Dietary identity and embitterment among vegans, vegetarians and omnivores

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ABSTRACT

Background: Although vegetarian and vegan dietary can positively contribute to animal welfare, the environment and health, they also entail social costs for the people following them. These costs may be an increased risk of stigmatization and, presumably, feelings of embitterment.

Methods: In this study, we investigated for the first time the association between feelings of embitterment and dietary identity centrality and motivation. Dietary motivation, dietary pattern centrality for identity (DIQ-D), and embitterment (PTED scale) were assessed in and compared between people with vegan (n = 489), vegetarian (n = 339) and omnivorous (n = 319) dietary pattern.

Results: The vegan group reported higher embitterment and discrimination perception than the vegetarian and omnivorous groups. High (vegan) dietary centrality, eating disorder, moral motivation, discrimination perception was associated with embitterment.

Conclusions: The association between vegan dietary centrality and moral motivation with embitterment is relevant for actions in dietary education and counseling in clinical and public health settings. When dietary pattern becomes relevant for identity building this may come along with problems when it makes the person prone for discrimination perception.

INTRODUCTION

Along with increasing awareness of the environment, eating norms are shifting toward meat-reduced diets in the western societies. In Germany, 55% of the general population classify their diet as flexitarian, which means an intentional, occasional avoidance of meat (Federal Ministry of Food and Agriculture, 2020). Currently, 10% of the German population eat vegetarian and 2% vegan (Federal Ministry of Food and Agriculture, 2021). Accordingly, the vegan-vegetarian group with 12% of the total population represents a minority that is growing, but whose diet does not currently...
represent the German norm. Internationally, there are similar distributions of dietary pattern (e.g. in Saudi Arabia 87% omnivores, 5% vegetarians and 8% vegans, AlHusseini et al., 2021; in USA college students 9.3% vegetarians, majority females, Zickgraf et al., 2020).

In addition to health and taste criteria, dietary habits can be chosen with regard to ethical considerations: animal suffering, environmental and climate protection, global nutritional justice or religious backgrounds. Vegetarian or vegan consumers are often motivated by both personal, prosocial and moral motivations, which are associated with certain feelings of pride about their dietary pattern (Kirsten et al., 2020; Rosenfeld & Burrow, 2018). In the case of prosocial motives, altruistic criteria such as animal welfare and environmental protection are relevant, while personal motives primarily aim at promoting one’s own quality of life, and moral and public motives strive for consistency in ethically reflected eating behavior and promoting this. Likewise vegetarian and vegans may regard their diet as more central to their identity compared to omnivores. However, vegetarians and vegans also experience that their diet deviates from the norm and their counter-normative identities and motivations may be stigmatized and pathologized.

What we eat is part of our identity (Rosenfeld & Burrow, 2017). Diverse studies emphasize that the vegan-vegetarian lifestyle has a serious impact on one’s identity (Rosenfeld, 2018). Kirsten et al. (2020) find that vegans perceive dietary practices to be more central to one’s identity than vegetarian, who in turn perceive them to be more central than people with omnivorous diets. Consequently, dietary habits are also related to sociocultural experiences (Sobal et al., 2014). In the course of adopting a vegan-vegetarian identity, experiences such as stigmatization may occur, which are reported by individuals to be socio-psychologically stressful, such that the effects of a vegan-vegetarian diet may pose threats to psychological well-being (Rosenfeld, 2018; Rosenfeld & Burrow, 2017).

Clinical studies provide conflicting evidence on the relationship between vegan-vegetarian diets and increased risk of disordered symptoms such as depression, eating disorders, and anxiety disorders (Brytek-Matera et al., 2019; Parra-Fernández et al., 2020; Paslakis et al., 2020; Rosenfeld, 2018; Timko et al., 2012). On the one hand, a general positive influence was observed for the dietary patterns characterized by high consumption of fruit and vegetables and of fruit or vegetable products (Guzek et al., 2022). On the other hand, people on vegetarian diets have been shown to be more neurotic compared to omnivorous diets (Forestell & Nezlek, 2018) and have a higher risk for depression (Bienvenu et al., 2001; Michalak et al., 2012). However, evidence is mixed in that respect: One meta-analysis (N = 43,728) reported that vegetarian diets are associated with a higher depression risk (Ocklenburg & Borawski, 2021), while another meta-analysis (N = 147,964) did not find this association (Askari et al., 2022). Another study found no differences in self-reported subjective well-being between vegetarians and omnivores (Pfeiler & Egloff, 2020) and the finding that vegetarians are more neurotic was reported to be not highly robust (Pfeiler & Egloff, 2017).

