HOLD THE MEAT BUT PASS THE DISGUST: DISGUST AS AN INSTRUMENTAL NEGATIVE EMOTION

BY

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ABSTRACT

People upregulate negative emotions when those emotions are instrumental to goal attainment (Tamir & Ford, 2009). Vegetarian diets are increasingly popular food goals that address moral, health, and environmental concerns associated with meat-eating. Therefore, we examined whether and how disgust toward meat is instrumental to vegetarian diet goals. We conducted two studies: one longitudinal and one experimental. In the longitudinal study, we predicted that experience of vegetarians would affect their disgust toward meat, as newer vegetarians might need to recruit more disgust than more experienced vegetarians whose vegetarian behaviors are likely more automatic. We found that both newer and more experienced vegetarians had higher disgust toward meat. Additionally, we found that throughout the course of the study, average vegetarians/reduced meat consumers experienced an increase in meat disgust followed by a decrease. However, time since quitting/reducing meat did not moderate the relationship between time and disgust toward meat. The experimental study tested whether vegetarians would willingly upregulate disgust during potential meat temptations. We predicted that vegetarians rating meat dishes would prefer to focus on disgusting versus appetizing aspects of the dishes. Indeed, we found that vegetarians preferred disgust when faced with meat temptations. However, vegetarians did not endorse the meta-emotion belief that disgust is useful to goal pursuit more than non-vegetarians. Our research suggests that disgust is an instrumental, negative emotion to vegetarian, vegan, and reduced-meat diets. Even more, people are motivated to leverage disgust, although subconsciously, when tempted with meat.

Keywords: vegetarians, disgust, negative emotions, goals

INTRODUCTION

The purpose of this paper is to discuss the basis for disgust being an instrumental negative emotion to vegetarianism as well as describe two studies that examined this hypothesis. Red meat organically elicits disgust and distaste, even in meat-eaters (Kubberød et al., 2002). There is evidence that disgust is a goal-relevant emotion (Porzig-Drummond et al., 2009; Shidlovski & Hassin, 2011), and disgust toward meat may be especially useful to vegetarianism. That is, disgust toward meat could encourage vegetarians to resist meat temptations. Previous research has found that people upregulate negative emotions such as anger, fear, and sadness when those emotions are instrumental to their goals (Lane et al., 2011; Millgram et al., 2019; Tamir & Ford, 2009). Because the relationship between disgust toward meat and vegetarian experience is currently unknown, our first study, a longitudinal study, aimed to uncover the nature of the aforementioned relationship. Our second study, an experimental study, tested whether vegetarians would willingly upregulate disgust when they anticipate a meat temptation.

Negative Emotions Can Be Instrumental to Goals

Self-regulation is the ability to exert effort to align thoughts, feelings, or behaviors with goals (Boekaerts et al., 2005; vanDellen et al., 2015). One specific form of self-regulation is emotion regulation, which entails initiating an emotion goal and using an emotion regulation strategy to pursue that goal (Tamir et al., 2019). Emotion goals are often prohedonic, meaning that the goal involves increasing good feelings and/or decreasing bad feelings. However, there is more and more research detailing the situations that promote contrahedonic emotion goals, meaning that the goal involves decreasing good feelings and/or increasing bad feelings (Parrott, 2014). In fact, many

studies have demonstrated that people actually upregulate negative emotions such as anger, sadness, and fear when these emotions are instrumental to their goals (Lane et al., 2011; Millgram et al., 2019; Tamir & Ford, 2009). For example, runners who endorsed the belief that running while angry increases their performance actually upregulated angry emotions before running (Lane et al., 2011). Also, clinically depressed populations were more likely to promote feelings of sadness versus happiness compared to non-clinically depressed samples (Millgram et al., 2019). Finally, participants tasked with a future avoidance goal (vs. approach goal) sought out fear-inducing (vs. excitement-inducing) music choices to listen to before the task (Tamir & Ford, 2009).

Disgust as an Instrumental Negative Emotion

Disgust likely evolved from natural selection and is thought to be derived from distaste, a response to sensorimotor reflexes of smelling and tasting (Haidt et al., 1997; Lazarus, 1991). Disgust notably elicits a particular facial expression, and creates nausea, revulsion, and distance between the self and the object of disgust (Rozin & Fallon, 1987). There are many proposed motives for experiencing disgust, including 1) the belief the substance has negative sensory properties; 2) anticipation of harm from its ingestion; and 3) cultural rejection of the substance (Rozin & Fallon, 1987). One example of cultural rejection includes that entomophagy (the consumption of insects) is non-normative and generally not accepted in Western cultures, whereas entomophagy is normative and common in central Africa (Jensen & Lieberoth, 2019).

