Appetite 186 (2023) 106544

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Moral emotions and justifying beliefs about meat, fish, dairy and egg consumption: A comparative study of dietary groups

Maria Ioannidou [a], Valerie Lesk [a], Barbara Stewart-Knox [a], Kathryn B. Francis [b,*]

[a] Department of Psychology, University of Bradford, UK
[b] School of Psychology, Keele University, UK

ARTICLE INFO

Keywords:
Food choice
Vegetarian
Vegan
Omnivore
Pescatarian
Moral emotion
Disgust
Guilt
Carnistic beliefs

ABSTRACT

Meat eaters and meat abstainers differ in their beliefs and moral emotions related to meat consumption alongside gender differences. Few studies have investigated beliefs and moral emotions in pescatarians and vegans. Little is known about differences in moral emotions and beliefs regarding dairy, eggs, and fish or about speciesist beliefs within and between specific dietary groups. To address this gap, we investigated moral emotions (consumption-related disgust and guilt), attitudes towards animals (Animal Attitudes Scale) and justifying beliefs related to meat (Carnism Inventory), dairy, egg, and fish consumption in omnivores (n = 167), pescatarians (n = 110), vegetarians (n = 116), and vegans (n = 149). Results showed that people who consumed animal-derived products reported lower disgust and guilt and held stronger justifying beliefs about consumption of these products, than those who did not consume animal products. All dietary groups significantly differed from each other in their attitudes about using animals for human benefit, with omnivores showing the least positive attitudes towards animals, followed by pescatarians and vegetarians, and with vegans showing the most positive attitudes towards animals. Women experienced greater moral emotions and held fewer justifying beliefs than men within groups where animal products were consumed and this was related to the animal-based products they consume (i.e., fish for pescatarians and eggs/dairy for vegetarians). These findings emphasise the importance of considering a wider range of animal products, and dietary groups in order to obtain a comprehensive understanding of the psychological underpinnings of animal product consumption. The results highlight differences between dietary groups in attitudes and moral concern towards animals, which may be important to consider when designing interventions to reduce animal product consumption.

1. Introduction

The consumption of meat and animal products is rising globally, with a projected increase in meat consumption of 73% and dairy consumption of 58% by 2050 (FAO, 2021). Animal agriculture is a major contributor to environmental problems including climate change, water and air pollution, and deforestation (Knutti, 2019; Springmann et al., 2016; Willett et al., 2019). At the same time, an increasing number of people recognize the ethical issues surrounding the treatment of animals in the animal agricultural industry (Deckers, 2016; Dhont & Hodson, 2020; Dhont et al., 2020; Ruby, 2012). To tackle these problems, and to determine ways to encourage people to reduce meat, fish, and animal product consumption, it is important to understand the psychological factors underlying people's food choices (Becker & Lawrence, 2021; Dhont et al., 2021; Valin et al., 2014; Willett et al., 2019).

Although definitions of vegetarian diets vary, in Western contexts they most commonly refer to diets that do not include products from slaughtered animals, including meat, fish, seafood, and poultry (Rosenfeld, 2018; Vegetarian Society, 2021). Vegetarian diets can further be distinguished from vegan diets, which exclude all animal products, and from pescatarian diets, which exclude meat and poultry but do include fish or seafood (Rosenfeld & Tomiyama, 2019). Past research has often grouped these together and investigated differences between 'meat-abstainers' and 'meat-consumers' with respect to their moral emotions and attitudes towards meat consumption and animals (Piazza et al., 2015; Rothgerber, 2014; Ruby & Heine, 2012).

Negative moral emotions such as disgust and guilt are experienced not only when thinking about the harm inflicted on animals during meat production (Dhont & Hodson, 2020; Piazza, 2020), but also at the thought of eating animal flesh (e.g., Bastian & Loughnan, 2017;

* Corresponding author. School of Psychology, Faculty of Natural Sciences, Keele University, UK.
E-mail address: k.francis@keele.ac.uk (K.B. Francis).

https://doi.org/10.1016/j.appet.2023.106544
Received 16 December 2022; Received in revised form 13 March 2023; Accepted 18 March 2023
Available online 23 March 2023

Loughnan & Davies, 2020). Expressions of disgust can be a symbolic reflection of moral disapproval, with many vegetarians and vegans reporting that they feel disgusted by meat (Becker & Lawrence, 2021; Hamilton, 2006; Piazza, 2022; Rozin et al., 1997). Disgust as a moral emotion, which is the focus of the current research, is therefore not necessarily linked to a revulsive response to the sensory aspects of meat (i.e., bodily reaction to avoid contamination risk), although some people might show such a response particularly towards red meat when for instance, seeing blood and muscle tissue (Kubberød et al., 2006; Piazza, 2022). Meat processing and packaging often dissociates the meat from its animal source, so that the visual presentation of meat products may bear little resemblance to the animal (Earle et al., 2019; Hoogland et al., 2005; Kunst & Hohle, 2016; Rothgerber, 2020). This dissociation serves to draw attention away from the idea that animals were killed for meat products, which can alleviate disgust and feelings of guilt (Earle et al., 2019).

When the association between meat and the animal source triggers negative emotions, omnivores use psychological strategies that reduce the experienced dissonance (the psychological state of holding inconsistent beliefs) between the appetite for meat and moral concern for animals (e.g., Bastian et al., 2012; Loughnan et al., 2014; Rothgerber, 2020). Meat-consumers adopt psychological strategies that alleviate this dissonance and often endorse justifying beliefs that eating meat is normal, nice, necessary, and natural (Monteiro et al., 2017; Piazza et al., 2015; Rothgerber, 2020). Dissonance can also be reduced by adopting carnistic beliefs and ascribing to the idea that the killing of animals is justified because of an assumed superiority of humans over animals (Dhont & Hodson, 2014; Monteiro et al., 2017). Those who are more accepting of using animals for human purposes more generally, such as for entertainment and/or medical experiments, and those that show lower moral concern for animals, also tend to report higher levels of meat consumption (Dhont & Hodson, 2014; Monteiro et al., 2017) and report less guilt and disgust regarding eating meat (Earle et al., 2019; Rothgerber 2015, 2020).

Compared to meat-eaters, vegetarians and especially vegans, could be more likely to associate meat with animal suffering (Rosenfeld, 2018) and are more likely to reject beliefs in human superiority over animals and deem it less morally acceptable to use animals for human benefit (Dhont & Ioannidou, 2021; Rosenfeld, 2019a). Meat abstainers also tend to show greater support for animal rights and are less likely to employ justifications to endorse meat consumption (Monteiro et al., 2017; Rosenfeld, 2019a). Given that choice of a vegetarian or vegan diet can be a moral issue, meat-abstainers may develop strong moral feelings of disgust towards meat (Feinberg et al., 2019; Fox & Ward, 2008; Rosenfeld, 2019a, 2019b, 2019c; Rothgerber, 2014, 2015). Previous research also indicates that vegetarians and vegans can experience guilt when they violate their diet and eat meat (Hamilton, 2006; Rosenfeld, 2019a; Rothgerber, 2015a). Transitioning to a meat-free diet is often driven by feelings of moral guilt as part of the process of considering meat consumption as a moral issue (Feinberg et al., 2019). Relatively little is known about differences in meat-related guilt between meat-eaters and meat-abstainers or how potential differences are rooted in more general attitudes towards animals.

Previous research has also identified gender differences in moral emotions. Compared to men, women tend to feel more guilt (Ward & King, 2018), experience stronger meat-related disgust (Al-Shawaf et al., 2018; Hoefling et al., 2009; Prokop & Fancovicova, 2010; Schaller, 2016), show greater compassion towards animals and are more concerned with animal welfare and protection (Graça et al., 2018; Herzog et al., 2015; Martens et al., 2019; Phillips et al., 2011; Piazza et al., 2018). Women are also more favourable towards vegetarianism and are more likely to be vegetarian (Forestell & Nezlek, 2018; Graça et al., 2015; Pfeiler & Egloff, 2018; Rosenfeld, 2018). Men are typically less willing to reduce their meat consumption (Caviola et al., 2018), are more likely to have defensive beliefs about meat consumption (Graça et al., 2015; Pohjolainen et al., 2015), are more likely to have stronger speciesist points of view and are more likely to consider animals to be inferior to humans (Caviola et al., 2018; Graça et al., 2018). Given these findings, it is important to investigate the influence of gender on moral emotions and dietary choices.

Taken together, past findings suggest that people who consume certain animal-derived products (i.e., meat-eaters), as compared to those who do not (i.e., meat abstainers), express weaker moral emotions and hold stronger justifying beliefs related to the products (i.e., meat) they consume (e.g., Dhont & Ioannidou, 2021; Rosenfeld, 2019a; Rothgerber, 2020). These patterns tend be stronger for men than for women (e.g., Rosenfeld, 2018; Rothgerber, 2013). However, the question remains as to whether similar moral and psychological factors are involved in other animal-based products such as dairy, eggs, and fish and also a wider range of dietary groups such as those that follow a pescatarian diet. Only recently, researchers have started to explore the psychological factors that distinguish for instance, vegetarians from vegans (e.g., Dhont & Ioannidou, 2021; Rothgerber, 2015) and pescatarians from vegetarians (e.g., Rosenfeld & Tomiyama, 2019). Findings from these studies show meaningful differences between each of these dietary groups. For instance, compared to vegans, vegetarians hold fewer moral motivations regarding their diet, tend to score lower on meat disgust, higher on meat justifications, and hold fewer positive attitudes towards animals (Dhont & Ioannidou, 2021; Rothgerber, 2015). However, compared to pescatarians, vegetarians hold stronger moral dietary motivations and more positive attitudes towards animals (Rosenfeld & Tomiyama, 2019). We expect that such differences between these specific dietary groups will be even more pronounced when investigating moral emotions and justifying beliefs related to dairy, egg, and fish consumption.

