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# Motivation matters: Examining vegetarianism, weight motivations, and eating disorder psychopathology among college students

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## Abstract

**Objective:** Previous research has suggested a link between vegetarianism, broadly defined, and symptoms of eating disorders (ED). However, the literature supporting this link is mixed and limited by possible measurement artifacts. Using data from a national sample of college students, the present study examines ED symptomatology among three groups: (1) vegetarians whose meat avoidance is motivated by weight concerns; (2) non-weight motivated vegetarians; and (3) non-vegetarians.

**Method:** Participants include 9,910 students from 12 colleges and universities across the United States who participated in the web-based Healthy Bodies Study. ED symptomatology was measured using the Short-Eating Disorder Examination-Questionnaire (S-EDE-Q). First, multi-group confirmatory factor analysis was conducted to test measurement invariance (MI) of the S-EDE-Q across weight-motivated vegetarians, non-weight-motivated vegetarians, and non-vegetarians. Gender- and BMI-adjusted ANCOVA was used to compare S-EDE-Q scores across groups.

**Results:** 9.3% of participants were vegetarian. Cis-female and gender minority students were more likely to be vegetarian; those who became vegetarians after entering college were more likely to report weight-related motivations. Strict MI was supported for the S-EDE-Q global and subscale scores. Weight-motivated vegetarians reported higher levels of restraint, shape/weight overvaluation, body dissatisfaction, and global ED psychopathology relative to other participants.

**Discussion:** To our knowledge, this is the first to explicitly link weight motivations for vegetarianism to ED psychopathology in a large, representative sample of young adults. Results

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suggest that students presenting with ED symptoms should be assessed for their motivations for adopting a vegetarian diet, and this information should considered in treatment decisions.

## Keywords

Vegetarianism refers to a spectrum of eating behaviors involving the elimination of meat and animal products from the diet to varying degrees. Vegetarian diets include veganism (elimination of all meat and animal products), lacto-ovo vegetarianism (elimination of all meat but not eggs and dairy products), and semi-vegetarianism (elimination of specific meats, attempts to reduce meat intake, or avoidance of meat under specific circumstances; Timko, Hormes, & Chubski, 2012). Unless otherwise specified, "vegetarianism" will be used to refer to the full spectrum of meat-reducing eating behaviors, from veganism to semi-vegetarianism. In a 2018 Gallop poll, an opinion survey conducted by a private company, 5% of representatively sampled Americans identified as vegetarians, with the highest rates (8%) reported among young adults ages 18–34 (e.g., Hrynowski, 2019).

While physical health benefits of following a vegetarian diet have been documented (e.g., Melina, Craig, & Levin, 2016), there is concern and uncertainty among clinicians and researchers about whether vegetarianism is psychologically healthy in people with, or at risk for, eating disorders. This may be due to a perception that vegetarianism may act as a socially acceptable "cover" for restrictive eating (Gilbody, Kirk, & Hill, 1998; Lindeman, Stark, & Latvala, 2000). Alternately, many researchers and clinicians who treat eating disorders emphasize the central role of rigid and rule-bound eating habits (e.g., "food rules") in maintaining eating disorder symptoms and that any attempt to restrict dietary intake can set the stage for the onset of an eating disorder, even if the initial restriction is not motivated by weight and shape concerns (e.g., Gilbody et al., 1998; Polivy, Herman, Younger, & Erskine, 1979). A similar argument has been made about the etiological role of non-weight-related restrictive eating due to food insecurity, in light of recent findings showing that people who are food insecure report elevated disordered eating symptoms and behaviors that increase with increasing levels of food insecurity (Becker, Middlemass, Taylor, Johnson, & Gomez, 2017; Lydecker & Grilo, 2019).

