Disgust Reactions and Their Justifications: The Case of Meat

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Abstract

Disgust reactions significantly impact food choices, particularly in meat consumption, yet the factors influencing their intensity and how individuals justify them remain underexplored. This study (n = 217) provides a novel, comprehensive examination of both disgust intensity and justification patterns across seven meat categories: cultured meat, genetically modified meat, game meat, small farm meat, factory-farmed meat, endangered animal meat, and pet meat. Results revealed that disgust sensitivity and gender significantly impact responses, with women reporting higher disgust intensity and greater likelihood to cite moral concerns as justification. Importantly, our study reveals a previously unidentified interaction effect: familiarity moderates the relationship between perceived naturalness and disgust intensity, suggesting a strategy to enhance acceptance of sustainable food alternatives. The justification patterns exhibited systematic variation by meat type. By bridging core and moral disgust research traditions, this work advances our understanding of how disgust functions at the intersection of biological protection and moral judgment.

Keywords: disgust; meat; morality; naturalness

Introduction

The emotion of disgust is elicited in response to revolting actions or ideas (Lazarus, 1991). This emotion has been studies in two main research traditions: one dedicated to *core* elicitors of disgust, such as blood, vomit, and rotten food, and the other to *moral* elicitors, including violations of moral and social norms (Rozin et al., 2008). The current study examines disgust in the context of meat consumption, which seems to elicit reactions of disgust that are linked in the literature to either core or moral reasons (Czarniecka-Skubina et al., 2022; Shulman et al., 2021). In this experiment, we asked participants to report their disgust at the idea of consuming seven categories of meat, which vary along dimensions expected to influence the intensity of their disgust, as well as the specific way they justify it. The overall objective was to document the properties of meat responsible for both the intensity of disgust and the type of justification provided for it. To achieve this, seven categories of meat were constructed based on state-of-the-art research regarding disgust-related properties in the food domain and beyond, which served as the foundations for developing the materials used in this study.

Health and Safety Risks related to health and safety are strongly associated with disgust (Karg et al., 2019), given its role in disease avoidance (Curtis et al., 2004). Perception of risk is also a major driver of food rejection, including meat avoidance (Corradini et al., 2022; Niewiadomska et al., 2021).

Uncertainty and Familiarity Familiarity and disgust have been linked in many domains (Gumussoy et al., 2021; Lee et al., 2020), including in food acceptance (Mina et al., 2023; Siegrist & Hartmann, 2020), as unfamiliar foods may lead to uncertainty about safety and enjoyment (Tuorila & Hartmann, 2020).

Sensory Considerations Unpleasant smells (Anja Juran et al., 2023) and visual images (Santos et al., 2023) can act as cues of pathogens, which can trigger disgust. Taste and odors are important characteristics in food choice (Tomasevic et al.,

In D. Barner, N.R. Bramley, A. Ruggeri and C.M. Walker (Eds.), *Proceedings of the 47th Annual Conference of the Cognitive Science Society*

2018) and unpleasant textures drive food rejection (Pellegrino & Luckett, 2020).

Naturalness A preference for naturalness is well documented across domains (Román et al., 2017; Rozin, 2005; Giner-Sorolla et al., 2012; Pivetti, 2007), shaping disgust reactions, for example, to cultured meat (Siegrist et al., 2018).

Moral, Ethical, and Sustainability Considerations Disgust's role in moral judgement is well documented (Chapman & Anderson, 2013; Pizarro et al., 2011), including in the moralization of meat consumption, particularly regarding concerns of animal welfare (Hamilton, 2006), sustainability (Hinsley & 't Sas-Rolfes, 2020), and ethical objections to certain methods of production (Hartmann & Siegrist, 2020).

Despite the recognized influence of these factors, uncertainty remains regarding whether they are genuine elicitors of disgust, or merely correlate with it. This study will contribute to this discussion by examining people's reported explanations for their disgust responses to various meat categories, assessing the role of the dimensions listed above (i.e. naturalness, familiarity, etc.). In addition to being influenced by these factors, disgust intensity and justification patterns are both expected to vary across individuals.