A common hypothesis is that vegan-vegetarian diets may be associated with nutrient deficiencies that lead to deficits in psychological well-being (Li et al., 2017). But, also the transition to a vegan-vegetarian diet requires the individual to make a psychological adjustment in addition to the nutritional change. Simply belonging to a recognizable
minority can produce a reduced sense of well-being (Forestell & Nezlek, 2018). Food is considered a central social factor, so that social processes can be unleashed by the decision to eat an alternative diet (Rosenfeld, 2018). After dietary changes are disclosed, affected individuals report unpleasant experiences among family and friends, stereotyping, and discrimination after dietary changes are disclosed (MacInnis & Hodson, 2017a, 2017b; Torti, 2017; Twine, 2014).

Perceived injustices in the prevailing food system, feeling belittled or stigmatized by omnivorous people may come along with embitterment effects in people who follow a vegetarian or vegan diet. Embitterment is a specific emotion, combining anger and helplessness, feeling humiliated and let down (Linden et al., 2011). Individual basic beliefs are violated. Embitterment is a dimensional phenomenon which occurs in 3-45% of general population people, whereby rates depend on context, samples and measures (Linden & Arnold, 2021). Embitterment can be relevant in the context of dietary pattern and identity: If, for example, a vegetarian vegan dietary is a basic belief in the sense of identity to be a good person, this may conflict with life reality, feeling belittled by omnivorous majority. Consequences of affect are suffering, anger, thoughts of revenge, and destructive rage. This is accompanied by low life satisfaction and perceived loneliness (Kühn et al., 2018).

**Research goal and question**

The described state of research shows that correlations between dietary patterns and psychological well-being have been identified, but evidence is not too clear until now. Embitterment is one emotional state which has been found relevant in contexts of (societal) injustice, crisis, and stigmatization (Linden et al., 2022). It has until now not been discussed in relation with dietary pattern, although this seems quite of interest from a theoretical point of view: From a societal perspective, people with vegetarian or vegan dietary centrality are presently minority groups and may be confronted with stigmatization. It is until now unknown whether and to which extent embitterment is present in these minority vegan and vegetarian groups, and whether the rate is higher than in omnivorous people. It is also unknown which role the centrality of dietary identity, and the dietary motivations play for explanation of embitterment. To investigate this research gap is highly relevant, as the transformation of the western food system for the purpose of environmental and climate protection is urgent. Also, an understanding of the psychological phenomena accompanying dietary pattern is valuable with regard to costs in the health care system and animal welfare protection (Heinrich Böll Foundation, 2021; Sun et al., 2022; WWF, 2021).

**Research question**

1. Which differences or similarities in embitterment degree and rate, socio-demographics and life satisfaction can be found
   a. between people with different dietary pattern: omnivorous, vegetarian, vegan, and
   b. between people with high or low centrality of dietary pattern?
2. Which characteristics – dietary centrality, dietary motivation, perceived public discrimination, life satisfaction – are explanatory for embitterment?

**Method**

**Procedure**

In order to reach a broad sample with different dietary schemes, participants were recruited via snowball system and placing a link to an online survey on several eating-related websites, and via professional and public websites. Participants were asked to fill in an anonymous online questionnaire. They were asked for their socio-demographics (age, gender, higher education), dietary pattern (categories vegetarian, vegan, omnivorous), and whether they suffered from an eating disorder (yes, no). After these basis data, they filled in the following psychometric questionnaires:

**Dietary pattern**

Following the DIQ-D (Kirsten et al., 2020), participants described their current diet using the food groups they generally (do not) eat. They chose between the following statements: ‘In general, I eat animal products,’ indicating an omnivorous diet; ‘In general, I do not eat meat and fish, but I do eat milk, cheese, and eggs.’, representative of a vegetarian diet; ‘In general, I do not eat animal products,’ equivalent to a vegan diet. The next item related to dietary identity. Accordingly, the question is not what the subjects actually eat, but whether they describe themselves as ‘omnivorous (meat-eating), vegetarian, vegan.’