There is evidence of higher rates of vegetarianism among women in treatment for a diagnosed eating disorder compared to college student control groups (Bardone-Cone et al., 2012; Zuromski et al., 2015). However, evidence for higher rates of disordered eating symptoms among vegetarians is decidedly mixed. The most common study design used to test this association involves comparing samples of vegetarians and non-vegetarians on eating disorder symptoms or related constructs such as cognitive restraint (i.e., the intent and/or attempt to restrict caloric intake; Polivy et al., 1979). While several studies comparing vegetarians and non-vegetarians on restraint or disordered eating symptoms report higher levels among vegetarians (Bas et al., 2005; Gilbody et al., 1998; Klopp, Heiss, & Smith, 2003; Lindeman et al., 2000; Martins, Pliner, & O'Connor, 1999; McLean & Barr, 2003; Wilson, Rau, Trautmann, Walters, 2004), others have failed to find differences (Brytek-Matera, Czepczor-Bernat, Jurzak, Kornaka, & Kołodziejczyk, 2019; Curtis & Comer, 2006;

Fisak, Peterson, Tantleff-Dunn, & Molnar, 2006; Norwood et al., 2019; Timko et al., 2012), or found that vegetarians report lower levels of restraint or eating disorder symptomatology (e.g., Brytek-Matera, 2020; Forestell et al., 2012; Heiss et al., 2018) compared to non-vegetarian comparison groups. Notably, all of the studies that reported an association between vegetarianism and restraint/disordered eating were limited by small sample sizes of vegetarians (e.g., n's ranging from 15 to 119). The studies that found no differences or that vegetarians reported lower levels of eating disorder symptomatology tended to employ larger samples of vegetarians, although some still relied on small vegetarian samples (e.g., n's ranging from 79 to 318).

There are also no naturalistic or representative longitudinal data showing the temporal relationship between the onset of vegetarianism and disordered eating, but at least two experimental weight loss studies have examined the role of restraint in relation to vegetarianism by randomizing participants with overweight or obesity to vegetarian or non-vegetarian low calorie diets. In both studies, comparable increases in restraint were observed over the course of the intervention across vegetarian and non-vegetarian groups (Kahleova, Hrachovinova, Hill, & Pelikanova, 2013; Moore, McGrievy & Turner-McGrievy, 2015). These findings suggest that weight loss motivations and reduced caloric intake, not vegetarianism per se, are associated with cognitive restraint and possible risk for the development of an eating disorder in individuals with obese-range BMIs. This has yet to be replicated in longitudinal studies of individuals across the weight spectrum who adopt vegetarian diets for weight loss vs. other reasons.

The existing cross-sectional literature comparing vegetarians to non-vegetarians on self-reported restraint and eating disorder symptoms has been criticized for failing to account for participants' stated motivation for vegetarianism (Forestell et al., 2018; Timko et al., 2012). In the broader body of vegetarianism literature, a majority of vegetarians report that their primary motivations are ethical, including concerns for animal welfare and/or concerns about the impact of the meat industry on the environment and on human health and welfare (Rosenfeld, 2018; Ruby, 2012). Others avoid some or all animal products because of hedonic preferences or disgust towards meat (Rosenfeld, 2018; Ruby, 2012). However, still others endorse adopting a vegetarian diet due primarily to motivations related to health and/or weight control. To our knowledge, no published study to date has directly compared groups of vegetarians who differ on weight motivation on measures of eating disorder psychopathology.

Additionally, the current literature may be flawed because observed differences between vegetarians and non-vegetarians might be driven by issues with measurement. Timko et al. (2012) raised concerns that higher scores on measures of restraint and eating disorder psychopathology might be an artifact of the need to give more time and thought to finding vegetarian-friendly food and planning ahead, and the occasional need to turn down social invitations or skip a meal in order to maintain a dietary approach that is defined by avoidance of a specific food group. To our knowledge, Heiss and colleagues (2018) were the first to attempt to assess the validity of the full Eating Disorders Examination Questionnaire (EDE-Q) in a sample of vegans compared to a non-vegetarian sample, but were unable to do so due to inadequate fit in both samples.

Given the limitations of past research (e.g., small sample sizes, lack of exploration of motivation, and potential measurement artifacts), the present study sought to explore the association between vegetarianism and eating disorder psychopathology in the largest vegetarian sample to date ($N = 9,910$; including $n = 968$ vegetarian/vegans). The primary aim of this study was to test the hypothesis that college students who report weight motivations for their vegetarianism show higher levels of eating disorder psychopathology compared to both non-weight-motivated vegetarians and non-vegetarians. This question is particularly relevant in a college sample, as the traditional college years (i.e., 18–25 years) represent a developmental stage with a high prevalence of eating disorders and incidence of new eating disorder cases(Hudson, Hiripi, Pope, & Kessler, 2007; Kessler et al., 2013). College students are also a demographic with greater autonomy over their food choices compared to younger adolescents, and high rates of vegetarianism (Eisenberg, Nicklett, Roeder, & Kirz, 2011; Lavender, De Young, & Anderson, 2010; O'Dea & Abraham, 2010; Taylor et al., 2006).

