average frequency with which respondents consumed various foods in each food group (ranging from more than once daily to never). The questionnaire listed grouped food items (e.g., fruit) as opposed to specific items (e.g., apples, oranges), and included typically vegetarian items (e.g., soy products, tofu, textured vegetable protein, seitan, tempeh). The FFQ was used to verify self-report of “true” vegetarian status. That is, the FFQ of all individuals who indicated some level of a vegetarian diet was examined in order to confirm their dietary status. Individuals who identified as a vegan, vegetarian, or semi-vegetarian and whose dietary status was *not* confirmed by responses in the dietary log were re-assigned to the appropriate dietary status. For example, a participant who identified as vegetarian but later indicated eating fish or poultry was reclassified as a semi-vegetarian. Statistical analyses used vegetarian status as determined by a combined examination of self-report status and the dietary log.

### *Drive for thinness and asceticism subscales of eating disorder inventory (EDI-3)*

The drive for thinness (DFT) subscale of the EDI-3 (Garner, 2004) is a seven-item measure which uses a six-point Likert-type scale (ranging from 0 = “always” to 5 = “never”) in order to assess desire to be thinner and weight concerns. Cronbach's alpha was 0.89 in this study. The Asceticism (A) subscale of the EDI-3 (Garner, 2004) is a seven-item measure that uses a six-point Likert-type scale (ranging from 0 = “always” to 5 = “never”) to assess the virtue placed on self discipline control of body urges, self denial, self sacrifice, and self sacrifice. This measure was included as some researchers have argued that vegetarianism can be interpreted as striving for purity and control (Garner, Olmstead, & Polivy, 1983). In this study, the Cronbach's alpha was 0.82. These two subscales of the EDI-3 have been employed in prior research on vegetarianism and disordered eating and for that reason were included in the battery employed here.

## Procedures

### *Statistical analyses*

For the purpose of the current study, participants were classified as being either vegan (diet excluding all animal products), vegetarian (including ovo-vegetarian diet, lacto-vegetarian, and lacto-ovo vegetarian diets), semi-vegetarian (defined as a diet that included occasional consumption of fish or poultry but no red meat or pork). Omnivores are individuals who eat all foods, including all

meat and other animal products. Only individuals who answered in the affirmative to the question regarding adherence to a vegetarian diet were classified as some level of vegetarian. Thus, an individual who indicated that he or she *did not* adhere to a vegetarian diet but later reported no consumption of red meat was labeled an “omnivore” and not a semi-vegetarian.

As the purpose of this study was to determine whether or not differences existed between vegans, vegetarians, semi-vegetarians, and omnivores, a series of one way analyses of variance (ANOVAs) were conducted. When significant, a bonferroni-adjusted post hoc procedure was used to control for Type I error. When appropriate, non-parametric analyses were employed.

## Results

The sample included 35 vegans (7.2%), 111 true vegetarians (22.9%), 75 semi-vegetarians (15.4%), and 265 non-vegetarians (54.5%), representing the largest number of vegans and true vegetarians studied to date. On average, vegans reported adhering to a vegan diet for  $6.63 \pm 5.53$  years, vegetarians reported  $9.40 \pm 8.77$  years, and semi-vegetarians reported  $7.66 \pm 7.52$  years adhering to their diet. There was a significant difference in BMI between groups [ $F(3, 477) = 27.18, p < 0.01, \eta_p^2 = 0.03$ , observed power = 0.83]; with vegans weighing significantly less than omnivores ( $p < 0.01$ ). Means and standard deviations are presented in Table 1.

### Comparison of groups on disordered eating

Of interest was whether or not those who identified as vegans or vegetarians had less disordered eating patterns than those who identified as semi-vegetarian. For these analyses, the independent variable was the type of diet and the dependent variable was disordered eating. Due to significant Levene's tests, nonparametric statistics were used when appropriate. The Kruskal Wallis test indicated no significant differences between groups on the EAT

total score [ $\chi^2(3, N = 486) = 7.73, p = 0.052$ ] (for means and standard deviations, see Table 3). Given that this analysis approached significance, rankings were examined. Semi-vegetarians had the highest scores, followed by vegetarians, vegans, and omnivores. There were also no significant differences on the dieting [ $\chi^2(3, N = 486) = 7.58, p = 0.056$ ], bulimia [ $\chi^2(3, N = 486) = 5.77, p = 0.12$ ], or oral control [ $F(3, 482) = 1.85, p = 0.14, \eta_p^2 = 0.01$ , observed power = 0.48] subscales of the EAT.

There were significant differences between groups on the Drive for thinness sub-scale of the EDI [ $F(3, 482) = 3.22, p = 0.02, \eta_p^2 = 0.02$ , observed power = 0.74], with vegans having higher scores than either vegetarians or semi-vegetarians ( $p < 0.05$ ), but not higher scores than omnivores. Omnivores had higher drive for thinness scores than vegetarians and semi-vegetarians ( $p < 0.05$ ). The latter two did not differ from one another. There was no difference between groups on the Athesicism sub-scale of the EDI [ $\chi^2(3, N = 485) = 3.33, p = 0.34$ ].