Not only is disgust culturally and socially influenced, but it is also influenced by cognitive appraisals: “We can learn to accept substances that others find offensive, or learn to reject substances that others find acceptable and even attractive” (Lazarus, 1991,

p. 261). Therefore, disgust may be instrumental to achieving many goals, perhaps especially those related to health and eating behaviors that may involve the rejection of substances (such as meat).

Literature suggests that an individual's disgust sensitivity can affect their behaviors and thoughts. A current and robust theory on disgust sensitivity is the Three Domain Disgust Scale (Tybur, 2009; Tybur et al., 2009). Factor analyses across several studies have revealed that disgust sensitivity has three general domains: moral, sexual, and pathogenic. These domains also support adaptationist theory, which suggests that disgust has evolved from selection pressures such as disease (i.e., pathogenic), social norms (i.e., moral), and mate preference (i.e., sexual). Disgust sensitivity seems to be stable within individuals. For example, individual differences in disgust sensitivity may impact body image (von Spreckelsen et al., 2018), Big 5 traits (Tybur et al., 2009), and psychopathic tendencies (Tybur et al., 2009), and even one's preferences toward personal space (Park, 2015). To our knowledge, only one study has tested the relationship between meat consumption and disgust sensitivity, finding that higher disgust sensitivity was actually related to higher meat consumption (Fessler et al., 2003).

Some experimental evidence suggesting that disgust is a goal-relevant emotion exists in the literature. For example, after being primed with their goal of motherhood, female participants experienced less disgust in response to goal-relevant stimuli, such as babies with runny noses, compared to goal-irrelevant stimuli, such as food contaminated with bugs (Shidlovski & Hassin, 2011). Additionally, there is evidence that disgust-based interventions that promote the experience of disgust can be used to increase hand washing (Porzig-Drummond et al., 2009). In these studies, the contexts lend themselves

to the experience of disgust. The goals of motherhood and hand hygiene determined whether available disgust was down- or upregulated.

Furthermore, moralization may induce disgust through the influence of social and cultural values (Rozin, 1999). An example of a popularly moralized behavior today is smoking. There is some existing literature suggesting that disgust could play an important role in increasing quitting intentions of smokers. When people viewed disgust messages in anti-smoking advertisements, the messages "activated aversive/avoid motivation resulting in reduced craving and increased quit intentions" (Clayton, Leshner, Tomko, et al., 2017, p. 254). Notably, one study found that sadness, but not disgust, predicted cigarette craving because sadness triggers reward-seeking behaviors whereas disgust does not (Dorison et al., 2020). In fact, disgust directionally decreased cravings, although nonsignificantly (p = .12). Therefore, smoking cessation may be more successful if sadness is downregulated and disgust is upregulated. We believe that a similar case can be made in the context of vegetarianism.

Disgust as an Instrumental Emotion to Vegetarianism

Eating meat has become moralized as the modern world is faced with high rates of cardiovascular disease, strain on environmental resources, and unethical treatment of livestock (Rozin et al., 1997). Indeed, eating a meat-free diet is one of the most effective ways to decrease one's carbon footprint. A vegan diet can cut carbon footprint by 61% - 73% (Poore & Nemecek, 2018). Additionally, vegetarian and/or reduced meat diets are associated with reduced risk of coronary heart disease and type II diabetes (McEvoy et al., 2012). In a U.K. Women's Cohort Study with a sample of 35,000 women, meat-eaters were more likely to have higher BMIs and more self-reported illnesses than oily fish-

eaters or vegetarians (Cade et al., 2004). Therefore, there may be many reasons that people would want to pursue vegetarian, vegan, and reduced meat diets.

One hindrance to pursuing vegetarian diets is the allure of meat as well as the widespread practice of meat-eating, especially in the Western world. Eating meat is perceived as delicious, nutritious, and socially normative. For example, although there are meat substitutes that offer similar nutritional benefits, red meat has essential nutrients such as iron and protein (Muschalik et al., 2020). Furthermore, meat seems to be most tempting to vegetarians when they are in social settings that normalize meat consumption. For instance, one study asked vegetarian participants the situations in which they were most likely to eat meat, and most reported that they would eat meat at family gatherings, on special occasions, or to make social gatherings flow smoothly (Rosenfeld & Tomiyama, 2019). Consequently, it is likely that there are vegetarians who struggle to avoid meat temptations in certain situations. Thus, it may be valuable to consider constructs that bolster meat abstinence for the sake of these individuals' personal goals as well as the moral, health, and environmental benefits that accompany reduced meat consumption and vegetarianism.