In order to ensure an accurate comparison of eating disorder psychopathology, the present study first aimed to address concerns regarding the validity of the tools used to assess disordered eating in individuals following vegetarian diets (Aim 1). Given concerns raised about the factor structure of the full EDE-Q by Heiss and colleagues (2018) as well as other groups (e.g., Peterson et al., 2007), we chose to explore the fit of a short form of the EDE-Q whose factor structure appears to be more sound (Grilo, Reas, Hopwood, & Crosby, 2015; Machado, Grilo, & Crosby, 2018).

Assuming that the measurement of eating disorder psychopathology was invariant across all groups, this study aimed to build on findings from past studies by comparing mean differences in eating disorder symptoms (e.g., dietary restraint, body dissatisfaction, overvaluation of weight/shape, global eating disorder psychopathology) across the three groups (Aim 2). We hypothesized that weight-motivated vegetarians would have elevated rates of eating disorder symptomatology compared to non-weight-motivated vegetarians, and that non-weight motivated vegetarians would have lower or comparable rates of eating disorder symptomatology compared to non-vegetarians. Because non-vegetarian participants were not asked about the extent to which their current dietary choices were weight-motivated, we did not make more specific hypotheses about this group. Gender identity was adjusted for in all analyses because we expected to find higher levels of disordered eating symptomatology and a higher prevalence of vegetarianism in female-identified participants, in line with previous research (e.g., Ruby, 2012), as well as a higher prevalence of disordered eating in gender minority individuals (Diemer, White Hughto, Gordon, Guss, Austin, & Reisner, 2018). Participant's body mass index (BMI) was included as a covariate due to previous findings suggesting that vegetarians have lower BMI compared to non-vegetarians (Melina et al., 2016).

Finally, in an exploratory aim, we compared the timing of the adoption of a vegetarian diet (i.e., before or after beginning college) in relation to weight motivation and eating disorder psychopathology.

## Methods

### Participants

Data for the present study came from the Healthy Bodies Study (HBS), a population-level, web-based study (Lipson, S, 2013–2015, The Healthy Bodies Study). Data collected from 2013–2015 were aggregated from 12 colleges and universities across the United States. Participants included randomly sampled undergraduate and graduate students from participating institutions, wherein up to 4,000 enrolled students at least 18 years of age were sampled from each school and recruited by email. HBS response rates were 19% during the 2013–2014 academic year and 27% in 2014–2015. Response rates likely did not occur at random; thus, consistent with past research (e.g., Sonneville & Lipson, 2018; Lipson & Sonneville, 2017), sample probability weights were used to adjust for differences in response rates by gender, academic level, race/ethnicity, and grade point average. All research activities were approved by the Institutional Review Boards at participating institutions. Additionally, the HBS was covered by a Certificate of Confidentiality from the National Institutes of Health.

The analytic sample consisted of 9,910 college students across the United States. After weighting, the mean age of the sample was 23.4 ± 5.8 years. Most participants identified as cisgender women (54.3%) or cisgender men (44.4%); a smaller percentage of participants identified as transgender men (0.2%), transgender women (0.2%), genderqueer/gender nonconforming (0.7%), and other (0.2%). The sample was 66.9% non-Hispanic White, 5.4% non-Hispanic Black/African American, 9.4% Hispanic/Latinx, 13.3% Asian, and 5.1% other race/ethnicity. The majority of participants were undergraduate students (71.1%).

### Measures

**Vegetarian Status.**—Participants responded to one question: "*Do the following eating practices apply to you?*" Individuals who selected response options "*I am a vegetarian*" and/or "*I am vegan*" were categorized as vegetarians. A decision was made to combine vegetarians ($n = 822$) and vegans ($n = 146$) into a single group due to: 1) veganism being a type of vegetarianism, 2) inadequate power to test measurement invariance between these two groups, and 3) past research which suggests that these two groups do not differ on eating disorder symptoms or restraint (e.g., Moore et al., 2015; Norwood et al., 2019). The extent to which vegetarian practices were weight-motivated was assessed with the following question: "*Compared to other reasons for [being a vegetarian/being vegan most of or all the time], how important is a desire to influence your body shape or weight?*" Participants who responded "*somewhat important*", "*important*", or "*very important*" were classified as weight-motivated vegetarians; participants who responded "*not important*" were classified as non-weight-motivated vegetarians. The duration of engagement in vegetarian practices was assessed with one question: "*How have your eating habits changed since you began as a student at your school?*" Individuals who selected option "*I became a vegetarian/vegan*" were considered to be new to vegetarian eating habits.