Then psychometric questionnaires were filled in on dietary-related motivation, discrimination perception, life satisfaction and embitterment:

**Centrality of dietary identity (DIQ-D, Kirsten et al., 2020)**

The centrality of dietary identity subscale of the DIQ-D self-assessment scale was used to assess the extent to which an individual understood their self-chosen dietary pattern as a predominant feature of their self-concept. Five items (rated 1 = no agreement to 5 = full agreement) operationalized the centrality of dietary identity with statements such as ‘My dietary pattern is an important part of how I would describe myself.’ A score >3.5 indicates high centrality. Cronbach’s alpha of 0.93 indicated excellent internal consistency.

**Personal, prosocial, and moral motivation (DIQ-D, Kirsten et al., 2020)**

The focus of Personal Motivation (three items, rated 1 = no agreement to 5 = full agreement) behind dietary pattern was on one’s own well-being, health, and quality of life, e.g. ‘I follow my dietary pattern because it improves my life.’ In this subscale, Cronbach’s alpha had an acceptable level of 0.78.

Prosocial Motivation encompassed six items (rated 1 = no agreement to 5 = full agreement) on the desire to use dietary practices to support a purpose beyond oneself. One example item is, ‘I view my dietary pattern as a way to make the world a better place for others.’ These external goals related to animals, people, and the environment. Cronbach’s alpha of 0.93 indicated excellent internal consistency.

The Moral Motivation subscale (three items, rated 1 = no agreement to 5 = full agreement) measured the extent to which moral judgments of right and wrong were critical to
dietary patterns, e.g. ‘I feel morally obligated to follow my dietary pattern.’ Cronbach’s alpha was 0.92.

**Perceived discrimination (DIQ-D, Kirsten et al., 2020)**
The Public Esteem subscale measured the extent to which subjects perceived their dietary identity negatively discriminated by society. One of the three items was ‘Following my dietary pattern is associated with negative prejudice.’ Cronbach’s alpha was 0.91.

**Differentiated Life Burden (DLB scale, Linden & Ritter, 2018)**
This scale was used to measure life satisfaction. Participants were asked to rank their feelings about 17 life domains. The self-report scale captured negative and positive valence on a six-point scale ranging from 1 = very negative to 6 = very positive. Included were the life domains partnership, sexuality, children, parents, friends, neighbors, colleagues, work, leisure, health, finances, housing, environment, home, politics, future, life balance. Internal consistency was high with Cronbach’s alpha of 0.87.

**Embitterment (PTED Scale, Linden et al., 2009)**
The Post-Traumatic Embitterment Disorder Questionnaire (Linden et al., 2009) was used to assess embitterment in the context of diet. The scale included 19 items, which in the original scale began with the statement ‘In the past few months, I have had to cope with an impactful (but common) life event, …’. To ensure that the reported experience of embitterment was related to dietary habits, the reference was made more specific and modified to ‘In relation to my current diet, there has been an incisive life event, …’.

The items completed the introductory sentence with possible embitterment responses, for example, ‘… that made me extremely offended or bitter’ or ‘… that makes me violently upset when I am reminded of it.’ Subjects rated their feelings using a five-point Likert scale ranging from 0 = strongly disagree to 4 = strongly agree. A mean value of 2.5 or higher corresponds to high embitterment (Linden et al., 2009). Cronbach’s alpha of the PTED scale was 0.93.

Data can be received from the authors upon request.