Because disgust elicits strong emotional and/or physiological responses, vegetarians who experience strong disgust toward meat should be more likely to avoid meat, even when meat is socially or physically tempting. This experience of disgust could increase vegetarian success. Furthermore, meat is indeed disgust-evoking. Even those who eat red meat may find it disgusting and distasteful (Kubberød et al., 2002). Two studies have examined the role of disgust on willingness to eat meat. In the first, participants reported being less willing to eat meat after being shown a picture of the

meat with the head attached (Kunst & Hohle, 2016). In the second, participants reported being less willing to eat meat after pathogen cues (i.e., images of infected toenails) were repeatedly paired with meat images (Tybur et al., 2016).

Another study examined the efficacy of disgust-evoking messages in campaigns against meat consumption (Palomo-Vélez et al., 2018). In this study, animal welfare and disgust-evoking messages were more effective in influencing meat attitudes compared to health-oriented messages. This means that similar to anti-smoking messages, disgust appeals are highly persuasive in anti-meat consumption messages. Thus, research indicates that disgust messages and disgust priming may be important in reducing meat consumption, as disgust may be an instrumental negative emotion in this context.

The Prior and Current Work

The first objective of our prior and current work involving disgust's potential usefulness in vegetarianism was to identify the relationship between disgust toward meat and time since quitting meat. If there is a concrete relationship between disgust toward meat and time since quitting meat (i.e., vegetarian experience), this would contribute to evidence that vegetarians' disgust toward meat changes as a function of how long they have successfully abstained from eating meat. For instance, vegetarians may experience higher disgust toward meat earlier in their vegetarian goal pursuit, as they may need to recruit more disgust when meat temptations are newer or more threatening.

The second objective was to measure whether vegetarians willingly upregulate disgust in the face of meat temptations. Our third objective was to measure vegetarians' and nonvegetarians' explicit perceptions of disgust's usefulness to vegetarianism. Evidence in support of the second and third objectives would contribute to the growing

body of literature suggesting that people identify goals and instrumental emotions to those goals, and they use emotion regulation strategies to achieve those goals, even if that means that they willingly increase negative feelings (Tamir & Ford, 2012).

In our prior work, we wanted to observe the relationship between disgust toward meat and time since quitting meat in order to determine whether disgust may be present as an instrumental emotion (Somerville & Masicampo, 2020). We conducted two Mechanical Turk studies that hypothesized and tested for a curvilinear relationship in which disgust toward meat was high in both newer and experienced vegetarians. Our reasoning for these hypotheses was twofold. First, newer vegetarians may face more meat temptations, or perhaps meat temptations are more threatening to newer vegetarians, so they may need to recruit disgust more than experienced vegetarians. Second, and alternatively, experienced vegetarians may have increased disgust toward meat, perhaps due to an increased saliency of their vegetarian identities. We found significant quadratic regressions in both studies, demonstrating that disgust was higher in both newer and experienced vegetarians with a decrease in disgust toward meat in-between. Using interrupted regression analysis (i.e., the Robin Hood method; Simonsohn, 2018) to test for a u-shaped curve, we found mixed support for the presence of a u-shaped curve. Although these studies presented inconclusive evidence about the exact shape of the relationship between disgust and vegetarian success, they did support preliminary hypotheses that disgust toward meat is higher in both newer and more experienced vegetarians.

There were several limitations in the Mechanical Turk studies. First, the studies were cross-sectional, so it was unclear whether the patterns we found were due to the true

nature of the relationship between disgust toward meat and vegetarian success, or confounds such as attrition. For instance, perhaps we found the quadratic pattern because vegetarians who would fall in the middle of the time since quitting distribution are more likely to give up on vegetarianism. Furthermore, we only found mixed support for the u-shaped curve model. Finally, there was only one question about current dietary restrictions, and participants self-selected to participate in the study as vegetarians in exchange for payment. Therefore, participants were incentivized to say that they were vegetarians. The researchers considered the limitations of the previous studies and these limitations informed the methods of Studies 1 and 2.

These objectives, which intend to identify patterns of disgust toward meat in vegetarians as well as explore whether disgust toward meat may be useful to vegetarians' avoidance of meat temptations, may be particularly helpful to both applied and theoretical emotion science. For example, this work should contribute to the research on the instrumentality of negative emotions to specific goals (Lane et al., 2011; Millgram et al., 2019; Tamir & Ford, 2009), as disgust has not been previously identified as an instrumental, negative emotion. Additionally, our work may point to the efficacy of disgust in interventions that aim to reduce meat consumption at an individual or public health level.