Levels of restraint (as measured by the DEBQ) differed significantly across groups [ $F(3, 480) = 4.08, p < 0.01, \eta_p^2 = 0.03$ , observed power = 0.85]. Vegans had significantly lower levels of restraint than semi-vegetarians ( $p < 0.01$ ); semi-vegetarians, in turn, had higher levels of restraint than omnivores ( $p < 0.01$ ). Vegetarians' scores on the DEBQ-R did not differ significantly from any other group. There were significant differences between groups on scores on external eating [ $F(3, 480) = 7.31, p < 0.001, \eta_p^2 = 0.04$ , observed power = 0.98]; vegans' scores on the external eating subscale were significantly lower than all other groups (all  $p$ 's  $< 0.01$ ). Vegetarians had lower levels of external eating than omnivores ( $p < 0.01$ ) but not semi-vegetarians. There were no significant differences between groups on the emotional eating subscales of the DEBQ [ $F(3, 480) = 1.23, p = 0.12, \eta_p^2 = 0.01$ , observed power = 0.50].

There were significant differences between groups in terms of their responsiveness to the food environment [PFS:  $F(3, 467) = 6.22, p < 0.01, \eta_p^2 = 0.04$ , observed power = 0.96]. Vegans were significantly less susceptible to the food environment than either

**Table 1**  
Demographic information by level of vegetarianism for study 1.

Demographics	Vegans $n = 35$	Vegetarians $n = 111$	Semi-vegetarians $n = 75$	Omnivores $n = 265$	Total Participants $n = 486$
Age – M (SD)	26.94 (7.93)	26.73 (9.08)	26.65 (9.55)	23.44 (9.70)	24.94 (9.54)
BMI – M (SD)	21.29 (3.84)	23.79 (5.86)	23.92 (4.45)	24.49 (5.28)	24.01 (5.26)
Gender (Female, Male)	86%, 14%	86%, 14%	85%, 15%	70%, 30%	77%, 23%
Smokers	$n = 6$	$n = 17$	$n = 9$	$n = 29$	$n = 61$
Dieting to lose weight	$n = 4$	$n = 23$	$n = 16$	$n = 52$	$n = 95$
Dieting to maintain weight	$n = 5$	$n = 4$	$n = 15$	$n = 21$	$n = 45$
Attempting to gain weight	$n = 0$	$n = 6$	$n = 1$	$n = 16$	$n = 23$

**Table 2**  
Reasons for beginning and continuing a vegetarian diet across levels of vegetarianism (study 1).

	Vegans $n = 35$	Vegetarians $n = 110$	Semi-vegetarians $n = 54$	Total $n = 199$
<i>Reason for starting diet</i>				
Health reasons	5	19	15	39
Weight control	2	2	4	8
Ethical reasons	23	74	21	118
Religious convictions	0	4	3	7
Environmental concerns	4	9	8	21
Other reasons	1	2	3	6
<i>Reason for continuing diet</i>				
Health reasons	4	18	23	45
Weight control	0	3	2	5
Ethical reasons	26	75	17	119
Religious convictions	0	2	2	4
Environmental concerns	4	9	5	18
Other reasons	1	3	5	9

**Table 3**  
Means and standard deviations (SD) for independent variables (study 1).

	Vegans <i>n</i> = 35		Vegetarians <i>n</i> = 111		Semi-vegetarians <i>n</i> = 75		Non-vegetarians <i>n</i> = 265		Total Participants <i>n</i> = 486	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
EAT-T	9.22	13.39	10.08	11.64	11.81	12.23	7.98	8.91	9.14	10.55
EAT-D	4.94	7.94	5.68	7.92	7.37	8.12	4.70	6.00	5.35	7.01
EAT-B	1.88	3.22	1.99	2.89	2.68	3.81	1.47	2.15	1.80	2.75
EAT-O	2.40	2.96	2.41	3.03	1.76	2.55	1.82	2.39	1.99	2.62
DEBQ-E	28.17	9.34	32.23	11.63	33.48	11.23	32.05	10.59	32.03	10.88
DEBQ-EX	27.29	6.45	30.42	6.64	31.53	6.79	32.21	6.00	31.34	6.43
DEBQ-R	24.11	9.54	27.02	8.26	29.01	7.46	25.85	8.07	26.49	8.21
PFS	29.59	10.25	34.15	10.95	39.11	13.57	37.09	12.46	36.19	12.37
Drive thinness	26.09	9.58	22.62	9.64	22.45	8.78	24.89	8.31	24.08	8.86
Aestheticism	5.66	7.49	5.70	5.55	5.67	4.50	5.42	4.53	5.54	5.02
RSES	21.89	6.30	20.32	5.81	20.41	5.61	21.02	5.42	20.83	5.61
PPAQ	8309.75	13893.21	16808.13	71278.18	95062.16	775967.21	1289954.30	17530873.70	722477.56	12952620.63
DASS-D	6.51	7.60	9.46	10.39	8.05	9.00	7.00	7.61	7.69	8.58
DASS-A	0.60	0.92	0.54	0.89	0.59	0.92	0.45	0.84	0.50	0.87
DASS-S	11.83	10.31	11.50	8.77	12.56	9.01	10.45	7.67	11.11	8.37