**Participants**
A total of 1233 subjects completed the survey. Of these, 86 subjects were excluded due to failure to provide dietary identity or incorrect, too short or too long participation duration. The sample for analysis included 1147 participants, of which 77% identified with female, 21% with male, and 1% with a diverse gender (n = 1133). A certain overrepresentation of women is typical in psychological studies. The mean age was 36 years with a minimum of 14 years and a maximum of 83 years. Most subjects were in salaried employment (51%), followed by 22% who were in college. The highest education was a college degree for 48%, high school diploma for 17%, and a vocational school degree such as an apprenticeship or traineeship for 11%. One quarter (25%) lived in a city with more than 500,000 inhabitants, 28% in a city up to 500,000, 18% up to 100,000 inhabitants, 28% in a city up to 20,000 inhabitants. The dietary pattern of the sample was divided into 42% vegan, 30% vegetarian and 28% omnivorous.
The characteristics of the omnivorous group are similar to the general population (Federal Employment Agency, 2021; Federal Statistical Office, 2020, 2021b), except an overrepresentation of women and people with a high level of education (Federal Statistical Office, 2021a). Compared to epidemiological data, the frequency of reported eating disorder diagnoses is slightly increased (Wälte, 2021).

In the vegetarian group, there is also an increased proportion of female and academic subjects, which is, however, a representative in the case of the vegetarian real population (Splendid Research, 2020; Statista, 2022). The same can be assumed for the vegan population, with reference to data from the Swiss and Austrian population (Marketagent, 2017; Swissveg, 2021). The younger average age in the vegan and vegetarian group compared to the omnivorous group also corresponds to an adequate representation of the real population with reference to German and Austrian data (IfD Allensbach, 2021; Marketagent, 2017).

**Statistical analysis**

Data were analyzed with SPSS version 28. Spearman correlations were calculated for specific relation pattern between dietary pattern and identity, embitterment, life satisfaction. Comparisons between groups were carried out using $X^2$-tests for comparison of frequencies, and $T$-tests for comparing people with high or low centrality of dietary pattern. Analysis of variance (ANOVA) with Bonferroni-corrected Post-Hoc tests and $\chi^2$-tests were used for comparison of mean scores and frequencies in the three dietary groups omnivorous, vegetarian, vegan (Tables 1 and 2). Exploring variance explanation of characteristics which – according to empirical findings and theoretically – could be associated with embitterment, multivariate linear regression analysis was calculated (Table 3). Correlations between the predictor characteristics were between $r = 0.004$ (age and personal motivation) and $r = 0.367$ (personal and prosocial motivation). There were only few narrower correlations between dietary centrality and motivational aspects ($r = 0.626$ prosocial motivation; $r = 0.653$ moral motivation) and between prosocial and moral motivation ($r = 0.778$). Correlations between predictor characteristics and embitterment ranged from $r = -0.042$ (age) to $r = 0.380$ (dietary centrality).

**Ethics statement**

The study protocol including full study material, research questions, and questionnaires, was approved by the ethics committee of the Faculty of Life Sciences, Technische Universität Braunschweig, approval number MA_2021-07.