**Short-Eating Disorder Examination-Questionnaire (S-EDE-Q).**—The seven-item, three-factor S-EDE-Q (Grilo et al., 2015; Machado et al., 2018) was used to assess eating

disorder attitudes and behaviors over the past 28 days. The S-EDE-Q demonstrates strong psychometric properties in clinical and non-clinical samples (Grilo et al., 2015; Machado et al., 2018). Items are scored on a seven-point scale, ranging from 0 to 6. Subscales include: Dietary Restraint, Shape/Weight Overvaluation, and Body Dissatisfaction. In the current study, internal consistency in the full sample was good for the Global scale ($\alpha = .88$), as well as the Dietary Restraint ($\alpha = .82$), Shape/Weight Overvaluation ($\alpha = .93$), and Body Dissatisfaction ($\alpha = .90$) subscales. Internal consistency of the S-EDE-Q Global and subscale scores was also good within non-vegetarians, the full vegetarian group, and both weight-motivated and non-weight-motivated vegetarians, with Cronbach's $\alpha$ ranging from .80 - .95. The S-EDE-Q has a suggested clinical cut-off of 2.4, computed by taking the mean of all seven items (e.g., Global score), that has been found to be sensitive and specific in identifying individuals with clinically significant eating disorder psychopathology (Machado, et al., 2018).

**Body mass index (BMI).**—Participants were asked to self-report their height and weight, which were used to calculate BMI.

**Gender identity.**—Gender identity was defined by the following three categories: cisgender men, cisgender women, and gender minorities. The gender minority category was comprised of students who identified as transgender men, transgender women, genderqueer, gender nonconforming, and other gender identity.

### Data Analyses

Descriptive statistics and internal consistency were computed with SPSS 25. Overall confirmatory factor analysis (CFA) and evaluation of measurement invariance of the S-EDE-Q via multi-group CFA were conducted using Mplus 8.3. Estimation via weighted least squares with mean and variance adjustment (WLSMV) was used, as has been recommended for ordinal data (Brown, 2015).

Measurement invariance refers to the extent to which a latent factor measures the same construct among different groups (i.e., non-vegetarians and vegetarians). Strong measurement invariance is crucial to determine whether mean scores on a measure can be compared across groups. Adequacy of model fit was judged by the following fit indices: comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root-mean square residual (SRMR). Values .95 for CFI, .06 for RMSEA, and .08 for SRMR indicate good model fit (Hu & Bentler, 1999). Values of .90 or higher for CFI, up to .10 for RMSEA, and up to .10 for SRMR indicate acceptable but mediocre model fit (Bentler, 1990; Browne & Cudeck, 1993; Hu & Bentler, 1995; MacCallum, Browne, & Sugawara, 1996; Schermelleh-Engel & Müller, 2003).

After acceptable model fit was established via initial CFA of the S-EDE-Q in the full sample, multi-group CFA was conducted to assess configural, metric, scalar, and residual measurement invariance across non-vegetarians, weight-motivated vegetarians, and non-weight-motivated vegetarians. The first step of the multi-group CFA assessed configural invariance, in which all factor loadings and item thresholds were free to vary across groups. The second step assessed metric (i.e., weak) invariance, in which the factor loadings were

constrained to be equal across groups. The third step assessed scalar (i.e., strong) invariance, in which factor loadings and item thresholds were constrained across groups. The fourth step assessed residual (i.e., strict) invariance, in which item residuals were constrained across groups. Nested models (i.e., metric compared to configural; scalar compared to metric; residual compared to scalar) were compared using the changes in CFI, RMSEA, and SRMR, as well as the DIFFTEST function in Mplus, which is the $\chi^2$ difference test for WLSMV estimation. Because $\chi^2$ is sensitive to sample size, changes in CFI, RMSEA, and SRMR were given stronger consideration than the $\chi^2$ difference test (Putnick, Diane & Bornstein, Mark, 2016). If changes between nested models indicating worse model fit with the addition of parameter constraints are greater than .01 for CFI, .015 for RMSEA, .030 for SRMR for metric invariance, or .015 for SRMR for scalar or residual invariance, measurement invariance across groups is not supported (Chen, 2007; Cheung & Rensvold, 2002).