1.1. Aims and objectives

Although previous research has indicated marked differences between omnivores and vegetarians, and between men and women, regarding moral emotions and beliefs related to meat consumption (Becker & Lawrence, 2021; Fessler et al., 2003; Rosenfeld, 2019b; Rothgerber, 2015), little is known about potential differences in moral emotions and beliefs related to the consumption of dairy, eggs, and fish. With the dominant focus on differences between omnivores and vegetarians, few studies have considered the wider range of dietary groups. The present research seeks to address these gaps in the literature by focusing on moral emotions and attitudes towards the consumption of dairy, eggs, and fish, in addition to meat consumption. Pescatarians and vegans as distinct dietary groups from omnivores and vegetarians were included in our investigations. We looked at differences between four specific dietary groups (omnivores, pescatarians, vegetarians and vegans) and considered gender differences with respect to moral emotions and the use of justifying beliefs concerning meat, fish, dairy, and egg consumption. We also looked at general attitudes towards animals.

Given findings of previous research, we hypothesise that (i) omnivores will score lower on meat-related disgust and guilt measures and have stronger carnistic beliefs (justifying beliefs for meat specifically) as compared to pescatarians, vegetarians and vegans. Assuming that consumption of fish, dairy and eggs is perceived similarly to the consumption of meat, we hypothesise the following, (ii) omnivores, pescatarians and vegetarians will score lower than vegans on disgust and guilt measures regarding dairy and egg consumption, and they will use more justifying beliefs regarding dairy and egg consumption as compared to vegans. Similarly, (iii) omnivores and pescatarians will score lower on measures of disgust and guilt regarding fish consumption, and will use more justifying beliefs related to fish consumption as compared to vegetarians and vegans; (iv) vegetarians, vegans and pescatarians will experience more guilt over the violations of their diet compared to omnivores; and (v) vegans, vegetarians, and pescatarians will have more positive attitudes towards animals compared to omnivores, with pescatarians having fewer positive attitudes towards animals compared to vegetarians and vegans. We further hypothesise that compared to men,

women will report more disgust and guilt, will use fewer justifying beliefs related to meat, fish and animal-derived products, and will be less accepting of the use of animals overall.

2. Method

2.1. Sample

We recruited 554 participants (326 women, 216 men, 8 non-binary, 4 prefer not to say) ranging in age from 18 to 82 years (M_{age} = 38.49 years, SD_{age} = 12.78 years). Given that the sample of non-binary and non-reporting participants (n = 12) was too small to include in the analyses, these participants were removed prior to further analyses (final N = 542, see Table 1). Inclusion criteria were that participants were aged 18 years and older, had no diagnosis of dementia, no history of an eating disorder, or any clinically diagnosed mental health condition. The study received ethical approval by the Chair of the Humanities, Social and Health Sciences Research Ethics Panel at the University of Bradford.

2.2. Measures

All measures and data file used for the study can be found on the OSF project page (seehttps://osf.io/vuxqg/).

2.2.1. Disgust (Rothgerber, 2015 and adapted items)

Four items from Rothgerber (2014) (based on Rozin et al., 1997) assessed disgust associated with factory-farmed meat, using six-point Likert Scales (1 for *strongly disagree* to 6 for *strongly agree*). As this measure was used in previous research comparing meat-eaters versus meat-abstainers (e.g., Rothgerber, 2014), we chose this scale to allow for a direct comparison with the findings from previous research. A sample item was *"Eating factory-farmed meat is offensive, repulsive and disgusting"*. We also created nine items replacing the word 'meat' to measure disgust levels for dairy (three items, e.g., "*Eating and drinking dairy-based products is offensive, repulsive and disgusting"*), eggs (three items e.g., "*Eating egg is offensive, repulsive and disgusting"*), and fish (three items, e.g.,"*Eating fish is offensive, repulsive and disgusting"*). We averaged the items for meat disgust (α = 0.95), fish disgust (α = 0.97) and then computed a combined score for dairy and egg disgust (i.e., collapsing the dairy and egg items into a single score; α = 0.97).[1] Higher scores indicated greater levels of disgust.

2.2.2. Guilt (Rothgerber, 2015 and adapted items)

To test the hypothesis concerning guilt related to meat, dairy, eggs, and fish, four items (one for each animal product) were created for which responses were on a five-point Likert scales ranging from 1 - *no guilt to* 5 *extreme guilt*. For guilt relating to meat and fish, the single items served as the guilt scores, while for guilt relating to dairy and eggs, the two items were averaged into one guilt score (i.e., collapsing the items of dairy and eggs). A sample item was *"If you consumed a dairy-based product, how much guilt would you experience from thinking of the animal (s) harmed?"*.

In addition to the guilt scales focusing on specific animal products, we also included a more general guilt measure developed by Rothgerber (2015) which assesses guilt when violating dietary practices. The participants completed six items, starting with "*If you broke or violate your diet, how much guilt you will experience from____,"* followed by statements such as "*thinking of the animal(s) harmed"* or "*hurting your personal health."* Four items were associated with ethical concerns, and two items were associated with health concerns. Items were completed on a six-point Likert Scale ranging from (1 for *extremely small* to 6 for *extremely large*). The six items were averaged into a single score of guilt over diet violations (α = .82). For all guilt measures, higher scores indicated more guilt.[2]

2.2.3. Attitudes towards animals (Herzog et al., 2015)

Participants completed the 20-item Animal Attitudes Scale (Herzog et al., 2015) which assesses moral acceptance of animals in areas such as pets, for food, human moral dominance, cosmetics, hunting and zoos (e.g., "*It is morally wrong to hunt animals for sport"*, α = .94). Responses were on five-point Likert scales ranging from (1 *strongly disagree* to 5 *strongly agree*). Item scores were summed with higher scores indicating more positive attitudes towards animals.

2.2.4. Justifying beliefs (Monteiro et al., 2017 and adapted items)

Meat-eating justifying beliefs related to meat consumption, dairy and egg consumption, and fish consumption were measured using the Carnism Inventory (Monteiro et al., 2017) which consists of two subscales of four items each. The carnistic defence subscale measures defensive beliefs related to meat consumption (e.g., *"I've been eating meat my whole life, I could never give it up"*), while the carnistic domination subscale refers to the idea of animals being subordinate compared to humans (e.g., *"I have the right to kill any animal I want"*). Responses were on a seven-point Likert Scale ranging from (1 for *strongly disagree* to 7 *for strongly agree*). Item scores were averaged into as single score (α = .87).

To measure justifying beliefs for dairy, eggs, and fish, we created five items similar to the ones included in the carnistic defence subscale: two items for dairy, one item for eggs, and two items for fish (e.g., "*"The production of dairy-based products causes animals to suffer" The production of eggs causes animals to suffer"; "The production of fish causes animals to suffer*"). As above, the items were completed on a seven-point Likert Scale ranging from (1 meaning *strongly disagree* to 7 meaning *strongly agree*). The three items referring to dairy and egg consumption were averaged into a single score (collapsing items on dairy/egg related justifying beliefs; α = .91) and the two items referring to fish consumption were averaged into a single score (α = .81).

2.3. Procedure

The study was advertised through several social media platforms, including Facebook and Twitter, asking for volunteers to participate in an online study and to share the survey on their own social media profiles (i.e., snowball sampling). It was advertised as a study investigating emotions and attitudes towards animals in different dietary and gender groups. Participants provided informed consent and then proceeded to the study. Participants were first asked to provide their demographic information and to self-identify their dietary preference: omnivore (eat meat, fish, dairy and eggs); pescatarian (no meat, eat fish, dairy, and eggs); vegetarian (no meat, no fish, eat dairy, eggs); vegan (no meat, no

[1] We computed combined scores for items related to eggs and dairy following our a priori data analysis plan. This was determined based on the description of the dietary groups, and thus the idea that the presence/absence of both dairy and eggs is what distinguishes vegetarians from vegans. To check that combining scores was justified, analyses were performed for dairy- and egg-related measures separately, and they produced a highly similar patterns of results. Further, a confirmatory factory analysis across the disgust, guilt, and justifying beliefs scales showed that all dairy- and egg-related items loaded on one factor.

[2] Even though omnivores might not have clear dietary restrictions, many omnivores might self-identify as a "conscious omnivore" or "meat-reducer", and thus might still adopt certain dietary habits, which can be violated. It is still informative to look at the levels of guilt experienced over diet violations among omnivores as a baseline comparison group (see e.g., Rothgerber, 2015). In the absence of such a comparison group for this measure, we would not be able to determine whether the levels of guilt over diet violations in the groups of meat-abstainers are linked to their dietary restrictions or reflect a general feeling that could be observed among all dietary groups, including omnivores.

Table 1
Demographic data.

Demographics	Omnivores		Pescatarians		Vegetarians		Vegans		Total Sample	
	n	%	n	%	n	%	n	%	n	%
Gender										
Men	80	37	55	25.5	35	16.2	46	21.3	216	39.9
Women	87	26	55	16.9	81	24.8	103	31.6	326	60.1

fish, no dairy, no eggs). The measures (outlined above) were then presented in a Latin-square randomization order.

2.4. Design and analysis

This was a cross-sectional survey design with dietary groups (omnivores, pescatarians, vegetarians and vegans) and gender as the categorical factors and moral emotions of disgust (Rothgerber, 2014 and adapted items), guilt (Rothgerber, 2015 and adapted items), attitudes towards animals (Herzog et al., 2015), carnistic beliefs (Monteiro et al., 2017 and adapted items) as the criterion variables.

Since data were not normally distributed and assumptions for multivariate analyses were not met, individual generalised linear models (GLiM) with gamma (loglink) were considered appropriate to determine if there were differences between the four dietary groups and between men and women in their moral emotions (scores on the disgust and guilt), their scores on acceptance of human use of animals, and their scores on justifying beliefs. The GLiM also enabled testing of any interaction effect between dietary groups and gender. Given that multiple analyses were performed, Bonferroni corrections were applied to determine the significance levels based on the number of associated outcome variables to protect against erroneous inferences. Significance thresholds were determined for analyses investigating guilt (i.e., meat-related, dairy/egg-related, fish-related guilt, guilt over diet violations), at $p < .0167$, for analyses investigating disgust (i.e., meat-related, dairy/egg-related, and fish-related guilt) at $p < .0167$, and for analyses investigating justifying beliefs (i.e., meat-related, dairy/egg-related, and fish-related guilt) at $p < .0167$. The analyses investigating attitudes towards animals and guilt over diet violations were not corrected ($p < .05$) as these were single outcome variables. SPSS version 27 was used for data analysis. All hypotheses were specified prior to data collection and analyses.[3] All data and measures can be found on the OSF project page: https://osf.io/vuxqg/?view_only=bc2cda6d0f3f4726abac1e2a47de1e23.