Note: EAT-T = Eating attitudes test – total; EAT-D = Eating attitudes test – dieting; EAT-B = Eating attitudes test – Bulimia; EAT-O = Oral control; DEBQ-E = Dutch eating behavior questionnaire – emotional eating subscale; DEBQ-EX = Dutch eating behavior questionnaire – external eating subscale; DEBQ-R = Dutch eating behavior questionnaire – restraint scale; PFS = Power of food scale; RSES = Rosenberg self esteem scale; PPAQ = Paffenberg physical activity questionnaire; DASS-D = Depression anxiety stress scale – depression; DASS-A = Depression anxiety stress scale – anxiety; DASS-S = Depression anxiety stress scale – stress.

semi-vegetarians or omnivores ( $p < 0.05$ ), as were vegetarians ( $p < 0.05$ ). There was no significant difference between semi-vegetarians and omnivores. Willingness to experience cravings and urges in a food-rich environment was highest amongst vegans [FAAQ:  $F(3, 465) = 8.83, p < 0.01, \eta_p^2 = 0.05$ , observed power = 0.90]. Vegetarians were also more willing to have cravings (without having to give into them) than omnivores ( $p < 0.01$ ) but were equivalent to semi-vegetarians. There was no difference in willingness to experience thoughts about food between semi-vegetarians and omnivores.

#### Reasons for vegetarian diet

Many respondents indicated that more than one reason played a role in their decision to begin restricting meat. In summarizing data, the top ranked choice given by participants was chosen as the primary reason. Given this, the majority of individuals who reported consuming some level of a meat-free diet indicated they did so primarily due to ethical reasons (see Table 2). Health reasons were the second highest reason, followed by environmental concerns, weight control, religious convictions, and “other” reasons. Other reasons included economical reasons, having been born into a vegetarian family, and being disgusted by meat. Generally speaking, individuals tended to continue their chosen diet for the same reason(s) they began the diet. However, more people indicated that they continued the diet out of habit or due to now being disgusted by meat. Table 2 reports prevalence of each reason for diet choice by the type of diet consumed.

In order to determine whether individuals who chose meat-restricted diet for weight control reasons would have more disordered eating than those who chose a meat restricted diet for other reasons, a series of one-way ANOVAs were conducted (only vegans, vegetarians, and semi-vegetarians were used as the sample for these analyses, thus the overall *N* was lower). The independent variables were the reasons for vegetarianism (health, weight, ethical, religious, environmental, economical, and political) and the dependent variables used were the EAT-total, EAT-dieting subscale, and Drive for Thinness sub-scale of the EDI. None of the analyses were significant: EAT-Total: [ $F(5, 184) = 0.93, p = 0.46, \eta_p^2 < 0.02$ , observed power = 0.33], EAT-Diet: [ $F(5, 184) = 0.63, p = 0.67, \eta_p^2 < 0.02$ , observed power = 0.23], and EDI-DFT: [ $F(5, 184) = 1.16, p = 0.33, \eta_p^2 < 0.03$ , observed power = 0.41] indicating that those who chose a diet for weight control reasons overall did not report higher levels of disordered eating.

#### Differences in general mental health

Overall, there were no differences between groups in terms of depression [ $\chi^2(3, N = 485) = 2.90, p = 0.41$ ], anxiety [ $F(3, 481) = 0.65, p = 0.59, \eta_p^2 < 0.01$ , observed power = 0.19], or stress [ $F(3, 481) = 1.49, p = 0.22, \eta_p^2 < 0.01$ , observed power = 0.39]. All groups reported exercising at approximately the same levels [ $F(3, 482) = 0.37, p = 0.77, \eta_p^2 < 0.01$ , observed power = 0.12], and they had equivalent levels of self-esteem [ $F(3, 476) = 0.96, p = 0.41, \eta_p^2 < 0.01$ , observed power = 0.26].

#### Discussion

The current study addressed the lack of useful operational definitions of “vegetarian” in prior studies by clearly defining vegan, vegetarian, semi-vegetarian, and non-vegetarian diets, and by confirming self-reported dietary status via a dietary log. Furthermore, an effort was made to recruit high numbers of individuals adhering to vegan, true vegetarian, and semi-vegetarian diets. This resulted in the largest samples of these individuals to date with more power to draw meaningful conclusions in comparisons of vegans, vegetarians, semi-vegetarians and non-vegetarians.

Unlike previous studies that reported health concerns as the number one reason for choosing a vegetarian diet, participants in this study indicated ethical reasons as the number one reason for choosing a vegan, vegetarian or semi-vegetarian diet. Health reasons were the second most commonly cited reason for beginning this type of diet. Ethical reasons were most commonly cited for maintaining a semi-vegetarian diet. Only eight participants indicated that weight was the primary reason they began a meat restricted diet.