**Results**

**Comparison of omnivorous, vegetarian and vegan dietary pattern**

People with omnivorous dietary pattern report least often high embitterment (0.6%) and the lowest average embitterment perception, whereas vegans have the highest scores and highest embitterment rate (2.6%, Table 1).
| Characteristics                  | All (N = 1147) | Omnivorous (n = 319) | Vegetarian (n = 339) | Vegan (n = 489) | p (significance) | eta² (effect size) | People with low centrality of dietary pattern (n = 655) | People with high centrality of dietary pattern (n = 486) | Comparison of the centrality groups T-test, χ² p |
|----------------------------------|----------------|----------------------|----------------------|----------------|-----------------|-------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|
| Age                             | 35.99 (13.9)   | 37.92 (13.9)         | 34.70 (14.08)        | 35.61 (13.7)   | .009            | .008              | 35.39 (13.6)                                           | 36.17 (14.2)                                         | .117                                             |
| Gender                          |                |                      |                      |                |                 |                   |                                                             |                                                             |                                                  |
| Diverse                         | 2.0%           | 0.9%                 | 3.2%                 | 1.8%           |                 |                   |                                                             |                                                             | .086                                             |
| Male                            | 21.4%          | 33.9%                | 14.5%                | 18.0%          |                 |                   |                                                             |                                                             |                                                  |
| Female                          | 76.6%          | 65.2%                | 82.3%                | 80.2%          |                 |                   |                                                             |                                                             |                                                  |
| A-Levels/High School            | 75.0%          | 77.3%                | 78.6%                | 71.0%          |                 |                   |                                                             |                                                             |                                                  |
| Eating Disorder                 | 7.5%           | 4.4%                 | 8.8%                 | 8.6%           |                 |                   |                                                             |                                                             |                                                  |
| Centrality of dietary pattern   | 3.25           | 2.41 (0.9)           | 3.13 (0.9)           | 3.88           | .001            | .329              | 2.51 (0.7)                                              | 4.25 (0.5)                                           | <.001                                             |
| (scale 1-5, N = 1141)           | (1.1)          | 10.4%                | 34.9%                | (0.9)          |                 |                   |                                                             |                                                             |                                                  |
| High centrality >3.5            | 42.6%          | 68.8%                |                      |                |                 |                   |                                                             |                                                             |                                                  |
| Personal Motivation (1-5)       | 3.78 (0.9)     | 3.49 (0.9)           | 3.72 (0.9)           | 4.01 (0.9)     |                 |                   | 3.52 (0.9)                                              | 4.13 (0.9)                                           | <.001                                             |
| Prosocial Motivation (scale 1 low – 5 high) | 3.70 (1.1) | 2.52 (1.0)           | 3.81 (0.7)           | 4.39 (0.6)     |                 |                   | 3.23 (1.1)                                              | 4.34 (0.6)                                           | <.001                                             |
| Moral Motivation (1-5)          | 3.70 (1.3)     | 2.35 (1.0)           | 3.71 (0.9)           | 4.57 (0.7)     |                 |                   | 3.11 (1.2)                                              | 4.49 (0.8)                                           | <.001                                             |
| Public Discrimination (1-5) | 3.20 (1.1) | 2.71 (1.1) | 2.75 (1.0) | 3.83 (0.8) | 2.94 (1.1) | 3.57 (0.9) | <.001 |
|-----------------------------|------------|------------|------------|------------|------------|------------|-------|
| Life Satisfaction (DLB, scale 1 negative – 6 positive) | 4.39 (0.6) | 4.33 (0.7) | 4.45 (0.53) | 4.40 (0.6) | 4.35 (0.6) | 4.44 (0.6) | .016 |
| Embitterment (PTED, scale 0–4) | 0.57 (0.7) | 0.33 (0.55) | 0.47 (0.61) | 0.81 (0.72) | 0.37 (0.5) | 0.85 (0.7) | <.001 |
| High embitterment ≥2.5 | 0.6% | 0.9% | 2.6% | 0.3% | 2.9% | | <.001 |

\( \rho < .001 \)
\( \eta^2 = .258 \)
\( \text{OvsVt} = 1.000 \)
\( \text{OvsVn} < .001 \)
\( \text{VtvsVn} < .001 \)
\( \rho = .026 \)
\( \eta^2 = .007 \)
\( \text{OvsVt} = .021 \)
\( \text{OvsVn} = .304 \)
\( \text{VtvsVn} = .547 \)
\( \rho < .001 \)
\( \eta^2 = .097 \)
\( \text{OvsVt} = .014 \)
\( \text{OvsVn} < .001 \)
\( \text{VtvsVn} < .001 \)
\( \rho = .061 \)
**Table 2.** Comparison of life satisfaction of people with different dietary pattern and high and low life centrality of dietary pattern.