3. Results

3.1. Meat consumption: disgust, guilt, and justifying beliefs

We investigated dietary group differences and gender differences in meat-related emotions (disgust and guilt) and justifying beliefs (carnistic beliefs). Specifically, three GLiMs were tested with scores on meat-related disgust, meat-related guilt, and carnistic beliefs as the dependent variables, and with dietary group and gender as the independent variables.

Dietary groups differed significantly from each other and showed a main effect in meat-related disgust (Wald $\chi^2(3) = 211.95$, $p < .001$), meat-related guilt (Wald $\chi^2(3) = 267.19$, $p < .001$), and carnistic beliefs (Wald $\chi^2(3) = 586.93$, $p < .001$; see Table 2). Post hoc tests indicated that omnivores experienced less meat-related disgust, and less meat-related guilt, than all other dietary groups ($ps < .001$) and endorsed more carnistic beliefs than the other dietary groups ($ps < .001$). Pescatarians experienced less meat-related disgust than vegetarians and vegans ($ps < .001$), and also less meat-related guilt than vegans ($p < .001$) (see Fig. 1a and Fig. 1b; Table 2). There were no significant differences in meat-related disgust ($p = 1.00$) and guilt ($p = .074$) between vegetarians and vegans, and no significant differences in meat-related guilt between pescatarians and vegetarians ($p = .248$). All dietary groups differed significantly with respect to carnistic beliefs, with vegans scoring the lowest compared to the other groups, followed by vegetarians and pescatarians ($ps < .001$).

In terms of gender differences, main effects show that overall, women reported significantly greater meat-related disgust (Wald $\chi^2(1) = 23.80$, $p < .001$) and meat-related guilt (Wald $\chi^2(1) = 10.82$, $p = .001$) than men (Table 3). Women also showed lower levels of carnistic beliefs than men (Wald $\chi^2(1) = 21.73$, $p < .001$). There were also significant interaction effects between gender and dietary group in meat-related disgust (Wald $\chi^2(3) = 11.76$, $p = .008$) and carnistic beliefs (Wald $\chi^2(3) = 30.83$, $p < .001$), with women experiencing more meat-related disgust and endorsing less carnistic beliefs than men but only amongst omnivores ($p < .001$) (See Fig. 1a and Fig. 1c). The interaction effect between dietary group and gender on meat-related guilt was not statistically significant ($p = .076$).

3.2. Dairy and egg consumption: disgust, guilt, and justifying beliefs

Analyses also considered dietary group and gender differences in moral emotions (disgust and guilt) and justifying beliefs (defensive beliefs) related to dairy and egg consumption. Three GLiMs were conducted with scores on dairy and egg-related disgust, dairy/egg-related guilt, and justifying beliefs related to dairy and eggs as the dependent variables, and with dietary group and gender as the independent variables.

Dietary groups differed significantly (Table 2, Fig. 2a, Fig. 2b, Fig. 2c) in their disgust towards dairy and eggs (Wald $\chi^2(3) = 577.92$, $p < .001$), guilt related to dairy and egg consumption (Wald $\chi^2(3) = 400.91$, $p < .001$), as well as in justifying beliefs about dairy and eggs (Wald $\chi^2(3) = 661.66$, $p < .001$). Post hoc analyses indicated that vegans experienced significantly higher dairy/egg-related disgust and dairy/egg-related guilt and endorsed fewer justifying beliefs related to dairy and eggs, as compared to all other groups ($ps < .001$). The three groups that did consume eggs and dairy (omnivores, vegetarians and pescatarians) did not significantly differ from each other in terms of dairy/egg-related guilt, and pescatarians and omnivores also did not show significant differences in their levels of dairy/egg-related disgust and use of justifying beliefs. However, vegetarians showed significantly higher levels of dairy/egg-related disgust than omnivores ($p < .001$) and pescatarians showed significantly higher levels of dairy/egg-related justifying beliefs ($p = .012$). These differences were, however, smaller than the pronounced differences between vegans and all other groups (see Table 2).

With respect to gender differences (Table 3), main effects showed that women reported higher levels of dairy/egg-related disgust (Wald $\chi^2(1) = 29.75$, $p < .001$) and dairy/egg-related guilt (Wald $\chi^2(1) = 56.05$, $p < .001$) than men, and were less likely than men to endorse justifying beliefs about dairy and egg consumption (Wald $\chi^2(1) = 41.32$, $p < .001$). These gender effects were qualified by significant interaction effects between gender x dietary group for dairy/egg-related disgust (Wald $\chi^2(3) = 13.38$, $p = .004$), dairy/egg-related guilt (Wald $\chi^2(3) =$

[3] Note that while all hypotheses were specified prior to applying for ethical approval, prior to data collection, and prior to data analyses, hypotheses were not pre-registered on the OSF.

Table 2
Mean and standard deviation scores for disgust, guilt, carnistic beliefs and the sum of scores on the animal attitude scale per dietary group.

	Dietary Group							
	Omnivores (n = 167)		Pescatarians (n = 110)		Vegetarians (n = 116)		Vegans (n = 149)	
Dependent Variables	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Meat disgust	2.89	1.50	4.08	2.04	5.28	1.26	5.62	0.91
Dairy/egg disgust	1.57	0.87	1.81	1.34	2.18	1.21	5.32	1.10
Fish disgust	1.63	1.04	1.39	0.80	4.43	1.77	5.46	1.08
Guilt over violations of diet	2.70	1.28	4.17	1.24	4.07	1.14	4.46	0.98
Meat guilt	2.25	1.28	3.65	1.55	4.30	1.18	4.82	0.57
Dairy/egg guilt	1.81	1.03	1.86	1.21	2.29	1.13	4.58	0.72
Fish guilt	1.89	1.14	1.55	1.00	3.88	1.37	4.72	0.66
AAS	70.17	16.15	76.52	18.99	86.93	11.58	95.31	5.54
Carnistic beliefs about meat	3.14	1.55	1.64	0.88	1.37	0.57	1.15	0.45
Justifying beliefs - dairy/eggs	4.47	1.71	4.75	2.10	3.56	1.99	1.26	0.86
Justifying beliefs - fish	4.97	1.51	5.65	1.66	2.35	1.61	1.33	0.93

Note. AAS: Attitudes towards Animals.

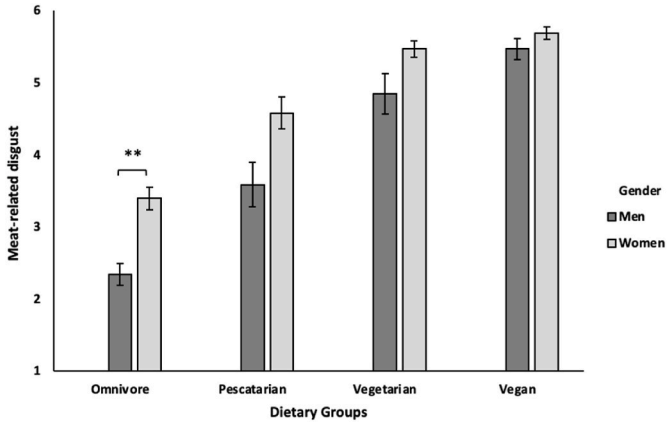

Fig. 1a. Interaction effect between gender x dietary group on meat-related disgust.
Note. $^{**}p < .001$. A significant gender difference in meat-related disgust was found among omnivores with omnivorous women experiencing more meat-related disgust than omnivorous men. Error bars represent ± 1 SE.

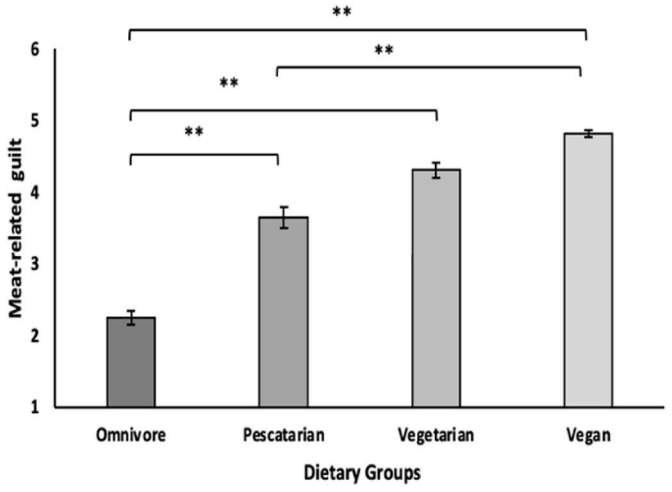

Fig. 1b. Mean of meat-related guilt by dietary groups.
Note. $^{**}p < .001$. Dietary groups differed significantly in their experience of meat-related guilt with omnivores experiencing the least meat guilt and vegans the most. Error bars represent ± 1 SE.

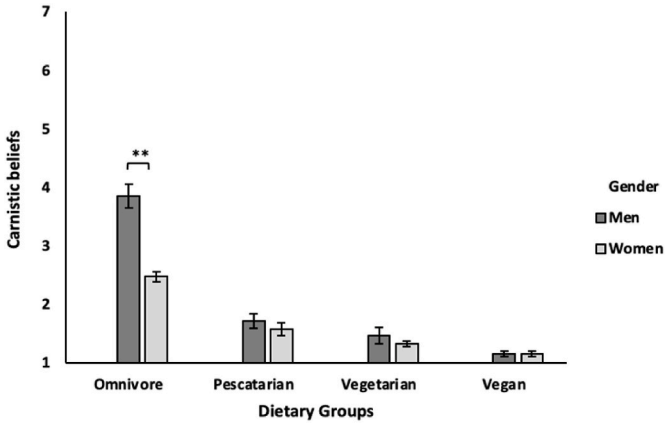

Fig. 1c. Interaction effect between gender x dietary group on carnistic beliefs.
Note. $^{**}p < .001$. A significant gender difference in carnistic beliefs was found in the omnivorous dietary group with omnivorous men endorsing more meat beliefs than omnivorous women. Error bars represent ± 1 SE.