Chi-square tests were used to compare rates of vegetarianism, motivations for vegetarian practices, and timing of adopting vegetarian practices by gender identity. Analysis of covariance (ANCOVA) was used to examine differences in S-EDE-Q Global and subscale scores across non-vegetarians, weight-motivated vegetarians, and non-weight-motivated vegetarians while controlling for gender identity and BMI. Data on height, weight, or both were missing or incomplete for 3202 participants (32.3%). Therefore, missing BMI data were multiply imputed with 20 replications using the fully conditional specification method. Little's MCAR test indicated that BMI data were missing completely at random (MCAR), $\chi^2(1)=0.75$, p=.39.

## Results

In the present study, 9.3% of college students were vegetarian ($n = 968$). Among vegetarians, 43.7% were weight-motivated and 56.3% were non-weight-motivated. A larger percentage of students who adopted a vegetarian diet since beginning college were weight-motivated (64.2%) than were non-weight-motivated (35.8%), whereas a higher percentage of college students who adopted a vegetarian diet prior to college were not weight-motivated (62.5%) than were weight-motivated (37.5%), $\chi^2 (1, N= 965) = 48.03, p < .001$, Cramer's V = .23.

In general, more cisgender women were vegetarian (11.7%) relative to cisgender men (6.0%), and more gender minorities were vegetarian (22.2%) relative to cisgender men and women. No gender differences were identified with regard to weight motivations for a vegetarian diet ($\chi^2(2) = 2.71, p = .26$, Cramer's V = .05) or the timing of adopting a vegetarian diet ($\chi^2(2) = 0.53, p = .77$, Cramer's V = .02). Both vegetarian groups reported lower BMI compared to non-vegetarians (M = 24.09, SD = 4.84), with no post-hoc differences between weight-motivated (M = 23.09, SE = 4.29) and non-weight-motivated vegetarians (M=22.45, SD = 3.93). F(2, 9907) = 36.48, p <.001, partial $\eta^2 = .007$. Comparisons between vegetarian practices, weight motivations, and timing of adoption of vegetarian practices by gender identity are presented in Table 1.

Model fit of the S-EDE-Q was adequate in the full sample (CFI = .998, RMSEA = .076 with 90% CI = .071-.081, SRMR = .011). Measurement invariance results across non-vegetarians, weight-motivated vegetarians, and non-weight-motivated vegetarians from the multi-group

CFA are reported in Table 2. Configural, metric, scalar, and residual measurement invariance was supported across groups.

Results of gender identity- and BMI-adjusted ANCOVA tests and pairwise comparisons examining differences in S-EDE-Q scores across groups are reported in Table 3. In general, weight-motivated vegetarians reported higher Global, Restraint, Shape/Weight Overvaluation, and Body Dissatisfaction scores relative to non-vegetarians and non-weight-motivated vegetarians. Moreover, non-weight-motivated vegetarians reported lower scores on the Global S-EDE-Q and the S-EDE-Q Restraint subscale relative to non-vegetarians. Non-weight motivated vegetarians and non-vegetarians did not differ on their Body Dissatisfaction and Weight/Shape Overvaluation subscale scores.

## Discussion

Results confirmed measurement invariance between weight-motivated vegetarians, non-weight-motivated vegetarians, and non-vegetarians on the S-EDE-Q, demonstrating that a commonly used test of eating disorder psychopathology is structurally equivalent across these groups. This finding helps to rule out the possibility that previous results might be influenced by biased measurement of restrained eating among vegetarians (Timko et al., 2012). Further, clinicians and researchers can be more confident that the S-EDE-Q assesses eating psychopathology in the same valid and reliable way for vegetarians that it does for non-vegetarians.