| Domain of Life Satisfaction (DLB scale, rating 1 negative – 6 positive) | All \((N = 1086-1103)\) | Omnivorous \((n = 299)\) | Vegetarian \((n = 327)\) | Vegan \((n = 477)\) | Comparison of the three groups \((O, Vt, Vn)\) ANOVA overall \(p\) (significance) and Post-Hoc tests \(p\) (Bonferroni-corrected) | People with low centrality of dietary pattern \((n = 615)\) | People with high centrality of dietary pattern \((n = 471)\) | Comparison of the centrality groups T-test \(p\) |
|---|---|---|---|---|---|---|---|---|
| Partnership | 4.50 (1.0) | 4.54 (0.9) | 4.47 (0.9) | 4.51 (1.2) | 4.49 (0.9) | 4.52 (1.1) | .608 |
| Sex | 4.59 (0.9) | 4.55 (0.9) | 4.52 (0.8) | 4.67 (0.9) | 4.55 (0.8) | 4.64 (0.9) | .087 |
| Children | 4.34 (1.2) | 4.37 (1.0) | 4.41 (1.1) | 4.27 (1.3) | 4.32 (1.1) | 4.35 (1.3) | .645 |
| Parents | 4.09 (1.1) | 4.51 (0.9) | 4.02 (1.1) | 3.89 (1.2) | 4.23 (1.0) | 3.91 (1.2) | <.001 |
| Friends | 4.44 (0.9) | 4.45 (0.9) | 4.62 (0.9) | 4.32 (0.9) | 4.47 (0.8) | 4.41 (1.0) | .322 |
| Neighbors | 3.95 (0.9) | 4.37 (0.8) | 4.10 (0.9) | 3.58 (1.0) | 4.12 (0.9) | 3.72 (1.0) | <.001 |
| Colleagues | 4.08 (1.0) | 4.45 (0.9) | 4.16 (0.9) | 3.79 (1.1) | 4.19 (0.9) | 3.94 (1.1) | <.001 |
| Category         | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | p     | eta² | OvS Vt | OvS Vn | Vt vs Vn |
|------------------|-----------|-----------|-----------|-----------|-------|------|--------|--------|----------|
| Work             | 4.11 (1.1)| 4.42 (0.9)| 4.09 (1.0)| 3.92 (1.2)| .009  |      | .002   | < .001 | < .001   |
| Leisure Time     | 4.59 (0.9)| 4.55 (0.9)| 4.61 (0.8)| 4.59 (1.0)| .015  |      | .752   | .001   | 1.000    |
| Health           | 5.05 (1.0)| 4.37 (1.1)| 5.08 (0.9)| 5.46 (0.7)| < .001| .207 | .001   | < .001 | < .001   |
| Finances         | 4.07 (1.0)| 4.00 (1.2)| 3.99 (1.0)| 4.16 (1.0)| .132  |      | .053   | .005   | .108     |
| Housing          | 4.51 (0.8)| 4.38 (0.9)| 4.49 (0.8)| 4.60 (0.9)| .021  |      | .002   | .012   | .211     |
| Environment      | 4.97 (1.2)| 4.04 (1.3)| 5.17 (0.8)| 5.42 (0.9)| < .001| .241 | .001   | < .001 | < .001   |
| Homeland         | 4.37 (1.0)| 4.43 (1.0)| 4.43 (1.0)| 4.29 (1.1)| .245  |      | .094   | .005   | 1.000    |

(Continued)
### Table 2. Continued.

| Domain of Life Satisfaction (DLB scale, rating 1 negative – 6 positive) | All \( (N = 1086–1103) \) | Omnivorous \( (n = 299) \) | Vegetarian \( (n = 327) \) | Vegan \( (n = 477) \) | Comparison of the three groups (O, Vt, Vn) ANOVA overall \( p \) (significance) | \( \eta^2 \) (effect size) and Post-Hoc tests \( p \) (Bonferroni-corrected) | People with low centrality of dietary pattern \( (n = 615) \) | People with high centrality of dietary pattern \( (n = 471) \) | Comparison of the centrality groups T-test \( p \) |
|---|---|---|---|---|---|---|---|---|---|
| Politics | 3.71 (1.4) | 3.84 (1.2) | 4.00 (1.2) | 3.43 (1.5) | OvsVn .228 | VtvsVn .190 \( p < .001 \) \( \eta^2 = .035 \) | 3.77 (1.3) | 3.61 (1.5) | .067 |
| Future | 4.46 (1.3) | 4.07 (1.2) | 4.71 (1.0) | 4.53 (1.4) | OvsVt .404 | OvsVn < .001 \( \eta^2 = .038 \) | OvsVt < .001 | OvsVn < .001 | VtvsVn .067 \( p < .001 \) \( \eta^2 = .106 \) | 4.34 (1.2) | 4.62 (1.3) | <.001 |
| Life | 4.86 (1.0) | 4.37 (1.1) | 4.90 (0.8) | 5.13 (0.8) | OvsVt < .001 | OvsVn < .001 | VtvsVn .022 \( p < .001 \) \( \eta^2 = .106 \) | 4.66 (0.9) | 5.11 (0.9) | <.001 |

Mean (standard deviation) are reported (\( N = 1086–1103 \)).
The proportion of females is higher in the vegetarian and vegan group as compared to the omnivorous. The vegans report most often a high centrality of their dietary pattern (69%) as compared to vegetarians (35%) and omnivorous (10%). The vegans feel much more discriminated ($M = 3.83$) than vegetarians or omnivorous ($M = 2.75, M = 2.71$).