Though the sample was overall rather healthy, the semi-vegetarian group was relatively the most disordered in terms of their food-related behaviors and attitudes. The semi-vegetarians had a more disordered eating pattern as evidenced by higher levels of restraint, external eating, hedonic hunger, and avoidance of food cues. Although not significantly different ( $p = 0.052$ ), semi-vegetarians had higher EAT-26 total and diet scores than the other groups. In contrast, vegans and omnivores did have higher (and statistically equivalent) scores on the EDI-DFT than either vegetarians or semi-vegetarians. This finding is unusual, and may be a reflection of vegans and omnivores being at opposite ends of the dietary/variety restriction spectrum. Drive for thinness has historically been viewed as a desire to lose weight; however, recent work (Chernyak & Lowe, 2010) has hypothesized that the EDI-DFT assesses a drive to

be thin (as opposed to objective thinness) and may reflect a fear of weight gain. If this is the case, elevated scores on the EDI-DFT for omnivores is logical given their higher BMI. Likewise, vegans had significantly lower BMIs than omnivores and a fear of weight gain may reflect a desire to maintain a lower weight. Whether or not this is related to health reasons or is indicative of disordered eating is unclear from the current data. Given that weight and shape reasons were not the primary reasons for choosing a vegan diet and that semi-vegetarians tended to be higher on other measures of disordered eating – the hypothesis that high EDI-DFT scores in vegans reflect a fear of weight gain that may be related to health reasons is plausible and needs to be explored further.

Previous research indicated that vegetarians may engage in more disordered eating habits (Kadambari et al., 1986; O'Connor et al., 1987; Perry et al., 2001; Trautman et al., 2008; Worsley & Skrzypiec, 1998); however, those studies grouped vegetarians and semi-vegetarians together due to low numbers. Based on findings presented here it seems that the appearance of disordered eating (and hence the potential of vegetarianism as a risk factor for eating disorders) may have been an artifact of the high number of semi-vegetarians included in prior research. This strongly suggests that when evaluating the potentially disordered eating patterns of vegetarians there is a need to differentiate between vegans, vegetarians, and semi-vegetarians and that research findings to date may not be generalizable to true vegetarians. Given the higher number of analyses and risk of Type I error in this study, it is essential that future research attempt to replicate the findings presented here using equally large sample sizes of the four groups and planned comparisons.

## Study 2

Having demonstrated that semi-vegetarians, but not full vegetarians or vegans, are most likely to engage in disordered eating behaviors, this follow-up study was designed to characterize weight and eating-related attitudes and behaviors characteristic of semi-vegetarians, compared to omnivores, in more detail. Patterns of responses to standard assessments of eating disorders pathology, reasons for vegetarianism (i.e., ideological versus health-related) and their relationship to eating behaviors were also assessed. Measures of eating behavior tend to assume that rigid rules around food consumption, such as the exclusion of red meat, are indications of disordered eating. Semi-vegetarians – regardless of the reason for their dietary choice – adhere to strict rules regarding the consumption of certain types of food and even eliminate entire food groups from their diet. Thus, it was hypothesized that due to the nature of semi-vegetarians' diet, individuals would have inflated scores on traditional assessments of eating behaviors.

## Method

### Statistical analyses

All methods were reviewed and approved by the Institutional Review Board at the University of Pennsylvania.

### Participants

Participants were 136 female undergraduates recruited through a departmental subject pool at the University of Pennsylvania to complete an anonymous web-based questionnaire in exchange for research participation credit in 2007 and 2008. Included in the analyses were 117 respondents who either avoided only some meat (such as “red meat” or “poultry;”  $n = 44$ , 37.3%) or indicated eating all meat ( $n = 74$ , 62.7%). Those who reported a vegetarian or vegan diet ( $n = 6$ , 4.4% of overall sample) were excluded from analyses. Respondents reported a mean age of 19 years ( $M = 19.43$ ,  $SD = 2.64$ ). They self-described as Caucasian ( $n = 871$ , 60.7%),

East/South-East Asian ( $n = 27$ , 23.1%), African-American ( $n = 7$ , 6.0%), Hispanic ( $n = 5$ , 4.3%), South Asian/Indian ( $n = 5$ , 4.3%), and “other” ( $n = 2$ , 1.7%).

## Measures

### Meat restriction

Respondents reported on their dietary behaviors, with a focus on meat-eating habits (e.g. “Do you avoid any meat? If yes, which kind?”), using categories of meat avoidance employed in previous studies on this issue (Curtis & Comer, 2006; Martins, Pliner, & O'Connor, 1999). Participants were also asked to indicate reasons for any meat avoidance, including health, morals, calories, taste, and religion.