Table 3
Descriptive statistics showing the means of disgust, guilt, carnistic beliefs and the sum of scores on the animal attitude scale for men and women.

	Gender			
	Men (n = 216)		Women (n = 326)	
Dependent Variables	M	SD	M	SD
Meat disgust	3.73	2.04	4.83	1.54
Dairy/egg disgust	2.28	1.81	3.11	1.94
Fish disgust	2.63	2.05	3.62	2.11
Guilt over violations of diet	3.65	1.57	3.86	1.22
Meat guilt	3.25	1.69	3.97	1.40
Dairy/egg guilt	2.15	1.47	3.03	1.51
Fish guilt	2.43	1.67	3.42	1.61
AAS	74.39	20.67	86.96	11.90
Carnistic beliefs about meat	2.35	1.73	1.61	.82
Justifying beliefs - dairy/eggs	4.30	2.30	2.86	1.94
Justifying beliefs - fish	4.27	2.40	3.07	2.08

Note. AAS: Attitudes towards Animals.

18.59 $p < .001$), and for justifying beliefs (Wald $\chi^2(3) = 15.36$, $p = .002$). Specifically, the gender differences seen for dairy/egg-related disgust and justifying beliefs were only significant in the pescatarian and vegetarian groups with women experiencing more disgust and endorsing fewer justifying beliefs ($ps < .010$) (Fig. 2a and Fig. 2c). The gender difference for dairy/egg-related guilt was only significant for the omnivores and vegetarians with women experiencing more guilt ($p < .001$) (see Fig. 2b; Tables 4 and 5).

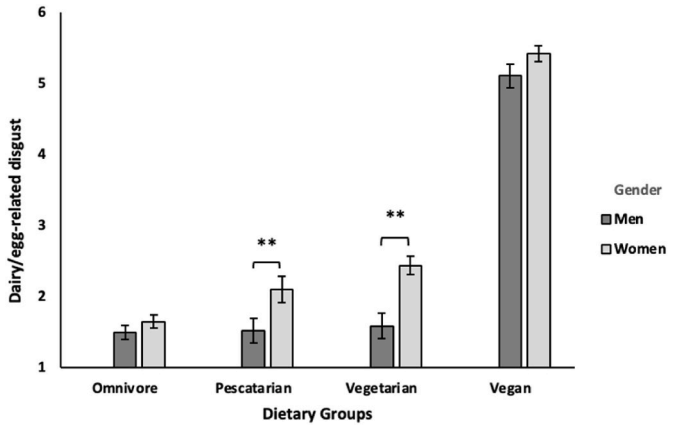

Fig. 2a. Interaction effect between gender x dietary group on dairy/egg-related disgust.
Note. $^{**}p < .001$. A significant gender difference in dairy/egg-related disgust levels was found in the vegetarian group with women in the vegetarian group experiencing more disgust than men in the vegetarian group. Error bars represent ± 1 SE.

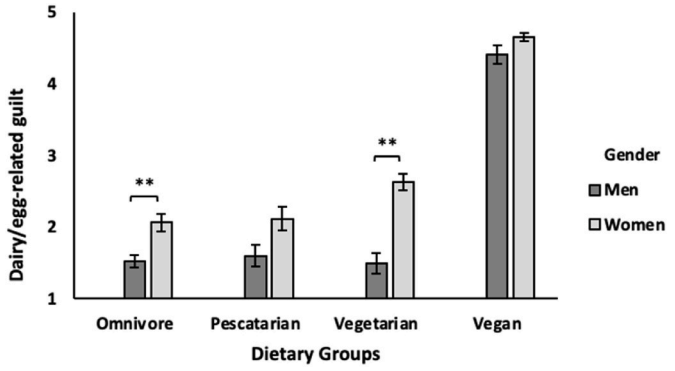

Fig. 2b. Interaction effect between gender x dietary group on dairy/egg-related guilt.
Note. $^{**}p < .001$. Significant gender differences in dairy/egg-related guilt were found in the omnivorous and vegetarian groups with omnivorous and vegetarian women experiencing more guilt than omnivorous and vegetarian men, respectively. Error bars represent ± 1 SE.

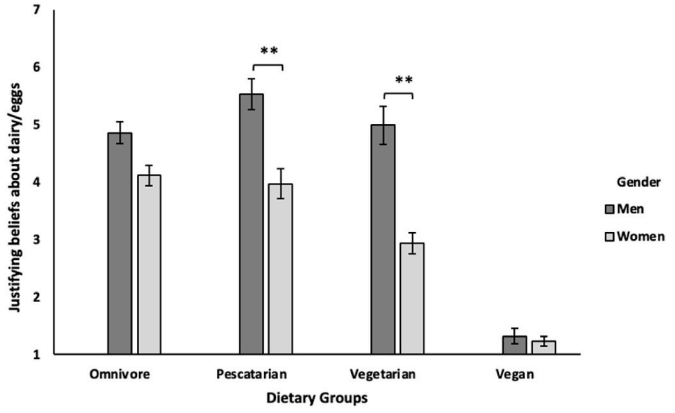

Fig. 2c. Interaction effect between gender x dietary group on justifying beliefs about dairy/eggs.
Note. $^{**}p < .001$. A significant gender difference in in dairy/egg justifying beliefs was found in the vegetarian dietary group, with men endorsing justifications more strongly than women. Error bars represent ± 1 SE.

3.3. Fish consumption: disgust, guilt, and justifying beliefs

We then analysed moral emotions and justifying beliefs related to fish consumption. Three generalised linear models (GLiM) were tested with scores on fish-related disgust, fish-related guilt, and justifying beliefs as the dependent variables and with dietary group and gender as the independent variables. The results (see Table 2, Fig. 3a, Fig. 3b, Fig. 3c) showed main effects between the dietary groups in their levels of fish-related disgust (Wald $\chi^2(3) = 937.41$, $p < .001$), fish-related guilt (Wald $\chi^2(3) = 587.90$, $p < .001$), and justifying beliefs related to fish consumption (Wald $\chi^2(3) = 845.35$, $p < .001$). Post hoc analyses indicated that the groups who did not eat fish (vegans and vegetarians) reported considerably higher levels of fish-related disgust and fish-related guilt and scored significantly lower on fish justifying beliefs compared to the groups who did eat fish (omnivores and pescatarians) ($ps < .001$). Omnivores and pescatarians did not differ significantly in their endorsement of justifying beliefs regarding fish ($p = .187$) (see Fig. 3c), but they did significantly differ in their fish-related disgust ($p = .004$) and guilt ($p < .001$) with pescatarians experiencing less disgust and guilt regarding fish than omnivores (Table 2, Fig. 3a and Fig. 3b). Overall, pescatarians experienced the least moral emotions related to fish compared to all other groups.

Main effects showed that women experienced greater fish-related disgust (Wald χ^2 (1) = 18.89, $p < .001$) and guilt (Wald $\chi^2(1) = 41.73$, $p < .001$) than men and expressed lower levels of justifying beliefs regarding fish consumption than men (Wald $\chi^2(1) = 9.61$, $p = .002$) (Table 3). Regarding the use of justifying beliefs for fish consumption, main effects show that men used more justifying beliefs in all dietary groups, although this effect was larger for men in the omnivore and pescatarian groups (see Table 4) than women (see Table 5). Significant interactions between gender and dietary group for fish-related disgust (Wald $\chi^2(3) = 16.64$, $p = .001$) and fish-related guilt (Wald $\chi^2(3) = 19.66$, $p = .001$), showed that the gender difference was significant for the pescatarian group only ($p < .001$) with women experiencing more disgust and guilt (See Fig. 3a and Fig. 3b). There was no significant interaction effect between gender and dietary group in fish justifying beliefs ($p = .256$).

3.4. Guilt over diet violations

We then analysed effects of dietary group and gender differences in general experiences of guilt over diet violations. A GLiM was conducted with scores on guilt over diet violations as the dependent variable and gender and dietary groups as the independent variables. The dietary groups significantly differed (Wald $\chi^2(3) = 191.09$, $p < .001$; Table 2), and the post hoc analyses indicated that omnivores experienced less guilt over diet violations than all other dietary groups ($ps < .001$). There were no significant differences between the other three dietary groups.

While there was no main effect of gender in experiencing guilt over diet violations ($p = .718$; Table 3), there was a significant interaction effect between gender and dietary group (Wald $\chi^2(3) = 26.44$, $p < 001$). Within the sample of omnivores (but not in any of the other dietary groups), women showed higher levels of guilt over diet violations than men ($p < .001$) (see Fig. 4; Tables 4 and 5).

3.5. Attitudes towards the use of animals for human benefit

A GLiM was used to analyse attitudes towards the use of animals for human benefits. Scores on the Attitudes Towards Animals Scale was the dependent variable, and dietary group and gender were the independent variables. The results showed a main effect of dietary group (Wald $\chi^2(3) = 219.88$, $p < .001$). Post hoc tests indicated that omnivores had the least positive attitudes towards animals (i.e., were more accepting of using animals for a wide range of practices) than the other dietary groups and that vegans had the most positive attitudes towards animals, followed by vegetarians and pescatarians (see Fig. 5; Table 2). All

Table 4
Mean and standard deviation scores for men only on disgust, guilt, carnistic beliefs and for the sum of scores on the animal attitude scale per dietary group.