Eating disorders are prevalent in vegetarian and vegan group with similar rates about 9%, whereas the omnivorous are half often affected (4%).

Life satisfaction is rather good in all three groups, with slight variations (lowest $M = 4.33$ in omnivorous, highest $M = 4.45$ in vegetarian). As compared to the other groups, vegans are less satisfied with parents, friends, neighbors, and colleagues and work, and politics (Table 2). They are more satisfied with their health, environment, and life in general.

The more the dietary pattern was directed to no-animal food, the more central was the dietary identity (Spearman correlation $r = 0.574^{**}$), the higher the embitterment perception ($r = 0.362^{**}$). However, there was no correlation between dietary pattern and life satisfaction ($r = 0.027$).

### Comparison of high and low centrality of dietary identity

People with high centrality of dietary pattern have significantly higher scores in the motivational aspects of their dietary pattern, but also feel more discriminated than people with low centrality of dietary identity (Table 1). High embitterment is reported by 2.9% of those with high dietary identity, but only 0.3% in the others. Those with high dietary centrality are less satisfied with other people (parents, neighbors, colleagues) and politics, but more satisfied with leisure time, environment, health, future and life perspective (Table 2).

### Indicators for embitterment

Being affected by an eating disorder and having a high centrality of dietary identity was associated with an increased probability for higher embitterment (Table 3).
Embitterment was also significantly explained by discrimination perceptions and moral motivations to follow one’s dietary pattern, but not by personal and prosocial motivations. Higher life satisfaction and higher education went along with rather lower embitterment.

Discussion

**Dietary specialties, centrality, motivation, and embitterment**

The main result from our explorative investigation is that the more central the vegetarian or especially vegan diet is to the self-image (centrality of dietary identity), and the more morally motivated these dietary identities are, the higher is the level of embitterment. Also eating disorders are associated with high dietary centrality and embitterment proneness. In sum, there are some relevant aspects that should be considered as indicators for potential embitterment problems in people with high centrality of dietary identity.

**Dietary centrality**

In case a central behavior such as dietary pattern is central to someone’s self-perception and identification, this opens up possibilities to be subjectively violated in case others react with a reduced tolerance for such behavioral specialties. Violated basic beliefs are a key mechanism in embitterment development (Linden et al., 2009, 2011). Someone with strong dietary identity in a group of others who do not share similar dietary identity beliefs may perceive conflicts in daily situations, e.g. when the teammates who are omnivores want to go to a non-vegan steak house. If vegans are strict and their identity is highly central and morally motivated, they might perceive the omnivorous group as violating their identity and feelings of moral obligation (e.g. toward animals and the environment). As a consequence, they might feel angry and rejected, and embitterment may arise.

Dietary centrality was related to embitterment, but it was independent of life satisfaction. The independence of life satisfaction and dietary centrality can be understood in the light of embitterment being a specific affect related to specific events, contexts or topics, in contrast to rather general life satisfaction covering a broad range of life domains. A person with vegan centrality who is embittered due to perceived insults of dietary-related basic beliefs can nevertheless be satisfied with other aspects of life in general. This fits to theory and clinical experience with persons suffering from embitterment, which is in many cases related to specific topics or events (Linden & Arnold, 2021).

**Life satisfaction**

From the findings, it seems like vegans are less satisfied by people in their direct social environment, which could be linked with findings that vegans think the general public evaluates their diet negatively (Rosenfeld & Burrow, 2018), or have struggles with families and friends (MacInnis & Hodson, 2017a, 2017b). Higher satisfaction with health, environment, and life in general may come along with their personal and moral motivations.
Moral motivation
Especially moral motives were associated with dietary centrality and embitterment. For dietary counseling and public health practice, this suggests having a look at the individual motivation of people, especially those who predominantly pursue moralizing motives with their diet and want to impact on others. They may be the ones who are most prone for specific dissatisfaction with other people, although they feel in good health themselves.