Individual Characteristics' Influence on Disgust

Indeed, disgust sensitivity varies among individuals (Druschel & Sherman, 1999), and is linked to food neophobia (Santisi et al., 2021), reflecting their common protective function. Perceived unnaturalness is also correlated with disgust (Siegrist & Hartmann, 2020), with preferences for natural foods varying across the population (Román et al., 2017). Demographic variables further shape disgust reactions. Gender differences in disgust are well documented (Egolf et al., 2018; Rozin et al., 2008; Simpson et al., 2006) and are reflected in different meat consumption habits between men and women (Kubberød et al., 2006; Sares-Jäske et al., 2022; Tomasevic et al., 2018). Age influences general disgust sensitivity (Egolf et al., 2018) and specific food consumption habits (Román et al., 2017; Tomasevic et al., 2018). Area of residence affects attitudes towards novel meats, with urban residents being more open to cultured meat (Shaw & Mac Con Iomaire, 2019). Education affects frequency of meat consumption (Sares-Jäske et al., 2022) and sustainable food choices (Klink et al., 2022). Culinary culture also affects meat acceptance, as seen in cross-national differences in acceptance of cultured meat (Siegrist & Hartmann, 2020). By integrating these factors, the present study aims to provide a clearer understanding of what factors shape disgust responses and how individuals justify their reactions. These findings will contribute to the broader discourse on the interplay between core and moral dimensions of disgust.

The Present Study

The first part of the study will investigate which factors influence the intensity of disgust reactions in seven meat categories, placing particular attention on the influence of perceived naturalness, which the existing literature has consistently found to be an important factor linked to disgust reactions (Gonzalez Coffin et al., 2024; Siegrist et al., 2018; Siegrist & Hartmann, 2020). The second part will analyze people's self-reported reasons for experiencing disgust, to explore how people's considerations and beliefs tend to apply within the meat categories investigated and how they vary with disgust reactions intensity.

Aims and Hypotheses

Focusing on meat consumption, a domain known to elicit disgust reactions for both moral and core-related reasons, this study aims to examine how different meat categories and meat properties influence disgust intensity and justifications. By analyzing participants' justification for their disgust reactions (selected from a list of pre-defined justifications), we seek to investigate how people's concerns are influenced by the variation in meat category. The study investigates the following pre-registered exploratory hypotheses:

1. Disgust intensity varies across meat categories and is influenced by individual characteristics.
2. Perceived naturalness affects both the intensity of disgust reactions and the type of justification provided.
3. The justifications provided for disgust responses are influenced by disgust reaction intensity and individual characteristics.

Materials and Methods

Participants

To determine sample size, we conducted a pre-test (n = 26). We found an effect size of r = .228 between average disgust rating of the meat categories and general score on the disgust sensitivity scale. Using the *pwr* package in R (Champely, 2020), we determined that to find an equal effect size with power of 0.9 and standard alpha error of 0.05 we required a sample of 197 subjects. In total, 250 participants were recruited among residents of the United States and Canada to complete the survey on Prolific. This sample size is in line with similar papers investigating disgust reactions (Rozin & Ruby, 2020). Subjects who did not complete the survey (n = 8), took too long to complete it (more than 2 standard deviations above the means, n = 10), vegetarians and vegans (n = 12), intersex participants (n = 1) and those who did not provide their gender (n = 2) were excluded. The final sample included 217 participants. The sample consisted of 106 women, 111 men, with an age range of 18-75 years (mean age = 37.7 years; SD = 13.2). 67.8% of participants had at least a bachelor's degree, and most lived in urban or suburban areas (86.2%). 72.8% of the subjects said they consume meat frequently.

Materials and Procedure

This study was exploratory in nature, and examined seven meat categories: cultured meat, meat from GMO animals, game meat, small farm meat, factory farm meat, meat from endangered animals, and pet meat. The selected categories represent different meat sources and were chosen to identify factors that drive disgust reactions, based on the existing literature on disgust elicitors. This selection allowed us to explore key concerns, for example naturalness in the case of GMO meat, and moral objections associated with consuming meat from endangered animals.