### Weight and dieting

Participants noted their current height and weight (to calculate BMI), as well as their ideal weight to determine actual-ideal weight discrepancy as an indicator of weight dissatisfaction. They were also asked about perceived overweight (e.g., “My belly is too fat”) and perceived weight relative to their peers. Questions regarding weight and dieting were adopted from those used by Rozin and colleagues (Rozin, Bauer, & Catanese, 2003).

### Restraint scale and eating disorders examination-questionnaire

In order to assess levels of dietary restraint and presence of any eating disorder symptoms respondents completed the Restraint Scale (RS) (Herman & Polivy, 1980) and the Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Cooper, 1993). The Restraint Scale is a ten-item measure assessing dietary restraint, including weight fluctuations and concern for dieting. It has good test-retest reliability and adequate internal consistency (Allison, Kalinsky, & Gorman, 1992). The EDE-Q is a 36-item questionnaire-based version of the widely used Eating Disorder Examination (Fairburn & Cooper, 1993) that assesses key behavioral and attitudinal aspects of eating disorders in terms of frequency and severity ratings. It has been shown to have adequate validity (Mond, Hay, Rodgers, Own, & Beumont, 2004) and internal consistency (Peterson et al., 2007). Though there are some inconsistent findings regarding the factor structure of the questionnaire version of this instrument (Peterson et al., 2007), for purposes of comparison with prior studies the standard four-factor solution (Weight, Eating, and Shape Concern, and Restraint) was applied here.

## Results

### Semi-vegetarians' reasons for avoiding meat

The semi-vegetarians reported avoiding meat for an average of  $5.77 \pm 4.99$  years. A majority of semi-vegetarians reported sensory factors or “taste” as the primary reason for their avoidance ( $n = 21$ , 47.7%). Eleven respondents (25.0%) reported avoiding meat for “health” reasons; seven limited their meat intake due to ideational reasons, including “religion” ( $n = 5$ , 11.4%) and “morals” ( $n = 2$ , 4.5%). Only two respondents (4.5%) cited “calories” as their primary reason for limiting their meat intake. Three (6.8%) reported “other” or no reasons for their meat avoidance. A majority ( $n = 33$ , 75.0%) of semi-vegetarians indicated that their current primary reason for avoiding meat was also the main reason they originally began to avoid meat.

### Weight and dieting

Respondents were in the low to average range of weight, with a mean BMI of 21.40 ( $SD = 3.80$ ). There were no significant differences in self-reported BMI between semi-vegetarians and omnivores [ $M = 21.27$ ,  $SD = 2.33$  versus  $M = 21.47$ ,  $SD = 4.47$ ;  $t(116) = -0.33$ ,  $p = 0.74$ ], nor were there any significant differences

in self-reported discrepancy between current and ideal weight between semi-vegetarian ( $M = 8.00$  lb,  $SD = 7.15$ ) and omnivore respondents [ $M = 11.75$  lb,  $SD = 11.69$ ;  $t(60) = 1.55$ ,  $p = 0.13$ ]. Semi-vegetarians did not differ significantly from omnivores in self-reported prevalence of dieting (20.5%,  $n = 9$  versus 31.1%,  $n = 23$  who reported being on a diet;  $\chi^2 = 1.68$ ,  $p = 0.29$ ), and they were not more likely to report controlling their caloric intake (59.1%,  $n = 26$  versus 51.4%,  $n = 38$ ,  $\chi^2 = 0.67$ ,  $p = 0.45$ ), or to have been overweight or obese in the past (18.2%,  $n = 8$  versus 24.3%,  $n = 18$ ;  $\chi^2 = 0.61$ ,  $p = 0.50$ ).

#### Restraint scale

A *t*-test indicated that semi-vegetarians scored significantly higher on the Restraint Scale than omnivores [ $M = 16.32$ ,  $SD = 5.03$  vs.  $M = 13.03$ ,  $SD = 5.36$ ;  $t(60) = -2.49$ ,  $p = 0.02$ ]. In order to understand where these differences might lie, a series of post hoc *t*-tests was conducted for each item. Semi-vegetarians scored significantly higher than omnivores on two of ten items on the RS, namely item 4: "In a typical week, how much does your weight fluctuate?" [ $M = 1.68$ ,  $SD = 0.91$  versus  $M = 0.91$ ,  $SD = 0.87$ ;  $t(60) = -1.90$ ,  $p = 0.002$ ;  $d = 0.83$ ], and item 7: "Do you give too much time and thought to food?" [ $M = 1.71$ ,  $SD = 0.71$  versus  $M = 1.29$ ,  $SD = 0.80$ ;  $t(60) = -2.16$ ,  $p = 0.04$ ,  $d = 0.55$ ]. Differences on item #9 "How conscious are you of what you are eating?" approached significance [ $M = 2.21$ ,  $SD = 0.63$  versus  $M = 1.85$ ,  $SD = 0.82$ ;  $t(60) = -1.91$ ,  $p = 0.06$ ,  $d = 0.49$ ]. Body mass index was not significantly correlated with RS scores in omnivores or semi-vegetarians (all  $p > 0.05$ ).