	Dietary group							
	Omnivore (n = 80)		Pescatarian (n = 55)		Vegetarian (n = 35)		Vegan (n = 46)	
Dependent Variables	M	SD	M	SD	M	SD	M	SD
Meat disgust	2.34	1.33	3.58	2.29	4.84	1.67	5.47	0.99
Dairy/egg disgust	1.49	0.89	1.52	1.26	1.58	1.06	5.11	1.09
Fish disgust	1.59	1.11	1.09	.48	3.99	2.05	5.26	1.11
Guilt over violations of diet	2.34	1.23	4.51	1.26	4.19	1.35	4.49	0.95
Meat guilt	1.96	1.18	3.74	1.65	3.74	1.65	4.63	.82
Dairy/egg guilt	1.53	.75	1.60	1.11	1.50	.84	4.41	.85
Fish guilt	1.66	.99	1.15	. 62	3.40	1.65	4.54	.84
AAS	62.21	17.18	70.58	21.73	82.20	15.72	94.17	6.43
Carnistic beliefs about meat	3.85	1.85	1.72	.94	1.47	.83	1.15	.30
Justifying beliefs - dairy/eggs	4.86	1.70	5.53	1.98	4.99	1.94	1.31	.91
Justifying beliefs - fish	5.28	1.55	6.27	1.55	2.64	1.87	1.33	.74

Note. AAS: Attitudes towards Animals.

Table 5
Mean and standard deviation scores for women only on disgust, guilt, carnistic beliefs and for the sum of scores on the animal attitude scale per dietary group.

	Dietary group							
	Omnivore (n = 87)		Pescatarian (n = 55)		Vegetarian (n = 81)		Vegan (n = 103)	
Dependent Variables	M	SD	M	SD	M	SD	M	SD
Meat disgust	3.39	1.49	4.58	1.63	5.46	.99	5.69	0.86
Dairy/egg disgust	1.64	.85	2.10	1.38	2.43	1.18	5.42	1.11
Fish disgust	1.66	.99	1.70	.95	4.62	1.61	5.52	1.06
Guilt (ethics/health related)	3.04	1.24	3.83	1.13	4.02	1.04	4.44	1.00
Meat guilt	2.52	1.32	3.67	1.46	4.56	.81	4.90	.38
Dairy/egg guilt	2.06	1.19	2.11	1.26	2.63	1.08	4.66	.64
Fish guilt	2.09	1.24	1.96	1.14	4.09	1.18	4.81	.56
AAS	77.48	10.93	82.46	13.55	88.98	8.59	95.82	5.05
Carnistic beliefs about meat	2.48	.78	1.58	.83	1.33	.40	1.50	.50
Justifying beliefs - dairy/eggs	4.12	1.66	3.97	1.93	2.94	1.68	1.23	.85
Justifying beliefs - fish	4.69	1.42	5.03	1.63	2.22	1.48	1.33	1.01

Note. AAS: Attitudes towards Animals.

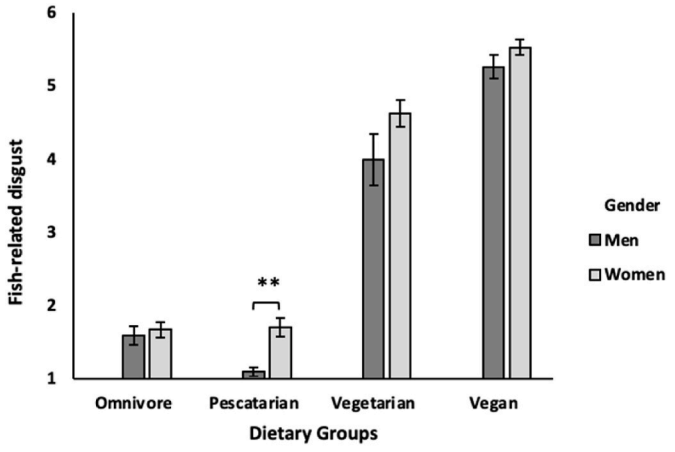

Fig. 3a. Interaction effect between gender x dietary group on fish-related disgust.
Note. $^{**}p < .001$. A significant gender difference in fish-related disgust was found in the pescatarian group with pescatarian women experiencing more disgust than pescatarian men. Error bars represent ± 1 SE.

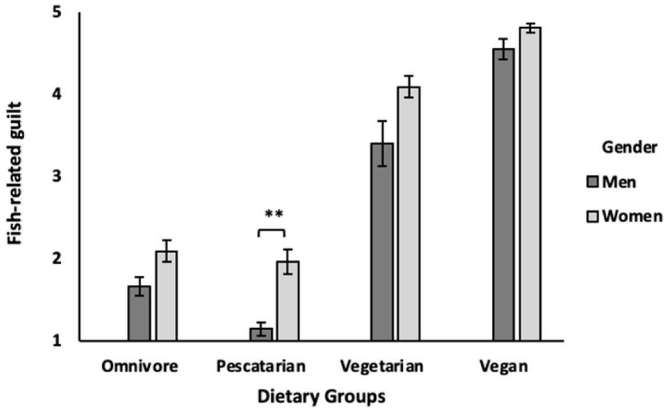

Fig. 3b. Interaction effect between gender x dietary group on fish-related guilt.
Note. $^{**}p < .001$. A significant gender difference in fish-related guilt was found in the pescatarian dietary group, with pescatarian women experiencing more fish-related guilt than pescatarian men. Error bars represent ± 1 SE.

dietary groups differed significantly from each other (*ps* < .001).

The main effect of gender was also significant Wald $\chi^2(1) = 47.31$, $p < .001$, indicating that women held more positive attitudes towards animals than men (see Table 3). There was a significant interaction effect between gender and dietary group (Wald $\chi^2(3) = 23.09$, $p < .001$), which indicated that this gender difference was only statistically significant for omnivores and pescatarians with women being less accepting of the use of animals for human benefit (*ps* < .001). There were no significant gender differences among vegetarians ($p = .972$) and vegans ($p = 1.00$) (see Fig. 5).

4. Discussion

This study investigated dietary group differences (vegans, vegetarians, pescatarians and omnivores), and gender differences (men and women) in moral emotions (disgust and guilt), justifying beliefs concerning meat, fish, dairy, and egg consumption, and attitudes towards

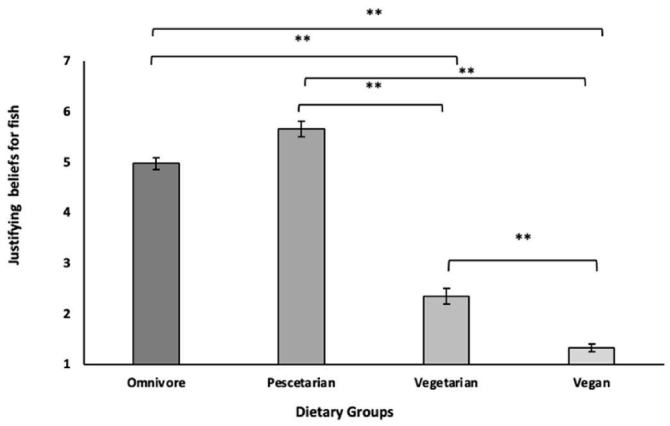

Fig. 3c. Mean of justifying beliefs for fish by dietary groups.
Note. $^{**}p < .001$. Dietary groups differ significantly in their use of justifying beliefs for fish consumption with pescatarians using justifying beliefs the most and vegans the least. Error bars represent ± 1 SE.

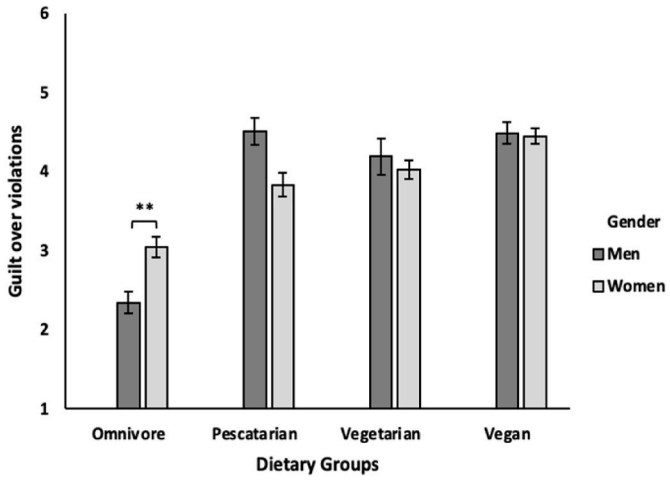

Fig. 4. Interaction effect between gender x dietary group on experiences of guilt over diet violations.
Note. $^{**}p < .001$. A significant gender effect in guilt over violations of diet was found in the omnivorous group, with omnivorous women experiencing more guilt over violations of diet compared to omnivorous men. Error bars represent ± 1 SE.

animals. By investigating a range of different animal products and dietary groups, our research moves beyond previous work that has primarily focussed on meat consumption and differences between meat-eaters and meat-abstainers. Overall, the results corroborated our expectation that people who consume certain animal-derived products would score lower on indices of moral emotions and higher on measures of justifying beliefs related to the consumption of those products, compared with those who do not consume those products. The results also indicate dietary group differences in people's attitudes towards animals as well as a nuanced picture with respect to gender differences, showing several interaction effects between gender and dietary group.

4.1. Meat consumption: disgust, guilt, and justifying beliefs

As expected, and in line with previous research, we found that vegetarians and vegans experienced greater meat-related disgust and guilt than omnivores (e.g., Piazza et al., 2015; Rozin et al., 1997; Rosenfeld & Burrow, 2017; Rothgerber, 2014, 2015a) and that omnivores reported the lowest levels of meat-related emotions. Also consistent with previous research, we found that omnivores used more justifying beliefs

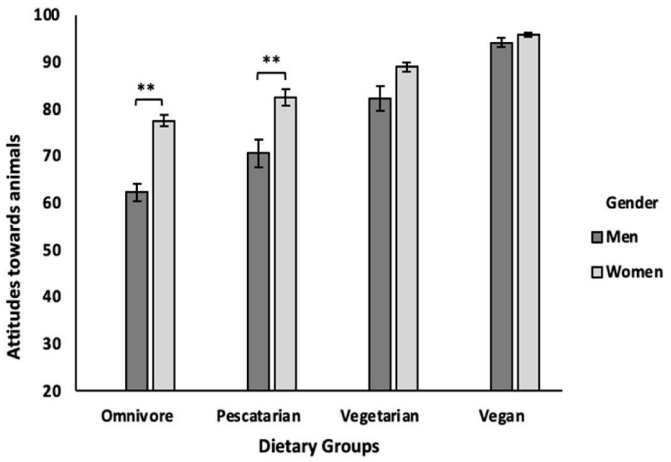

Fig. 5. Interaction effect between gender x dietary group on attitudes towards animals.
Note. $^{**}p < .001$. Significant gender differences in attitudes towards animals were found in the omnivore and pescatarian groups with women having more positive attitudes towards animals than men. Error bars represent ± 1 SE.

regarding their meat-eating, compared to the other dietary groups (Dhont & Hodson, 2014, 2020; Earle et al., 2019). Extending previous research, we found that pescatarians reported higher meat-related emotions (disgust and guilt) and lower carnistic beliefs than omnivores, yet they reported lower meat-related emotions and higher carnistic beliefs than vegetarians and vegans. With pescatarians falling in between omnivores and vegetarians, this finding could indicate that although pescatarians do not consume meat and thus do not need to justify meat consumption as meat eaters do, their dietary choices might be less ethically driven and more often motivated by health than those of vegetarians and vegans (Rosenfeld & Tomiyama, 2019).