Data was collected through a survey administered through Labvanced (Finger et al., 2017) on the platform Prolific. It lasted 10-15 minutes and was divided into four parts:

1. Meat properties rating
2. Disgust reactions ratings and justification selection
3. Scales measuring food neophobia, disgust sensitivity, and preference for natural foods
4. Demographic and meat consumption data

Meat Properties Rating Data was collected to measure people's familiarity, and their perception of typicality and naturalness of all the seven meat categories, presented randomly. Participants were provided with a brief description of each variable and rated them on a Likert scale from 1 to 7 (Sample question: *How familiar are you with this food item? [Not familiar at all – Very familiar]*). Full text of the descriptions provided to participants is available in the supplementary materials.

Disgust Reactions and Justifications Participants were presented with the seven meat categories (as well as a brief description) in random order and were asked to respond to the question "*How disgusting do you find the idea of eating the following?*" on a Likert scale from 1 to 7 *(Not disgusting at all – Very disgusting*). Rating justification was recorded through a multiple-choice question, where participants selected one among five options (Health and safety; Uncertainty or familiarity; Sensory consideration; Naturalness; Moral, Ethical, or Sustainability consideration). They also had the opportunity to write a different answer in an open box. Full description of the meat categories and the justifications, as provided to the participants, is available in the supplementary materials.

Neophobia, Disgust and Naturalness Questionnaires Disgust sensitivity was assessed through the pathogen and moral subscales of the Three Domains of Disgust Scale (TDDS, Tybur et al., 2009), which have high internal consistency and have been found to measure different constructs of disgust (Olatunji et al., 2012). Food neophobia was measured through the Food Neophobia Scale (FNS, Pliner & Hobden, 1992), which measures the tendency to avoid novel foods. Importance of naturalness was measured through the Adherence to Natural Food Scale (Bäckström et al., 2004), which focuses on the importance of nature in food choice.

Demographics and Meat Consumption Information about gender, age, residence, education level, and nationality was recorded. Additionally, we collected data on frequency of meat consumption (*frequently, occasionally, rarely, never*), culinary culture, and whether participants were vegan or vegetarians.

Transparency

The study was pre-registered on the Open Science Framework. Details and additional materials are available at https://osf.io/8bvmc/?view_only=5a36f8ece6354dd1a623f54f82eb2c32. Informed consent was obtained from the participants prior to their completion of the survey. The study followed institutional ethics board approval.

Results

What Factors Predict the Intensity of Disgust Reactions?

A linear mixed effects model was run with the *lme4* package (Bates et al., 2015) in R Studio with disgust rating as the dependent variable, and participants as random intercepts to account for the repeated measures design. Model building was approached iteratively, by adding fixed effects according to their contribution to the variance (marginal R^2 criteria). BIC was used to select the best model fit to value parsimony. The best fit model contained random effects (participants) and, as fixed effects, meat category, gender, pathogen disgust sensitivity, and the interaction between meat naturalness and meat familiarity (and their main effects). Marginal R^2 is 0.496, showing that the fixed effects explain 49.6 % of the variance. The variance of the random effect of participant was 0.441 (SD = 0.664), indicating a moderate variability in disgust rating among subjects. The model showed that meat category has a large significant effect on disgust ($F(6,1361.87) = 80.08$, $p < .001$, $\eta p2 = 0.26$, 95% CI [0.22,0.30]), showing a statistically significant difference in disgust among meat categories (Figure 1). Pairwise comparison with Bonferroni correction showed a statistically significant difference between all pairs of meat categories, except for endangered animals' meat and pet meat ($p = .126$), and GMO animals' meat and cultured meat ($p = 1.000$).