#### Eating disorder examination-questionnaire

In order to determine whether or not semi-vegetarians scored significantly higher than omnivores on subscales of the EDE-Q, a series of *t*-tests were conducted. The only difference found was on the the Eating Concern subscale of the EDE-Q, with semi-vegetarians having higher scores than omnivores [ $M = 13.70$ ,  $SD = 6.75$  versus  $M = 11.08$ ,  $SD = 5.51$ ;  $t(116) = -2.30$ ,  $p = 0.02$ ;  $d = 0.43$ ]. There were no significant differences on the Weight Concern, Shape Concern and Restraint subscales (all  $p > 0.05$ ).

#### Discussion

The present study examined the differences between semi-vegetarians and omnivores. Results of Study 1 indicated that semi-vegetarians may have more eating pathology than other groups. Study 2 suggested that omnivores do not differ from semi-vegetarians in self-reported BMI, weight dissatisfaction, perceived overweight, or rates of dieting and controlling calories. Semi-vegetarians did indicate more dietary restraint than omnivores; differences in scores on individual items of the Restraint Scale were significant on two of the ten scale items. It is important to note that there were a number of *t*-tests conducted in order to compare semi-vegetarians and omnivores and there is an increased possibility of Type I error. However, even with a bonferroni correction, the item referring to weight fluctuation continues to be significant. Despite the increased possibility of Type I error, the apparent difference between omnivores and semi-vegetarians on individual items indicates that the validity of these measures in a meat restricted population needs to be explored in greater detail. Future studies should conducted planned comparisons with a larger sample on the items that appear relevant here. Of note is that one of these items refers simply to being conscious of and giving time and thought to what is being eaten, which should come as no surprise in a sample of individuals whose diet is defined by an explicit avoidance of entire food groups.

In order to have a deeper understanding of disordered eating in semi-vegetarians, the EDE-Q was also administered. Semi-vegetar-

ians scored higher on the Eating Concern subscale of the EDE-Q, possibility because being more conscious of what is consumed in order to avoid ingesting meat is generally pathologized by the measure. The difference between groups on the Eating Concern subscale combined with the differences on some items of the RS calls into question the appropriateness of existing assessments of dietary restraint and eating disorders in determining pathology in semi-vegetarians.

#### General discussion

Previous research on vegetarianism and its relationship to disordered eating has been fraught with problems. The primary areas of concern in previous research were the broad definitions of vegetarianism, small sample size, and questionable applicability of traditional assessments of eating behavior. The two studies presented here had different goals and thus employed different measures. While limiting the amount of comparison that can be drawn between the two studies, together they paint a more complete and nuanced picture of the relationship between vegetarianism and disordered eating.

The first study indicated that semi-vegetarians had the most pathological relationship with food and the body. Semi-vegetarians not only attempt to restrict their intake via restraint, but are much more susceptible to over-eating due to higher external eating tendencies, greater levels of hedonic hunger, and a desire to avoid negative food related cognitions, affect, and physiological sensations. It may be that this combination serves as a risk factor for disordered eating in this population. In the second study, differences between semi-vegetarians and omnivores were explored in more depth – specifically disordered eating. Overall, differences between the groups were few – though, semi-vegetarians did appear to have more eating concerns than omnivores. Further investigation of the data indicated that there were differences between groups on individual scale items. The nature of these differences suggests that overall scores may be overly inflated by reports of eating-related attitudes and behaviors that can be considered normative in the context of a meat-restricting diet. Findings indicated that the Restraint Scale (Herman & Polivy, 1980) may not be the most appropriate measure for assessing restraint in this population as a key item differentiating the two groups merely reflected heightened awareness of what was being eaten. As noted above, this would be expected in a group defined by avoidance of particular food types. Similarly, higher scores on the EDE-Q Eating Concern subscale may over-pathologize semi-vegetarians. The extent to which these responses are reflective of simply following a restrictive diet versus indicative of underlying pathology should be explored further in future research. Differentiating between semi-vegetarians who restrict their meat intake for weight and shape reasons and those who restrict meat from their diet for reasons such as health, ethics, or disgust may be a useful approach. Findings emphasize the need to revisit the way in which disordered eating is assessed in meat-restricting individuals, and point to a potential need to develop more suitable measures for use in this population.

Taken together, these two studies do indicate clearly that semi-vegetarians are at the most risk for disordered eating patterns. The food environment in the United States is considered to be "obesogenic" which means it has appealing, inexpensive, high calorie food available rather easily (Hill & Peters, 1998), and eating a healthy lower calorie diet is more difficult because it is more expensive and not as readily available (Drewnowski & Darmon, 2005). Due to the current food environment, semi-vegetarians may eat a diet low in meat products in an attempt to control their weight and type of food consumed. It is also possible that the development of disordered eating can put an individual "at risk" for developing a semi-vegetarian diet. Given the cross-sectional nature of the data

from these two studies, it is impossible to tell if semi-vegetarians restrict meat from their diets because they struggle with food-related issues or if they struggle with food-related issues because they restrict meat from their diets. Future studies should assess the directionality of the relationship between semi-vegetarianism and disordered eating and specifically investigate the eating behavior and attitudes of semi-vegetarians who chose the diet for weight and shape reasons.