4.2. Dairy and egg consumption: disgust, guilt, and justifying beliefs

With respect to dairy and egg consumption, omnivores, pescatarians, and vegetarians reported lower levels of moral emotions (disgust and guilt) and held stronger justifying beliefs related to dairy and egg consumption than the vegan group (i.e., the group that abstained from meat, fish, dairy and eggs). As expected, vegans clearly stood out from the other dietary groups given their higher levels of dairy/egg-related disgust and guilt and their relatively low levels of justifying beliefs. For vegans, the consumption of dairy and eggs is likely viewed as equally problematic to the consumption of meat and fish and raises similar moral concerns regarding the treatment of animals (Deckers, 2016; Kolbe, 2018). In other words, for vegans, dairy/egg-related disgust and guilt might be a result of moralising their eating behaviour akin to the moralisation of meat-eating behaviour (Feinberg et al., 2019).

In the context of meat consumption, Leach et al. (2022) investigated people's reactions to being exposed to information (e.g., presented in articles and internet pop-ups) about the cognitive capacities of farmed animals and found that participants who were more (vs. less) committed to eating meat, were more likely to avoid this information. Furthermore, according to a survey study by Onwezen and van der Weele (2016), a substantial portion of omnivores report that they deliberately ignore information about the treatment of farmed animals and would rather not think about this when buying cheap meat (Onwezen and van der Weele (2016; see also Dhont et al., 2021). This allows these individuals to avoid experiencing distressing moral emotions such as guilt and disgust (Rothgerber, 2020). This strategy of *willful ignorance* (e.g., Dhont et al., 2021; Leach et al., 2022) might also occur in the context of dairy and egg

consumption and could explain why omnivores, vegetarians, and pescatarians experience less dairy/egg-related moral emotions compared to vegans.[4]

In the present study, omnivores, vegetarians, and pescatarians also endorsed justifying beliefs related to dairy and egg consumption more strongly than vegans, which may partly explain why they experience less dairy/egg-related guilt than vegans. This is similar to how greater endorsement of meat-eating justifications is associated with less meat-related guilt (Piazza et al., 2015). Our findings therefore extend previous work on meat-eating behaviour, to the use of justifying beliefs for dairy/egg consumption and dairy/egg-related guilt.

4.3. Fish consumption: disgust, guilt, and justifying beliefs

Supporting our hypothesis, both omnivores and pescatarians (i.e., the groups that consume fish) reported lower levels of moral emotions and held stronger justifying beliefs related to fish consumption compared to vegetarians and vegans (i.e., the groups that did not consume fish). Interestingly, the findings suggest that pescatarians experienced less moral emotions than all the other dietary groups, including omnivores. A possible explanation for why omnivores experienced more fish-related disgust than pescatarians is that irrespective of dietary group, some people have a low preference for fish which might elicit emotions of disgust (see Egolf et al., 2018). These individuals appear more likely to be found in the omnivore group than in the pescatarian group where fish is a primary component of their dietary identity. More generally, a potential explanation for the lower moral emotions observed for omnivores and pescatarians, could be that many people do not consider fish to be 'animals' or believe that fish are not sentient or capable of experiencing pain (Rosenfeld & Tomiyama, 2019). The use of such justifying beliefs for fish are similar between the meat-eating and/or fish-eating groups (omnivores and pescatarians), which could also explain why they experience less moral emotions.

4.4. Guilt over diet violations and attitudes towards the human use of animals

With respect to guilt over diet violations and attitudes towards using animals for human benefits, the results confirmed that the three dietary groups who avoid eating meat (pescatarians, vegetarians, and vegans) all expressed higher levels of guilt at the thought of violating their diet and held more positive attitudes towards animals (were less accepting of animal exploitation) than omnivores. These findings are consistent with previous studies showing that vegetarians and vegans experience more guilt over diet violations than omnivores, especially if their dietary choices are ethically driven (Hamilton, 2006; Rothgerber 2014, 2015a). This is also reflected in their stronger rejection of using animals for human means. Extending previous findings, our research indicates that this pattern also applies to pescatarians as compared to omnivores. While pescatarians expressed similar guilt levels over diet violations as vegetarians and vegans, they were more accepting of using animals for human benefits than vegetarians and vegans. This could be because pescatarians not only consume certain animals such as fish and shellfish, but may also be less motivated by ethical concerns (see also Rosenfeld & Tomiyama, 2019). Vegans reported more positive attitudes towards animals than any other dietary group, which also supports the idea that vegans are more concerned with animal rights and their suffering even when compared to vegetarians (Dhont & Ioannidou, 2021; North et al., 2021; Rothgerber 2013, 2015a). Taken together, attitudes towards animals appear to improve incrementally with greater exclusion of animal products. This could suggest that interventions designed to reduce animal product consumption, need to address people's attitudes towards animals, not only among omnivores but also among pescatarians and vegetarians.

4.5. Gender differences

We hypothesised that women, compared to men, would i) report greater disgust and guilt, ii) be less likely to use justifying beliefs related to animal-derived products, and iii) be less accepting of the use of animals for human purposes. The overall pattern of findings across measures upheld these hypothesised gender differences yet pointed to important nuances with respect to gender effects within specific dietary groups.

Consistent with previous research, our results showed that women across all dietary groups experienced more meat-related guilt than men (Al-Shawaf et al., 2018; Kubberød et al., 2002, 2006; Prokop & Fancovicova, 2010; Ruby & Heine, 2012). This is consistent with findings from previous research that women have stronger emotional connections with animals and are more concerned with their suffering (Broida et al., 1993; Rothgerber, 2015a; Rosenfeld, 2018). However, only omnivorous women as compared to omnivorous men, experienced more meat-related disgust, used less carnistic beliefs to justify their meat consumption, experienced greater guilt over diet violations, and held more positive attitudes towards animals. Although this corroborates previous findings that women are less accepting of using animals for human purposes (e.g., Graça et al., 2018), it does so only to a certain extent. No significant gender differences were observed within the vegan and vegetarian groups for these variables, and pescatarians only showed a gender effect for attitudes towards animals. These findings thus suggest that gender differences in meat-related disgust, carnistic beliefs, and attitudes towards animals are primarily found in meat-eating populations (see also Piazza et al., 2015; Rothgerber, 2013; Rothgerber, 2019; Rosenfeld et al., 2020).

Interestingly, pescatarian and vegetarian women experienced more dairy/egg-related disgust than pescatarian and vegetarian men, while omnivorous and vegetarian women experienced more dairy/egg-related guilt than omnivorous and vegetarian men. Along similar lines, pescatarian women experienced greater fish-related disgust and guilt than pescatarian men. Moral emotions appear to have been experienced to a greater degree by women in those groups where animal products are still being consumed (e.g., fish for pescatarians and eggs/dairy for vegetarians).

Pescatarian and vegetarian men used more justifying beliefs for eating dairy and eggs than pescatarian and vegetarian women. Although men in all dietary groups used more justifying beliefs for fish consumption than women, these gender differences seemed most pronounced for the omnivorous and pescatarian groups. To some extent, these patterns mirror the findings for meat-related justifications (see also Rothgerber, 2019; Piazza et al., 2015), and extend previous findings on gender differences to the consumption of fish, as well as to the consumption of dairy/eggs but especially so for groups who eat animal products. A potential reason for this gender difference could be that women who follow a meat-free diet but who still eat other animal products (e.g., dairy and eggs or fish), might be more aware of the ethical issues associated with their diet, and therefore, experience more guilt or disgust and use fewer justifying beliefs than men. Moreover, this could indicate that pescatarian and vegetarian women (vs. men) are more likely to transition further toward respectively, vegetarianism and veganism. At the same time, men tend to endorse speciesist beliefs more strongly and are more accepting of animal exploitation (Caviola et al., 2018; Graça et al., 2016). Hence, they might also care less about animals in the fish, dairy and egg industry (Brown, 2014; Chandroo et al., 2004; Rose et al., 2014; Webster, 2006). This idea should be tested in future research.

[4] Note that vegetarians showed significantly higher levels of dairy/egg-related disgust than omnivores, yet this difference was rather small as compared to the pronounced difference between these two groups and the group of vegans.

4.6. Limitations and future directions

The current research provides a novel set of findings regarding psychological differences between dietary groups. Owing to the cross-sectional design, however, it is unclear whether higher food-related moral emotions or more positive attitudes towards animals, predict reduced consumption of certain animal products. Alternatively, shifts in dietary behaviour (i.e., excluding certain animal products) may increase food-related moral guilt and disgust or improve attitudes towards animals. Future research could manipulate food-related moral emotions and attitudes towards animals, to test the impact on willingness to change animal product consumption (or vice versa). A second limitation is that dietary group was assessed through self-reports and some people may claim to be vegetarian but occasionally eat meat or fish (Rosenfeld, 2018; Rosenfeld et al., 2020). To avoid this problem, future research could verify dietary adherence by assessing dietary behaviour (e.g., using a food frequency survey) to distinguish between dietary identity and actual behaviour. By recruiting a sample of online volunteers, it was not possible to have a clear indication of how well the subsamples of dietary groups represented these dietary groups in the general population.