Vegetarians who reported weight motivations for their meat avoidance scored higher on the Global S-EDE-Q and all three subscales compared to non-weight motivated vegetarians and non-vegetarians. These differences were associated with small effect sizes, although it is notable that weight-motivated vegetarians were the only group whose mean score was above the suggested clinical cut-off for high risk of disordered eating (Machado et al., 2018). These results suggest that weight motivation, and not vegetarianism, is associated with elevated scores on the S-EDE-Q. It should be noted that in the current study, non-vegetarians were not asked about weight-related motivations for their own eating choices, so no hypotheses were made about their levels of disordered eating symptomatology relative to non-weight-motivated vegetarians. Although women were more likely than men to be vegetarians (11.7% vs. 6%), a difference associated with a small effect size, they were not more likely to be vegetarians due to weight concerns. Gender minority participants were more likely than both cis-men and cis-women to be vegetarians, with 22% of these participants endorsing being vegetarians. Weight-motivated vegetarians were more likely to have become vegetarians after the transition to college. These findings have important implications for screening for, and treating, eating disorder psychopathology in college student populations.

The current findings might help to explain the mixed literature comparing vegetarians to non-vegetarians on restraint and disordered eating. The proportion of weight-motivated vegetarians in previous samples may have influenced results. Because the majority of vegetarians appear to have non-weight-related motivations such as concern for animal welfare, environmentalism, and hedonic preference (e.g., Rosenfeld, 2018; Ruby, 2012),

larger samples of vegetarians may be more likely to reflect the true proportion of weight vs. non-weight motivated vegetarians, and therefore report no differences. In addition, recruitment methods might influence the proportion of weight and non-weight-motivated vegetarians participants. In order to recruit large samples of vegetarians, authors have advertised on social media, discussion boards focused on environmentalism, animal welfare, and vegetarian/veganism, and health food stores (e.g., Heiss et al., 2018; Norwood et al., 2012). Weight-related vegetarians might be less involved in vegetarian activism and vegetarian identity groups (e.g., Hoffman et al., 2013), and therefore under-recruited by some of these methods.

### Clinical Implications

Vegetarianism is not an eating disorder, and there is no evidence to suggest that becoming a vegetarian is a standalone risk factor for developing an eating disorder. However, the current results suggest that vegetarians who report that their meat avoidance is motivated by weight control report higher levels of disordered eating symptoms compared to other vegetarians. Although this study was not conducted in a treatment seeking or clinical sample, the results suggest that when assessing an individual with suspected eating disorder psychopathology who identifies as a vegetarian, clinicians should assess the degree to which current vegetarian dietary practices are maintained by moral considerations and/or by weight and shape concerns. Patients who avoid all meat, and in the case of vegans, all animal products, and who do not attribute this avoidance to weight loss motivations, may not need to reintroduce meat/animal products to be successful in treatment. Instead, treatment may focus on enhancing dietary flexibility and restoring weight within a meatless or vegan diet. Because vegan diets in particular are quite restrictive, clinicians should consider both the role of any-reason dietary restraint in maintaining disordered eating (e.g., Becker et al., 2017; Lydecker & Grilo, 2019) and the potential difficulty of restoring weight and engaging in challenging food exposures within a vegan diet. Importantly, some vegetarians who present with eating disorder symptoms might initially minimize the degree to which vegetarianism is weight motivated or might gain greater insight into this relationship during treatment. Motivation for vegetarianism should be reassessed throughout treatment, particularly in patients who are struggling. Currently there is no empirical research exploring motivations for vegetarianism in patients or participants with clinical disordered eating; such research will be helpful in addressing remaining clinical questions about how best to help vegetarian and vegan patients restore weight, maintain flexible diets, and reduce disordered eating behaviors and cognitions. The current research provides strong evidence only that vegetarianism per se, in the general population, does not appear to be a manifestation of disordered eating tendencies, but that weight-motivated vegetarians may be at risk for disordered eating.

### Limitations & Future Directions

While the current study has several strengths (e.g., large sample size, random sample of young adults, use of a commonly used measure of eating disorder psychopathology), several limitations should be noted. First, the nuances between different versions of vegetarian diets were not captured in this study. For example, participants did not report the degree to which they adhered to a vegetarian diet. Prior research suggests that individuals who report that