It is important to note that in Study 1 vegans and true vegetarians had significantly lower levels of restraint, external eating, hedonic hunger, and greater levels of acceptance in relation to food in comparison to semi-vegetarians. This highlights previously unacknowledged positive aspects of adhering to a completely meat or animal product free diet. The unknown is whether or not this type of diet could actually serve as a protective factor against developing disordered eating. Vegans appear to have the healthiest attitudes towards food, closely followed by vegetarians. Non-vegetarians more closely resemble semi-vegetarians, though as noted the former has more maladaptive attitudes.

Although these studies demonstrate clear differences between vegans, vegetarians, semi-vegetarians and non-vegetarians, there are limitations. The first study had a much larger sample of vegetarians and vegans than any previous research. However, it is entirely possible that only those vegetarians or vegans who have healthy attitudes towards food opted to participate. Furthermore, the attempt to include the most common measures used in past research in Study 1 resulted in a number of analyses potentially increasing the likelihood of Type 1 error. Given the importance of having a large sample of true vegans, true vegetarians, semi-vegetarians to explore the question of disordered eating in this group, the benefits of conducting so many analyses outweighed the risks. Nonetheless, attempts should be made to recruit large samples and replicate these findings. Furthermore, now that (lack of) differences on certain measures has been established, more complicated hypotheses involving moderating factors (such as reasons for beginning a diet, gender, etc.) can be formulated and tested.

Based on differences in item responses on measures of restraint and disordered eating in Study 2, the measures used may not be appropriate to measure eating pathology in vegetarians. In semi-vegetarians, the reasons for meat restriction may need to be taken in account. Thus, further research (both cross-sectional and prospective) is necessary to complete our understanding of the relationship between vegetarianism, disordered eating patterns, and clinical eating disorders.