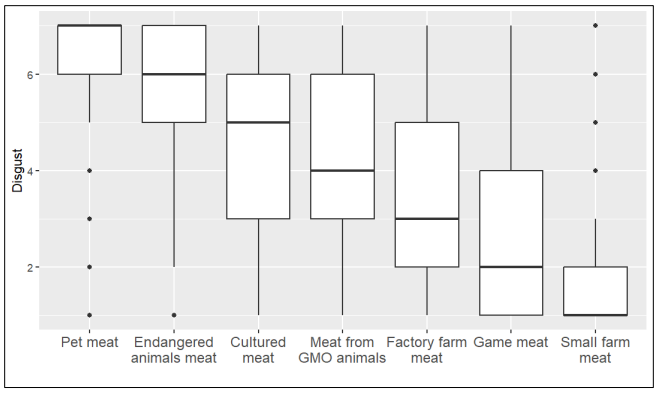

Figure 1: Disgust rating according to meat category. The horizontal black line indicates the median disgust rating.

Gender had a significant impact on disgust ($F(1,216.99) = 14.95$, $p < .001$, $\eta p2 = 0.07$, 95% CI [0.02,0.14]), with a moderate effect size. Pathogen disgust sensitivity also showed a significant moderate effect ($F(1,216.14) = 12.27$, $p < .001$, $\eta p2 = 0.06$, 95% CI [0.01,0.12]). Familiarity had a small but significant effect ($F(1,1461.49) = 19.41$, $p < .001$, $\eta p2 = 0.01$, 95% CI [0.00,0.03]) and naturalness showed a moderate significant effect ($F(1,1506.92) = 83.34$, $p < .001$, $\eta p2 = 0.05$, 95% CI [0.03,0.08]). Additionally, the interaction between familiarity and naturalness was significant ($F(1,1483.13) = 31.94$, $p < .001$, $\eta p2 = 0.02$, 95% CI [0.01,0.04]), showing that the effect of perceived naturalness on disgust intensity varied depending on the perceived familiarity of the meat.

What Is the Effect of Perceived Meat Naturalness?

A moderate general correlation was observed between disgust intensity and perceived naturalness ($r = -.42$, $p < .001$). Table 1 shows correlations for each meat category.

Table 1: Disgust Intensity-Perceived Naturalness correlations per meat category

Meat category	Correlation	p-value
GMO meat	$r = -.40$	$\mathbf{p < .001}$
Cultured meat	$r = -.23$	$\mathbf{p < .001}$
Factory Farm meat	$r = -.44$	$\mathbf{p < .001}$
Small Farm meat	$r = -.41$	$\mathbf{p < .001}$
Game meat	$r = -.38$	$\mathbf{p < .001}$
Pet meat	$r = -.20$	$\mathbf{p = .003}$
Endangered animals meat	$r = -.05$	$p = .487$

Additional correlation analyses were run for each justification category to explore the effect of naturalness (Table 2). The correlation was strongest among people who justified their disgust with a naturalness consideration, so perception of naturalness had a stronger effect on disgust when a naturalness-based justification was chosen.

Table 2: Disgust Intensity-Perceived Naturalness correlations per justification category

Meat category	Correlation	p-value
Health and safety	$r = -.39$	$\mathbf{p < .001}$
Uncertainty or familiarity	$r = -.28$	$\mathbf{p < .001}$
Sensory consideration	$r = -.25$	$\mathbf{p = .025}$
Naturalness	$r = -.78$	$\mathbf{p < .001}$
Moral, Ethical, or Sustainability consideration	$r = -.24$	$\mathbf{p < .001}$
Other	$r = -.32$	$p = .092$

Do Disgust Ratings and Individual Characteristics Influence Category of Justification?

Mean disgust varies between justification categories: moral justifications (M = 4.97, SD = 2.25) and naturalness justifications (M = 2.96, SD = 2.09) have the highest and lowest mean disgust respectively.