their vegetarianism is motivated by weight control are more likely to be semi-vegetarians (e.g., eating some animal products but not others, or eating animal products only under certain circumstances) as opposed to vegetarians who completely eliminate meat (and animal products, in the case of vegans; De Backer & Hudders, 2014; Forestell, Spaeth, & Kane, 2012). Although some authors have speculated that adherent vegetarianism resembles eating disorder symptoms because of the black-and-white nature of food avoidance "rules" (e.g., Lindeham et al., 2000), there is evidence that semi-vegetarians, and not full vegetarians, actually report more cognitive restraint (Curtis & Comer, 2006), eating disorder symptoms (Timko et al., 2012), and disordered eating behaviors such as vomiting, laxative abuse, and dieting (Neumark-Sztainer et al., 1997). The use of vegetarian samples that blend vegetarians and semi-vegetarians has been criticized by previous authors (e.g., Forestell, 2018; Timko et al., 2012), who point out that semi-vegetarians might represent a separate, higher-risk group than "true" vegetarians. Future research should test the hypothesis that the relationship between semi-vegetarianism and eating disorder psychopathology is driven by the higher likelihood that semi-vegetarianism, as opposed to "true" vegetarianism, is weight-motivated.

Second, we were unable to examine vegans separately in measurement invariance testing due to inadequate sample size for that group. Future studies should seek to test measurement invariance and compare differences in eating disorder psychopathology across the broader spectrum of vegetarian diets, as well as non-vegetarian dietary practices such as organic/"natural", low-carbohydrate, "paleo," or "ketogenic" diets.

Third, we did not assess the number of years that a person had been vegetarian. Participants who did not endorse becoming vegetarians during college may have ranged from being raised as vegetarians to having become vegetarians late in high school. Further, the current study cannot speak to whether the association we found is specific to college students, or would generalize to all new vegetarians.

Fourth, our data are cross-sectional. Future studies should explore time-lagged associations between the trajectory of eating disorder symptoms and changes in vegetarian self-identification and eating behavior in order to better understand the relations between vegetarianism and eating pathology risk. There is evidence that weight-motivated vegetarians are more likely than ethically-motivated vegetarians to report occasional "lapses" in adherence to their dietary restrictions, and are more likely to desist from being vegetarians (Hoffman et al., 2013). It is possible that these individuals may show a pattern of more or less vegetarian adherence corresponding to fluctuations in eating disorder symptom severity over time. The tendency of weight-motivated vegetarians to desist, and potentially, to resume vegetarian practices might help to account for the higher rate of weight-motivated vegetarians in our sample reporting a recent dietary change since starting college. Detailed dietary measures such as food frequency questionnaires and semi-structured dietary recall interviews should be employed in future research to assess both dietary restraint/restrictive eating behavior and adherence to a vegetarian diet (e.g., vegetarian/vegan vs. semi-vegetarian; Timko et al., 2012).

Fifth, our findings rely on participants acknowledging that their vegetarianism is weight motivated. Individuals with eating disorder psychopathology may minimize the extent to which their eating behaviors are problematic or disordered, and it is likely that this sample includes some vegetarians with disordered eating who denied weight motivations due to lack of insight or defensive responding. This may be particularly problematic in populations who are not self-referring for eating disorder treatment and may not be motivated for change. This limitation should be addressed in future research aimed at exploring psychological and behavioral differences between participants who do versus those who do not acknowledge that their vegetarianism is weight-motivated. This research design would represent a logical next step towards a better understanding of how to provide evidence-based guidance to meet the needs of vegetarian patients with eating disorder psychopathology.

Finally, HBS response rates were low, and although sample probability weights were used to account for non-response based on administrative data from the full population, these weights do not account for differences that may exist between responders and non-responders on characteristics that were not measured among non-responders, such as eating disorder psychopathology and vegetarianism.

## Conclusions

It is likely that clinicians working with college students and other young adults will encounter patients with eating disorder symptoms who adhere to vegetarian diets to varying degrees. The S-EDE-Q is a brief, validated screening tool for disordered eating that appears to be equally valid in assessing eating disorder symptomatology in vegetarians and non-vegetarians; to date, information on MI for vegetarians and non-vegetarians is not available for any other eating disorder symptom inventory. Results suggest that eating disorder prevention and intervention efforts for college students may benefit from thoughtful efforts to assess motivations for following a vegetarian diet. Individuals may have multiple motivations for adopting a vegetarian diet (e.g., hedonic preference, ethical convictions, religious beliefs); however, weight control motivations should be particularly assessed and considered when conceptualizing an individual client's dietary practices.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgements

## Data availability

Data are available from the senior author on request.