Discrimination perception
The fact that vegan group reports higher embitterment proneness and discrimination perception than the vegetarian group seems plausible due to the even smaller share of the population of the vegans, and thus their possibly perceived higher risk of discrimination. Furthermore, the very restrictive form of vegan diet is most far away from the flexitarian average (eating meat not every day), to which the vegetarian diet is closer as vegetarians usually drink milk or eat cheese (Federal Ministry of Food and Agriculture, 2020).

Eating disorders and vegetarian/vegan diet
The frequency of eating disorders in vegan and vegetarian diets is often discussed. Some empirical research found that restrictive diets and eating disorders are often co-occurring (e.g. Bardone-Cone et al., 2012). However, the overall evidence until now is mixed: For example, Brytek-Matera et al. (2019) reported that vegetarians and vegans do not differ in orthorexic eating behavior, but both groups presented a higher level of orthorexic eating behavior than people with meat consumption. There are findings for higher risk of orthorexia in vegetarians and vegans, but also other studies that did not find such an association, and also criticize the instrument for measuring orthorexia (Parra-Fernández et al., 2020). Despite finding an association between vegetarianism and disordered eating, Paslakis et al. (2020) report, they cannot make assumptions about causality. They say that ‘Vegetarianism may be a symptom of the disorder or a maintaining factor, rather than linked to its causal development’ (p. 8).

Our findings show that vegetarian and vegan diets and high dietary centrality come along with an increased percentage of eating disorders according to self-report. This is in line with findings from other studies and can therefore be assumed to be typical (Brytek-Matera et al., 2019; Parra-Fernández et al., 2020; Paslakis et al., 2020; Timko et al., 2012). However, dietary pattern is not only related to eating disorders, but also with other mental health problems, such as mood or anxiety problems (Brytek-Matera et al., 2019; Parra-Fernández et al., 2020; Paslakis et al., 2020; Rosenfeld, 2018; Timko et al., 2012). Our findings suggest that especially the combination of eating disorder, vegan dietary identity, and high centrality of dietary identity may be an indicator for embitterment proneness.

Limitations, strengths, and future research
This is a cross-sectional observation study based on self-reports. Thus, no causal conclusion or temporal prediction can be drawn whether specific dietary pattern lead to embitterment or not. Due to the nature of the phenomena and ethical reasons, there is
hardly a possibility for experimental investigations, as dietary habits cannot be manipulated experimentally in naturalistic settings, in order to investigate the development of embitterment. Thus, the naturalistic observation design is appropriate for the purpose of comparison.

There were more women than men in the total sample, and especially in the vegetarian and vegan group. This is similar to representative findings: vegetarians or vegans are in about 70% of cases women (Statista, 2022). Thus, the here investigated sample can be expected to be near the naturalistic distribution of dietary pattern.

Due to limited capacities in the study design, we could not implement larger diagnostics on eating disorders.

In our study we used rather broad self-rated dietary categories. Further research could also address more differentiated dietary pattern. For example, Timko et al. (2012) reported that semi-vegetarianism – as opposed to true vegetarianism or veganism – would be most likely related to disordered eating. It is also difficult to say whether vegetarian diets are closer to flexitarian diets or vegan diets. Thus, dietary pattern could be operationalized even more differentiated and set in relation with embitterment and centrality.

Some of the predictors (motivational aspects and centrality) showed some moderate correlations, which may be due to methodological reasons (items from one questionnaire, and conceptual relationship). However, correlations are not perfect, which shows that the items measure nevertheless different aspects.

**Conclusion**

This naturalistic observation study shows for the first time that – beside eating disorders – high (vegan) dietary centrality, moral motivation and discrimination perception are associated with increased probability for embitterment. This possible association should be kept in mind in dietary education and counseling in both clinical and public health settings.

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Data sharing

Data can be received from the authors upon request.

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