Finally, as far as we are aware, our study is the first to simultaneously consider disgust related to meat, dairy/eggs, and fish. Our conceptual focus was on disgust as a moral emotion. We cannot ascertain, therefore, whether someone was experiencing disgust because they felt averted by the risk of contamination (i.e., pathogen disgust) or because they had ethical concerns about the treatment of animals (i.e., moral disgust) (or both). The items measuring disgust did not make an explicit distinction between pathogen and moral disgust. However, such distinction may be important to identify critical factors that are associated with the avoidance of animal products.

4.7. Implications and conclusion

Our research uniquely contributes to the growing literature on the psychological differences between dietary groups by providing new data on the psychological factors that distinguish omnivores, pescatarians, vegetarians, and vegans. The present research highlights the importance of moving beyond merely focusing on meat-related variables but instead, also investigating factors related to fish, dairy, and egg consumption to gain a more comprehensive understanding of consumption behaviour and associated moral emotions, beliefs, and general attitudes towards animals. Indeed, the morally-troubling issues and detrimental environmental impact of animal agriculture, are not uniquely related to meat production and consumption but also apply to the industrial production and consumption of other animal-based products.

A greater understanding of people's attitudes towards animals and their beliefs about different animal-based products, helps with understanding the factors that shape dietary behaviour. Moreover, how people experience moral emotions related to different animal-based products and to what extent these moral emotions can impact dietary choices, seems crucial in understanding and predicting consumption behaviour. For instance, our findings may imply that it is important to improve people's attitudes and moral concern towards animals to effectively reduce their meat, fish, egg, and dairy intake, and that it may take greater effort to improve attitudes and moral concern among men (vs. women) regarding the ethical issues surrounding the production and consumption of animal-based products. Although more direct and causal evidence is needed, such knowledge, in turn, can help inform interventions that aim to address recent recommendations from scientists and policy makers calling for a global shift away from animal agriculture and towards plant-based diets (Beezhold et al., 2015; Dyett et al., 2013; Leitzmann, 2014; Orlich et al., 2013; Ruby, 2012).

Ethical declaration

The study received ethical approval by the Chair of the Humanities, Social and Health Sciences Research Ethics Panel at the University of Bradford. Participants read online the information page, and they provided consent to participate in the study.

Author contributions

MI contributed to all aspects of this study design and prepared the manuscript. MI contributed to participant recruitment. MI and KF contributed to data processing, data analysis, and interpretation. All authors (MI, KF, VL and BS-K) contributed to the study design, manuscript revision, and read and approved the submitted version.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

Declarations of interest: none.

Data availability

The dataset presented in this study and the measures used can be found online below: https://osf.io/vuxqg/.

References

Al-Shawaf, L., Lewis, D. M. G., & Buss, D. M. (2018). Sex differences in disgust: Why are women more easily disgusted than men? *Emotion Review, 10*(2), 149–160. https://doi.org/10.1177/1754073917709940

Bastian, B., & Loughnan, S. (2017). Resolving the meat-paradox: A motivational account of morally troublesome behaviour and its maintenance. *Personality and Social Psychology Review, 21*(3), 278–299. https://doi.org/10.1177/1088868316647562

Bastian, B., Loughnan, S., Haslam, N., & Radke, H. (2012). Don't mind meat? The denial of mind to animals used for human consumption. *Personality and Social Psychology Bulletin, 38*, 247–256. https://doi.org/10.1177/0146167211424291

Becker, E., & Lawrence, N. S. (2021). Meat disgust is negatively associated with meat intake – evidence from a cross-sectional and longitudinal study. *Appetite, 164*, Article 105299. https://doi.org/10.3389/fnut.2022.958248

Beezhold, B., Radnitz, C., Rinnd, A., & DiMatteo, J. (2015). Vegans report less stress and anxiety than omnivores. *Nutritional Neuroscience, 18*(7), 289–296. https://doi.org/10.1179/1476830514Y.0000000164

Broida, J., Tingley, L., Kimball, R., & Miele, J. (1993). Personality differences between pro- and anti-vivisectionists. *Society and Animals, 1*, 129–144.

Brown, C. (2014). Fish intelligence, sentience and ethics. *Animal Cognition, 1–17*. https://doi.org/10.1007/s10071-014-0761-0

Caviola, L., Everett, J. A., & Faber, N. S. (2018). The moral standing of animals: Towards a psychology of speciesism. *Journal of Personality and Social Psychology, 116*(6), 1011–1029. https://doi.org/10.1037/pspp0000182

Chandroo, K. P., Duncan, I. J. H., & Moccia, R. D. (2004). Can fish suffer?: Perspectives on sentience, pain, fear and stress. *Applied Animal Behaviour Science, 86*, 225–250.

Deckers, J. (2016). *Animal (De)liberation: Should the consumption of animal products Be banned?* London: Ubiquity Press.

Dhont, K., & Hodson, G. (2014). Why do right-wing adherents engage in more animal exploitation and meat consumption? *Personality and Individual Differences, 64*, 12–17. https://doi.org/10.1016/j.paid.2014.02.002

Dhont, K., & Hodson, G. (2020). *Why we love and exploit animals*. London: Routledge.

Dhont, K., Hodson, G., Leite, A. C., & Salmen, A. (2020). The psychology of speciesism. In K. Dhont, & G. Hodson (Eds.), *Why we love and exploit animals: Bridging insights from academia and advocacy* (pp. 29–49). Routledge.

Dhont, K., & Ioannidou, M. (2021). *Vegan for the animals. The vegan society-the expert series autumn/winter 2021*. https://www.vegansociety.com/get-involved/research/research-news/expert-series-autumnwinter-2021-vegan-animals.

Dhont, K., Piazza, J., & Hodson, G. (2021). The role of meat appetite in wilfully disregarding factory farming as a pandemic catalyst risk. *Appetite, 164*, Article 105279. https://doi.org/10.1016/j.appet.2021.105279

Dyett, P. A., Sabate, J., Haddad, E., Rajaram, S., & Shavlik, D. (2013). Vegan lifestyle behaviors. An exploration of congruence with health-related beliefs and assessed health indices. *Appetite, 67*, 119–124. https://doi.org/10.1016/j.appet.2013.03.015

Earle, M., Hodson, G., Dhont, K., & MacInnis, C. (2019). Eating with our eyes (closed): Effects of visually associating animals with meat on antivegan/vegetarian attitudes and meat consumption willingness. *Group Processes & Intergroup Relations, 22*(6), 818–835. https://doi.org/10.1177/1368430219861848

Egolf, A., Siegrist, M, & Hartmann, C. (2018). How people's food disgust sensitivity shapes their eating and food behaviour. *Appetite, 127*, 28–36. https://doi.org/10.1016/j.appet.2018.04.014.

FAO. (2021). Major gains in efficiency of livestock systems needed. Food and Agriculture Organization of the United Nations. Retrieved from: http://www.fao.org/news/story/en/item/116937/icode/.

Feinberg, M., Kovacheff, C., Teper, R., & Inbar, Y. (2019). Understanding the process of moralization: How eating meat becomes a moral issue. *Journal of Personality and Social Psychology: Attitudes and Social Cognition, 117*(1), 50–72. https://doi.org/10.1037/pspa0000149

Fessler, D. M. T., Arguello, A. P., Mekdara, M. J., & Macias, R. (2003). Disgust sensitivity and meat consumption: A test of an emotivist account of moral vegetarianism. *Appetite, 41*, 31–41. https://doi.org/10.1016/S0195-6663(03)00037-0

Forestell, C. A., & Nezlek, J. B. (2018). Vegetarianism, depression, and the five-factor model of personality. *Ecology of Food and Nutrition, 57*, 246–259. https://doi.org/10.1080/03670244.2018.1455675

Fox, N., & Ward, K. J. (2008). Health, ethics and environment: A qualitative study of vegetarian motivations. *Appetite, 50*, 422–429. https://doi.org/10.1016/j.appet.2007.09.007

Graça, J., Calheiros, M. M., & Oliveira, A. (2015). Attached to meat? (Un) willingness and intentions to adopt a more plant-based diet. *Appetite, 95*, 113–125. https://doi.org/10.1016/j.appet.2015.06.024

Graça, J., Calheiros, M. M., & Oliveira, A. (2016). Situating moral disengagement: Motivated reasoning in meat consumption and substitution. *Personality and Individual Differences, 90*, 353–364. https://doi.org/10.1016/j.paid.2015.11.042.

Graça, J., Calheiros, M. M., Oliveira, A., & Milfont, T. L. (2018). Why are women less likely to support animal exploitation than men? The mediating roles of social dominance orientation and empathy. *Personality and Individual Differences, 129*, 66–69. https://doi.org/10.1016/j.paid.2018.03.007

Hamilton, M. (2006). Eating death: Vegetarians, meat and violence. *Food, Culture and Society, 9*, 155–177. https://doi.org/10.2752/155280106778606053

Herzog, H. A. H., Grayson, S., & McCord, D. (2015). Brief measures of the animal attitude scale. *Anthrozoös, 28*, 145–152. https://doi.org/10.2752/089279315X14129350721894

Hoefling, A., Likowski, K. U., Deutsch, R., Häfner, M., Seibt, B., Mühlberger, A., & Strack, F. (2009). When hunger finds no fault with moldy corn: Food deprivation reduces food-related disgust. *Emotion, 9*(1), 50–58. https://psycnet.apa.org/doi/10.1037/a0014449.