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**Table 1.**

Vegetarian status, weight motivations for vegetarian diet, and timing of vegetarian diet by gender identity

| | Cisgender Men | | Cisgender Women | | Gender Minorities | | | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | p | Cramer's V |
| Vegetarian status | | | | | | | | |
| Non-vegetarian | 2,835 | 94.0[a] | 6,012 | 88.3[b] | 79 | 77.8[c] | | |
| Vegetarian | 157 | 6.0[a] | 784 | 11.7[b] | 27 | 22.2[c] | < .001 | .11 |
| *Among vegetarians* | | | | | | | | |
| Weight motivations for vegetarian diet | | | | | | | | |
| No | 89 | 55.5 | 446 | 56.0 | 20 | 71.4 | | |
| Yes | 68 | 44.5 | 338 | 44.0 | 7 | 28.6 | .26 | .05 |
| Timing of adopting vegetarian diet | | | | | | | | |
| Since beginning college | 34 | 25.3 | 165 | 23.1 | 5 | 25.0 | .77 | .02 |
| Prior to college | 121 | 74.7 | 618 | 76.9 | 22 | 22 | | |

*Note.* The gender minority group includes students identifying as transgender men, transgender women, genderqueer, gender nonconforming, and other. Superscript letters represent groups between which there are significant differences in prevalence between male-identifying and female-identifying students ($p < .05$). $N$'s represent observed counts, while percentages are weighted to account for non-response.

**Table 2.**

Measurement invariance of the three-factor S-EDE-Q across non-vegetarians ($n = 8,942$), weight-motivated vegetarians ($n = 413$), and non-weight-motivated vegetarians ($n = 555$)

| Invariance Model | $\chi^2$ (df) | CFI | RMSEA (90% CI) | SRMR | $\chi^2$ ( df), p | CFI | RMSEA | SRMR | Invariance? |
|---|---|---|---|---|---|---|---|---|---|
| Configural | 681.36 (33) *** | .997 | .077 (.072, .082) | .012 | -- | -- | -- | -- | Yes |
| Metric | 652.97 (41) *** | .998 | .067 (.063, .072) | .012 | 15.89 (8), .04 | .001 | .010 | <.001 | Yes |
| Scalar | 632.74 (105) *** | .998 | .039 (.036, .042) | .013 | 104.93 (64), *** | <.001 | .028 | .001 | Yes |
| Residual | 629.56 (112) *** | .998 | .037 (.035, .040) | .013 | 17.86 (7), .01 | <.001 | .002 | .000 | Yes |

*Note.* S-EDE-Q = Short-Eating Disorder Examination-Questionnaire; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval; SRMR = standardized root-mean square residual.

***
$p < .001$.

**Table 3.**

S-EDE-Q global and subscale score comparisons across groups, adjusted for gender identity and body mass index

| | Group A: Non-Vegetarians ($n$ = 8,926) | Group B: Weight-Motivated Vegetarians ($n$ = 413) | Group C: Non-Weight-Motivated Vegetarians ($n$ = 555) | | | |
|---|---|---|---|---|---|---|
| | **Estimated Marginal Mean (*SE*)** | | | ***F(df)*** | **Partial $\eta^2$** | **Pairwise Comparisons** |
| Global scale | 2.08 (0.02) | 2.89 (0.07) | 1.90 (0.06) | $F$(2, 9888) = 72.52 *** | .013 | Group B > Group A > Group C |
| *Subscales* | | | | | | |
| Restraint | 2.02 (0.02) | 3.03 (0.09) | 1.78 (0.08) | $F$(2, 9888) = 68.98 *** | .013 | Group B > Group A > Group C |
| Shape/weight overvaluation | 1.91 (0.02) | 2.70 (0.09) | 1.77 (0.08) | $F$(2, 9888) = 45.04 *** | .008 | Group B > Group A, Group C |
| Body dissatisfaction | 2.36 (0.02) | 2.87 (0.08) | 2.22 (0.07) | $F$(2, 9888) = 23.73 *** | .004 | Group B > Group A, Group C |

*Note.* S-EDE-Q = Short-Eating Disorder Examination-Questionnaire; *SE* = standard error; *df* = degrees of freedom. ANCOVA results are weighted to account for non-response. All pairwise comparisons listed were significant at least at $p < .01$.

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$p < .001$