## References

- Allison, D. B., Kalinsky, L. B., & Gorman, B. S. (1992). A comparison of the psychometric properties of three measures of dietary restraint. *Psychological Assessment, 4*(3), 391–398.
- Amato, P.R., & Partridge, S.A. "The Origins of Modern Vegetarianism." Eatveg.com. 15 Nov. 2008. <<http://www.eatveg.com/veghistory.htm>>.
- Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales (DASS) in clinical groups and a community sample. *Psychological Assessment, 10*, 176–181.
- Barr, S. I., & Broughton, T. M. (2000). Relative weight, weight loss efforts and nutrient intakes among health-conscious vegetarian, past vegetarian, and non-vegetarian women ages 18–50. *Journal of the American College of Nutrition, 19*, 781–788.
- Barr, S. I., Janelle, K. C., & Prior, J. C. (1994). Vegetarian vs nonvegetarian diets, dietary restraint, and subclinical ovulatory disturbances. Prospective 6-month study. *American Journal of Clinical Nutrition, 60*, 887–894.
- Beardsworth, A. D., & Keil, E. T. (1993). Contemporary vegetarianism in the UK. Challenge and incorporation? *Appetite, 20*, 229–234.
- Chernyak, Y., & Lowe, M. R. (2010). Motivations for dieting. Drive for thinness is different from drive for objective thinness. *Journal of Abnormal Psychology, 119*, 276–281.
- Curtis, M. J., & Comer, L. K. (2006). Vegetarianism, dietary restraint, and feminist identity. *Eating Behaviors, 7*, 91–104.
- Drewnowski, A., & Darmon, N. (2005). The economics of obesity. Dietary energy density and energy cost. *American Journal of Clinical Nutrition, 82*, 265S–273S.
- Fairburn, C. G., & Cooper, Z. (1993). The eating disorder examination. In C. G. Fairburn & G. T. Wilson (Eds.), *Binge eating: Nature, assessment, and treatment* (pp. 227–249). New York: The Guilford Press.
- Fisak, B., Peterson, R. D., Tantleff-Dunn, S., & Molnar, J. M. (2006). Challenging previous conceptions of vegetarianism and eating disorders. *Eating and Weight Disorders, 11*, 195–200.
- Garner, D. M. (2004). *Eating disorder inventory – Third Edition (EDI-3)*. Lutz, FL: Psychological Assessment Resources.
- Garner, D. M., & Garfinkel, P. E. (1979). The eating attitudes test. An index of the symptoms of anorexia nervosa. *Psychological Medicine, 9*, 273–279.
- Garner, D. M., Olmstead, M. P., & Polivy, J. (1983). Development and validation of a multidimensional eating disorder inventory for anorexia and bulimia. *International Journal of Eating Disorders, 2*, 15–34.
- Gilbody, S. M., Kirk, S. F. L., & Hill, A. J. (1999). Vegetarianism in young women. Another means of weight control? *International Journal of Eating Disorders, 26*, 87–90.
- Herman, C. P., & Polivy, J. (1980). Restrained eating. In A. J. Stunkard (Ed.), *Obesity*. Philadelphia: Saunders.
- Hill, J. O., & Peters, J. C. (1998). Environmental contributions to the obesity epidemic. *Science, 280*, 1371–1374. doi:10.1126/science.280.5368.1371.
- Janelle, K. C., & Barr, S. I. (1995). Nutrient intake and eating behavior scores of vegetarian and nonvegetarian women. *Journal of the American Dietetic Association, 95*, 180–186.
- Juarascio, A., Forman, E., Timko, C. A., Butryn, M., & Goodwin, C. (2011). The development and validation of the Food Acceptance and Action Questionnaire (FAAQ). *Eating Behavior, 12*, 182–187.
- Kadambari, R., Gowers, S., & Crisp, A. H. (1986). Some correlates of vegetarianism in anorexia nervosa. *International Journal of Eating Disorders, 5*, 539–544.
- Klopp, S. A., Heiss, C. J., & Smith, H. S. (2003). Self-reported vegetarianism may be a marker for college women at risk for disordered eating. *Journal of the American Dietetic Association, 103*(6), 745–747.
- Larsson, C. L., Klock, K. S., Astrom, A. N., Haugejorden, O., & Johansson, G. (2002). Lifestyle-related characteristics of young low-meat consumers and omnivores in Sweden and Norway. *Journal of Adolescent Health, 31*, 190–198.
- Lovibond, P. F., & Lovibond, S. H. (March 1995). The structure of negative emotional states. Comparison of the depression anxiety stress scales (DASS) with the beck depression and anxiety inventories. *Behaviour Research and Therapy, 33*(3), 335–343. doi:10.1016/0005-7967(94)00075-U.
- Lowe, M. R., Butryn, M. L., Didie, E. R., Annunziato, R. A., Thomas, J. G., Crerand, C. E., Ochner, C. N., Coletta, M. C., Bellace, D., Wallaert, M., & Halford, J. (2009). The power of food scale. A new measure of the psychological influence of the food environment. *Appetite, 53*, 114–118.
- Martins, Y., Pliner, P., & O'Connor, R. (1999). Restrained eating among vegetarians. Does a vegetarian eating style mask concerns about weight? *Appetite, 32*, 145–154.
- Messina, V. K., & Burke, K. I. (1997). Position of the American Dietetic Association. Vegetarian diets. *Journal of the American Dietetic Association, 97*(11).
- Mond, J. M., Hay, P. J., Rodgers, B., Own, C., & Beumont, P. J. V. (2004). Validity of the Eating Disorders Examination Questionnaire (EDE-Q) in screening for eating disorders in community samples. *Behavior Research and Therapy, 42*(5), 551–567.
- Nowak, Z., Plewa, M., Skowron, M., Markiewicz, A., Kucio, C., & Osiadło, G. (2010). Paffenbarger physical activity questionnaire as an additional tool in clinical assessment of patients with coronary artery disease treated with angioplasty. *Kardiologia Polska, 68*, 32–39.
- O'Connor, M. A., Touyz, S. W., Dunn, S. M., & Beumont, P. J. V. (1987). Vegetarianism in anorexia nervosa? A review of 116 consecutive cases. *Medical Journal of Australia, 147*(11–12), 540–542.
- Osler, M., & Heitmann, B. L. (1996). The validity of a short food frequency questionnaire and its ability to measure changes in food intake. A longitudinal study. *International Journal of Epidemiology, 25*, 1023–1029.
- Paffenbarger, R. S., Wing, A. L., & Hyde, R. T. (1978). Physical activity as an index of heart attack risk in college alumni. *American Journal of Epidemiology, 108*, 161–175.
- Perry, C. L., McGuire, M. T., Neumark-Sztainer, D., & Story, M. (2001). Characteristics of vegetarian adolescents in a multiethnic urban population. *Journal of Adolescent Health, 29*, 406–416.
- Peterson, C. B., Crosby, R. D., Wonderlich, S. A., Joiner, T., Crow, S. J., Mitchell, J. E., et al. (2007). Psychometric properties of the eating disorder examination-questionnaire. Factor structure and internal consistency. *International Journal of Eating Disorders, 40*, 386–389.
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
- Rozin, P., Bauer, R., & Catanese, D. (2003). Food and life, pleasure and worry, among American college students. Gender differences and regional similarities. *Journal of Personality and Social Psychology, 85*, 132–141.
- Sullivan, V., & Damani, S. (2000). Vegetarianism and eating disorders – partners in crime? *European Eating Disorder Review, 8*, 263–266.
- Trautman, J., Rau, S. I., Wilson, M. A., & Walters, C. (2008). Vegetarian students in their first year of college. Are they at risk for restrictive or disordered eating behavior? *College Student Journal, 42*(2).



van Strien, T., Frijters, J. E. R., Bergers, G. P. A., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders*, 5(2), 295–315.

Worsley, A., & Skrzypiec, G. (1998). Teenage vegetarianism. Prevalence, social and cognitive contexts. *Appetite*, 30, 151–170.