STUDY 1: THE LONGITUDINAL STUDY

The purpose of Study 1 was to assess the longitudinal relationship between disgust and time since quitting and/or reducing meat. Time since quitting/reducing meat reflects one's experience as a vegetarian/reduced meat consumer. Unlike our previous cross-sectional studies in which a direct relationship between disgust toward meat and time since quitting meat was inferred, this longitudinal study actually tracked disgust biweekly over five months. Furthermore, this study's sample included participants from an undergraduate research pool at Wake Forest University who were screened to participate in the study through testing at the beginning of Fall 2020. Unlike the Mechanical Turk participants, student participants had no motive to falsely identify as vegetarians.

In this study, our main question of interest was: how does disgust toward meat change as a function of time, vegetarian status (i.e., vegetarian, non-vegetarian), and/or vegetarian experience? We hypothesized that as found in our previous two studies, there would be a curvilinear relationship between disgust toward meat and time since quitting/reducing meat. In this curvilinear relationship, we predicted that disgust would be higher in both newer and more experienced vegetarians/reduced meat consumers. We also predicted that newer vegetarians or reduced meat consumers would experience a decrease in disgust during the study as their vegetarian behaviors became more automatized and meat temptations became less threatening. We formally preregistered hypotheses at aspredicted.org.

Method

Participants

We recruited 119 total participants, including 77 non-vegetarians, 11 vegetarians, and 31 reduced meat consumers. Our sample was 62.1% female; 27.6% Asian, 59.5% White, 4.3% Mixed, 5.2% Hispanic, and 3.4% Black; *M*age = 19.16 (*SD* = 2.48). We recruited introductory psychology students at Wake Forest University as part of a curriculum research participation requirement. We further incentivized participation via a lottery drawing. We collected 634 responses over five months, with 409 responses from non-vegetarians, 71 responses from vegetarians, and 153 responses from reduced meat consumers. Vegetarians and reduced meat consumers were identified at the beginning of Fall 2020 through participation in mass testing at Wake Forest University as part of a curriculum research participation. In order to identify eligible participants, we asked students two questions. First, we asked participants if they were currently attempting to reduce their meat consumption. Second, we asked them if they were currently vegetarians. Those who answered "yes" participated in our study as either vegetarians or reduced meat consumers, depending on their responses. Those who answered "no" to both questions were considered non-vegetarians and were also eligible to participate in our study as such.

Procedure

Ostensibly, we recruited participants for the study via two separate online studies with almost identical measures. One study was available to non-vegetarians in the research pool; the second study was available to vegetarians/reduced meat consumers as identified in mass testing. The only difference in the measures of these studies was that

vegetarians and reduced meat consumers were asked to indicate first, whether they were vegetarians or reduced meat consumers, and then second, how long they had been vegetarians or reduced meat consumers. Non-vegetarians were not asked these questions. All other measures were the same (see Appendix A).

Eligible participants took the first three surveys via the online research pool website on their own computers, each within a five-day window. Surveys became available to participants every other week. Participants answered questions about how long they had quit eating meat and/or reduced meat consumption, their disgust sensitivity, and disgust toward meat. Participants were asked about their political disgust. Lastly, they answered a few demographics questions. We asked participants for their email addresses in the first survey so that we could contact them for future lottery participation. We asked for the participants' university usernames in every survey so that all surveys could be linked together for analyses. Email addresses were kept on a spreadsheet separate from the data.

For each of the three surveys taken from the online research pool website, participants were given course credit. Surveys after the first only asked for participants' university usernames, current meat disgust, and how many times they ate meat in the previous two weeks. After the online research pool ended in December 2020, we invited participants to continue taking surveys biweekly via Qualtrics Contact List emails. For every survey completed, a ticket was entered into a gift card lottery in compensation for their voluntary participation. When data collection was complete, we drew four lottery winners.

Measures

Time Since Quitting Meat

Participants reported the amount of time, in months, since they have quit eating meat or reduced their meat consumption.

Disgust Toward Meat

Participants rated their current disgust toward meat as well as their disgust toward meat at the time of quitting on a scale of *Not at all disgusting* (0) to *Extremely disgusting* (6).