Justification category was modelled as a function of disgust, meat category, and their interaction using a multinomial regression with the *nnet* package in R Studio (Venables & Ripley, 2002). A Type III Anova conducted to test the significance of each model term suggests that justification category depends both on the intensity of the disgust and on the category of meat. According to the model, disgust has a significant effect on justification category ($\chi^2(5) = 43.64$, $p < .001$), which shows that disgust rating affects justification independently of other variables. Meat category also has a significant effect on justification category ($\chi^2(30) = 200.06$, $p < .001$), indicating differences in justification among the seven meat categories. The interaction effect between disgust and meat category is also significant ($\chi^2(30) = 233.79$, $p < .001$), which indicates that the relationship between disgust and justification category varies according to the meat category. Figure 2 shows predicted probabilities of each justification according to meat categories and disgust.

A chi square test showed a gender difference in justification selection $\chi^2(5) = 16.01$, $p = .007$, only for high disgust ratings (higher than the mean rating of 4), where a descriptive analysis showed that moral and naturalness justifications were more likely to be selected by women. Type III Anovas were performed to examine how gender and disgust interacted to predict justification: A significant effect was found for the naturalness justification, $\chi^2(1) = 6.71$, $p = .010$, where women were more likely to select this justification for higher disgust ratings, while men were more likely to select it for lower disgust ratings.

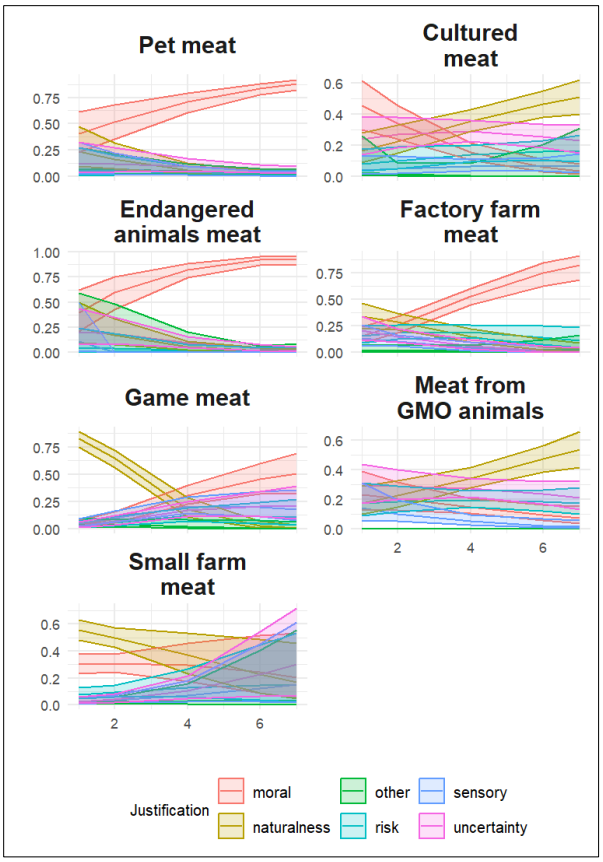

Figure 2: Probability of selecting each justification (indicated in the *y-axis*, with confidence intervals) for each meat category, according to disgust rating (indicated in the *x-axis*)

Discussion

This study investigated variations of disgust intensity among seven meat categories and explored the influence of specific properties and individual characteristics on disgust ratings and self-reported justifications. Key findings indicate that disgust intensity varied across meat categories, with perceived naturalness, familiarity, gender and pathogen disgust sensitivity playing significant roles in shaping participants' reactions.

In line with our exploratory hypothesis, disgust intensity was found to vary among the seven meat categories studied. Specifically, participants reported the highest disgust ratings for endangered animals and pet meat, and the lowest for game and small farm meat. This finding is consistent with previous research showing a variation in disgust intensity among types of meat with different characteristics of origin and production (Kubberød et al., 2002, 2006; Wilks et al., 2021).

Both perceived naturalness and familiarity with the meat affected the intensity of disgust. Naturalness has been previously found to affect disgust in a variety of food products (Siegrist & Hartmann, 2020), including meat, and familiarity with the food item can lower risk perception and thus disgust (Tuorila & Hartmann, 2020). A significant finding was that the relationship between naturalness and disgust varied according to familiarity, with increased familiarity leading to lower levels of disgust at the same level of naturalness.