Hoogland, C. T., de Boer, J., & Boersema, J. J. (2005). Transparency of the meat chain in the light of food culture and history. *Appetite, 45*, 15–23. https://doi.org/10.1016/j.appet.2005.01.010

Knutti, R. (2019). Closing the knowledge-action gap in climate change. *One Earth, 1*, 21–23. https://doi.org/10.1016/j.oneear.2019.09.001

Kolbe, K. (2018). Why milk consumption is the bigger problem: Ethical implications and deaths per calorie created of milk compared to meat production. *Journal of Agricultural and Environmental Ethics, 31*, 467–481. https://doi.org/10.1007/s10806-018-9740-9

Kubberød, E., Ueland, Ø., Risvik, E., & Henjesand, I. J. (2006). A study on the mediating role of disgust with meat in the prediction of red meat consumption among young females. *Journal of Consumer Behaviour, 5*, 281–291. https://doi.org/10.1002/cb.180

Kubberød, E., Ueland, Ø., Rødbotten, M., Westad, F., & Risvik, E. (2002). Gender specific preferences and attitudes towards meat. *Food Quality and Preference, 13*(5), 285–294. https://doi.org/10.1016/S0950-3293(02)00041-1

Kunst, J. R., & Hohle, S. M. (2016). Meat eaters by dissociation: How we present, prepare and talk about meat increases willingness to eat meat by reducing empathy and disgust. *Appetite, 105*, 758–774. https://doi.org/10.1016/j.appet.2016.07.009

Leach, S., Piazza, J., Loughnan, S., Sutton, R. M., Kapantai, I., Dhont, K., & Douglas, M. K. (2022). Unpalatable truths: Commitment to eating meat is associated with strategic ignorance of food-animal minds. *Appetite, 171*(1), Article 105935. https://doi.org/10.1016/j.appet.2022.105935

Leitzmann, C. (2014). Vegetarian nutrition: Past, present, future. *The American Journal of Clinical Nutrition, 100*(1), 496S–502S. https://doi.org/10.3945/ajcn.113.071365

Loughnan, S., Bastian, B., & Hasalam, N. (2014). The psychology of eating animals. *Current Directions in Psychological Science*, 1–5. https://doi.org/10.1177/0963721414525781

Loughnan, S., & Davies, T. (2020). The meat paradox. In K. Dhont, & G. Hodson (Eds.), *Why people love and exploit animals: Bridging insights from academia and advocacy* (pp. 177–187). Abingdon, UK: Routledge.

Martens, P., Hansart, C., & Su, B. (2019). Attitudes of young adults toward animals - the Case of high school students in Belgium and The Netherlands. *Animals, 9*, 1–12. https://doi.org/10.3390/ani9030088

Monteiro, C. A., Pfeiler, T. M., Patterson, M. D., & Milburn, M. A. (2017). The Carnism Inventory: Measuring the ideology of eating animals. *Appetite, 113*, 51–62. https://doi.org/10.1016/j.appet.2017.02.011

North, M., Klas, A., Ling, M., & Kothe, E. (2021). A qualitative examination of the motivations behind vegan, vegetarian, and omnivore diets in an Australian population. *Appetite, 167*, Article 105614. https://doi.org/10.1016/j.appet.2021.105614

Onwezen, M., & van der Weele, N. C. (2016). When indifference is ambivalence: Strategic ignorance about meat consumption. *Food Quality and Preference, 52*, 96–105. https://doi.org/10.1016/j.foodqual.2016.04.001

Orlich, J. M., Singh, N. P., Sabaté, J., Jaceldo-Siegl, K., Fan, J., Knutsen, S., Beeson, W. L., & Fraser, G. E. (2013). Vegetarian dietary patterns and mortality in adventist health study 2. *JAMA Internal Medicine, 173*(13), 1230–1238. https://doi.org/10.1001/jamainternmed.2013.6473

Pfeiler, T. M., & Egloff, B. (2018). Examining the "Veggie" personality: Results from a representative German sample. *Appetite, 120*, 246–255. https://doi.org/10.1016/j.appet.2017.09.005

Phillips, C., Izmirli, S., Aldavood, J., Alonso, M., Choe, B., Hanlon, A., Handziska, A., Illmann, G., Keeling, L., Kennedy, M., Lee, G., Lund, V., Mejdell, C., Pelagic, V., & Rehn, T. (2011). An international comparison of female and male students' attitudes to the use of animals. *Animals, 1*, 7–26. https://doi.org/10.3390/ani1010007

Piazza, J. (2020). Why people love animals yet continue to eat them. In K. Dhont, & G. Hodson (Eds.), *Why people love and exploit animals: Bridging insights from academia and advocacy* (pp. 229–244). Abingdon, UK: Routledge.

Piazza, J. (2022). *Yuck! Does disgust keep us avoiding meat?* PHAIR Society. Retrieved from https://phairsociety.org/2022/06/26/yuck-does-disgust-keep-us-avoiding-meat/.

Piazza, J., McLatchie, N., & Olesen, C. (2018). Are baby animals less appetizing? Tenderness toward baby animals and appetite for meat. *Anthrozoös, 31*(3), 319–335. https://doi.org/10.1080/08927936.2018.1455456

Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4Ns. *Appetite, 91*, 114–128. https://doi.org/10.1016/j.appet.2015.04.011

Pohjolainen, P., Vinnari, M., & Jokinen, P. (2015). Consumers' perceived barriers to following a plant-based diet. *British Food Journal, 117*, 1150–1167. https://doi.org/10.1108/BFJ-09-2013-0252

Prokop, P., & Fancovicova, J. (2010). The association between disgust, danger and fear of macroparasites and human behaviour. *Acta Ethologica, 13*, 57–62. https://doi.org/10.1007/s10211-010-0075-4

Rose, J. D., Arlinghaus, R., Cooke, S. J., Diggles, B. K., Sawynok, W., Stevens, E. D., & Wynne, C. D. L. (2014). Can fish really feel pain? *Fish and Fisheries, 15*, 97–133. https://doi.org/10.1111/faf.12010

Rosenfeld, D. L. (2018). The psychology of vegetarianism: Recent advances and future directions. *Appetite, 131*, 125–138. https://doi.org/10.1016/j.appet.2018.09.011

Rosenfeld, D. L. (2019a). Ethical motivation and vegetarian dieting: The underlying role of anti-speciesist attitudes. *Anthrozoös, 32*(6), 785–796. https://doi.org/10.1080/08927936.2019.1673048

Rosenfeld, D. L. (2019b). *What does it take to get a vegetarian to eat meat? Factors predicting dietary adherence*. Preprint. Retrieved 7 April 2021 from: https://psyarxiv.com/97a2s/.

Rosenfeld, D. L. (2019c). Why some choose the vegetarian option: Are all ethical motivations the same? *Motivation and Emotion, 43*, 400–411. https://doi.org/10.1007/s11031-018-9747-6

Rosenfeld, D. L, & Burrow, A. L (2017). Vegetarian on purpose: Understanding the motivations of plant-based dieters. *Appetite, 116*, 456–463. https://doi.org/10.1016/j.appet.2017.05.039.

Rosenfeld, D. L., Rothgerber, H., & Tomiyama, A. J. (2020). Mostly vegetarian, but flexible about it: Investigating how meat-reducers express social identity around their diets. *Social Psychological and Personality Science, 11*(3), 406–415. https://doi.org/10.1177/1948550619869619.

Rosenfeld, D. L., & Tomiyama, J. A. (2019). How proximal are pescatarians to vegetarians? An investigation of dietary identity, motivation, and attitudes toward animals. *Journal of Health Psychology, 26*(5), 1–15. https://doi.org/10.1177/1359105319842933

Rothgerber, H. (2013). Real men don't eat (vegetable) quiche: Masculinity and the justification of meat consumption. *Psychology of Men and Masculinity, 14*(4), 363–375. https://doi.org/10.1037/a0030379

Rothgerber, H. (2014). A comparison of attitudes toward meat and animals among strict and semi-vegetarians. *Appetite, 72*, 98–105. https://doi.org/10.1016/j.appet.2013.10.002

Rothgerber, H. (2015). Can you have your meat and eat it too? Conscientious omnivores, vegetarians, and adherence to diet. *Appetite, 84*, 196–203. https://doi.org/10.1016/j.appet.2014.10.012

Rothgerber, H. (2015a). Underlying differences between conscientious omnivores and vegetarians in the evaluation of meat and animals. *Appetite, 87*, 251–258. https://doi.org/10.1016/j.appet.2014.12.206

Rothgerber, H. (2019). But I don't eat that much meat:" Situational underreporting of meat consumption by women. *Society and Animals, 27*, 150–173. https://doi.org/10.1163/15685306-12341468

Rothgerber, H. (2020). Meat-related cognitive dissonance: A conceptual framework for understanding how meat eaters reduce negative arousal from eating animals. *Appetite, 146*, 104511l. https://doi.org/10.1016/j.appet.2019.104511

Rozin, P., Markwith, M., & Stoess, C. (1997). Moralization and becoming a vegetarian: The transformation of preferences into values and the recruitment of disgust. *Psychological Science, 8*, 67–73. https://doi.org/10.1111/j.1467-9280.1997.tb00685.x

Ruby, M. B. (2012). Vegetarianism. A blossoming field of study. *Appetite, 58*, 141–150. https://doi.org/10.1016/j.appet.2011.09.019

Ruby, M. B., & Heine, S. J. (2012). Too close to home. Factors predicting meat avoidance. *Appetite, 59*, 47–52. https://doi.org/10.1016/j.appet.2012.03.020

Schaller, M. (2016). The behavioural immune system. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 206–224). Hoboken, NJ: John Wiley & Sons.

Springmann, M., Godfray, H. C., Rayner, M., & Scarborough, P. (2016). Analysis and valuation of the health and climate change cobenefits of dietary change. *Proceedings of the National Academy of Sciences, 113*, 4146–4151. https://doi.org/10.1073/pnas.1523119113

Valin, H., Sands, R. D., van der Mensbrugghe, D., Nelson, G. C., Ahammad, H., Blanc, E., Bodirsky, B., Fujimori, S., Hasegawa, T., Havlik, P., Heyhoe, E., Page, K., Mason-D'Croz, D., Paltsev, S., Rolinski, S., Tabeau, A., Hans van, M., von Lampe, M., & Willenbockel, D. (2014). The future of food demand: Understanding differences in

global economic models. *Agricultural Economics, 45*(1), 51–67. https://doi.org/10.1111/agec.12089

Vegetarian Society. (2021). *What is vegetarian*?. Retrieved from https://vegsoc.org/info-hub/definition/.

Webster, J. (2006). Animal sentience and animal welfare: What is it to them and what is it to us? *Applied Animal Behaviour Science, 100*, 1–3. https://doi.org/10.1016/j.applanim.2006.05.012

Willett, W., Rockstrom, J., Brent, L., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., & Murray, L. (2019). Food in the anthropocene: The EAT–lancet commission on healthy diets from sustainable food systems. *The Lancet, 393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4