Consistent with the existing literature on gender and disgust (Druschel & Sherman, 1999; Hartmann & Siegrist, 2020; Kubberød et al., 2006), female participants reported higher disgust ratings. Higher disgust sensitivity also correlated with stronger disgust reactions, likely reflecting the protective function of disgust in preventing exposure to diseases and contaminants (Tybur et al., 2009), which may lead to people being more cautious about what food they ingest.

Analysis of participants' self-reported justifications provided further insights. Strong moral and ethical reasons underpinned consistently high disgust reactions to pet meat and meat from endangered animals. In contrast, beliefs about the naturalness of the category (e.g. in categories such as game meat, which involves hunting wild animals, and meat from small farms) elicited lower disgust reactions. For categories with more varied disgust reactions (i.e. factory farm meat, cultured meat, meat from GMO animals) the justification patterns also varied. Factory farm meat showed strongest moral opposition as disgust ratings increased, possibly reflecting people's concerns over industrial farming practices. Cultured and GMO meat elicited concerns due to uncertainty, likely due to a lack of familiarity with these types of meat, as well as about naturalness.

A gender difference in justifications was found, aligning with previous findings on the different concerns exhibited between men and women (Czech et al., 2001). Women were more likely to cite moral and ethical reasons for their disgust, and to emphasise concerns over naturalness.

These results confirm the heterogeneous nature of disgust, showing that it arises from a range of concerns and considerations, which vary between individuals. Beyond theoretical contributions, these findings provide practical implications for interventions aimed at reducing disgust responses, specifically in the context of promoting sustainable food alternatives. Strategies that increase familiarity and address concerns about naturalness, especially among women, could improve acceptance of novel meat products. By identifying key factors that shape disgust reactions, this study provides a foundation for developing targeted approaches to encourage more sustainable dietary choices.

Limitations

Findings of this study may not generalize directly beyond meat consumption. Additionally, we tried to minimize cultural variability by focusing on participants from the United States and Canada, but cultural differences exist among different countries and geographical areas, especially in relation to familiarity with specific types of products (e.g. game meat). The fact that participants could only choose among pre-selected justifications may have limited the breadth of responses we might have received through an

open-ended question. Finally, meat categories were presented only through a written description, which does not reflect how people would come across these meats in an ecological setting. Thematic relations, which help make inferences and guide behaviour in context (Estes et al., 2011), were not present, and the lack of contextual information may have influenced disgust reactions in either direction, as well as the justification provided.

Further Research

Future research avenues could explore the relationship between explicit justifications and the underlying causes of disgust reactions. Our findings highlight the significant role of disgust sensitivity, suggesting the need to investigate strategies for lowering baseline sensitivity. Additionally, the prominence of naturalness and moral considerations as central drivers of disgust deserves further investigation. Notably, essentialist reasoning, the idea that objects possess deep, intrinsic qualities that make them what they are, has been linked to food enjoyment (Bloom, 2010). A similar mechanism may underlie disgust-based rejection: the methods of production of GMO and cultured meat may be perceived as altering the "essence" of the food, thereby eliciting disgust. This potential cognitive process is an important avenue for future study. Lastly, further research into the relationship between perception of naturalness and disgust in warranted, as it may prove instrumental in lowering food rejection. Our finding that familiarity can mitigate the disgust elicited by unnatural meat products, which is consistent with the existing literature (Tuorila & Hartmann, 2020), can serve as a starting point to devise interventions to increase acceptance of novel and more sustainable food alternatives. Such investigations could provide both theoretical insights and practical strategies for improving food acceptance.

Acknowledgments

This research was funded by the Department of Philosophy "Piero Martinetti" of the University of Milan under the Project "Departments of Excellence 2023-2027" awarded by the Ministry of University and Research (MUR) and the Institut Lyfe (ex Paul Bocuse) Research and Innovation Center.

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