Disgust Sensitivity

Participants rated 21 various actions as being *Not at all disgusting* (0) to *Extremely disgusting* (6; Tybur, 2009). The three domains of disgust within this scale include moral disgust (e.g., "Shoplifting a candy bar from a convenience store"), pathogen disgust (e.g., "Accidentally touching a person's bloody cut"), and sexual disgust (e.g., "Finding out that someone you don't like has sexual fantasies about you"). Items had high reliability between domains ($\alpha = .89$).

Results

We conducted nonlinear mixed modeling using SPSS version 25 to test our hypothesis. Nonlinear mixed modeling involves nonlinear regression within a multilevel modeling structure. The multilevel modeling structure accounted for our repeated-measures data. We also created exploratory plots in R version 4.0.3 with the ggplot2 package.

Nonlinear Mixed Modeling

Linear and Quadratic Effects of Time Since Quitting/Reducing Meat on Disgust Toward Meat

Two nonlinear mixed models tested the effects of time since quitting/reducing meat and time since quitting/reducing meat-squared (a quadratic variable) on disgust toward meat. We combined the vegetarian and reduced meat consumer samples to account for the small sample size of the vegetarian sample. We added time since quitting/reducing meat (in months; a Level 1 predictor), and time since quitting/reducing meat-squared, to each model to observe linear and quadratic effects, respectively.

As shown in Table 1, there was a significant linear effect of time since quitting/reducing meat on disgust toward meat in our vegetarian/reduced meat consumer sample, such that time since quitting/reducing meat positively predicted disgust toward meat (Model 1). There was also a significant quadratic effect of time since quitting/reducing-squared in our vegetarian/reduced meat consumer sample, such that time since quitting/reducing meat-squared positively predicted disgust toward meat (Model 2). These significant and positive linear and quadratic effects suggested that those who are some months into quitting/reducing meat, and those who are many months into quitting/reducing meat, tend to have higher disgust toward meat.

Table 1

Nonlinear Mixed Modeling Estimates of Fixed Effects: Linear and Quadratic Effects of Time Since Quitting/Reducing Meat on Disgust Toward Meat

Model	Variable	Estimate	*SE*	*t*	*p*
1	Time Since Quitting/Reducing Meat	0.06	0.02	2.55	.014
2	Time Since Quitting/Reducing Meat-squared	0.01	<0.01	2.33	.024

Note. Model 1: Time since quitting/reducing meat predicting disgust toward meat; Model 2: Time since quitting/reducing meat-squared predicting disgust toward meat. P-values are two-tailed.

Linear and Quadratic Effects and Interactions of Time and Vegetarian Status on Disgust Toward Meat

Two nonlinear mixed models tested for the linear and quadratic effects of time and time-squared (a quadratic variable) on disgust toward meat. Survey number was included as a Level 1 predictor and a proxy for time. We added Level 2 predictors to the model including each individual's average disgust sensitivity and vegetarian status (0 = non-vegetarian; 1 = vegetarian/reduced meat consumer). We again combined the vegetarian and reduced meat consumer samples to account for the small sample size of the vegetarian sample compared to the non-vegetarian sample. There were significant, positive linear and quadratic effects of time and time squared on disgust (Models 1 and 2), but these effects did not hold when other predictors were entered into the model. One nonlinear model tested for an effect of vegetarian status on disgust toward meat. As

shown in Table 2, vegetarian status significantly and uniquely predicted disgust toward meat such that vegetarians/reduced meat consumers had higher disgust toward meat (Model 3). This effect held when other predictors were entered into the model.

Next, we conducted a nonlinear mixed model to test for a significant linear interaction between vegetarian status and time on disgust toward meat to test for changes in disgust toward meat throughout the course of the study. We also tested for a significant quadratic interaction between time and vegetarian status. We found a significant, linear cross-level interaction between time and vegetarian status, such that the slope between time and disgust toward meat was more *positive* in vegetarians/reduced meat consumers (Model 4). We also found a significant, quadratic cross-level interaction between time-squared and vegetarian status, such that that the slope between time and disgust toward meat was more *negative* in vegetarians/reduced meat consumers (Model 4). This suggests that disgust was higher in vegetarians and reduced meat consumers (vs. non-vegetarians) when time predicted disgust, but disgust was lower in vegetarians and reduced meat consumers (vs. non-vegetarians) when time-squared predicted disgust. In other words, vegetarians and reduced meat consumers experienced an increase in disgust, followed by a decrease in disgust, during the study, whereas non-vegetarians did not (Figure 1).

Table 2

Nonlinear Mixed Modeling Estimates of Fixed Effects: Linear and Quadratic Effects and Interactions of Time, Vegetarian Status, and Time Since Quitting/Reducing Meat on Disgust Toward Meat

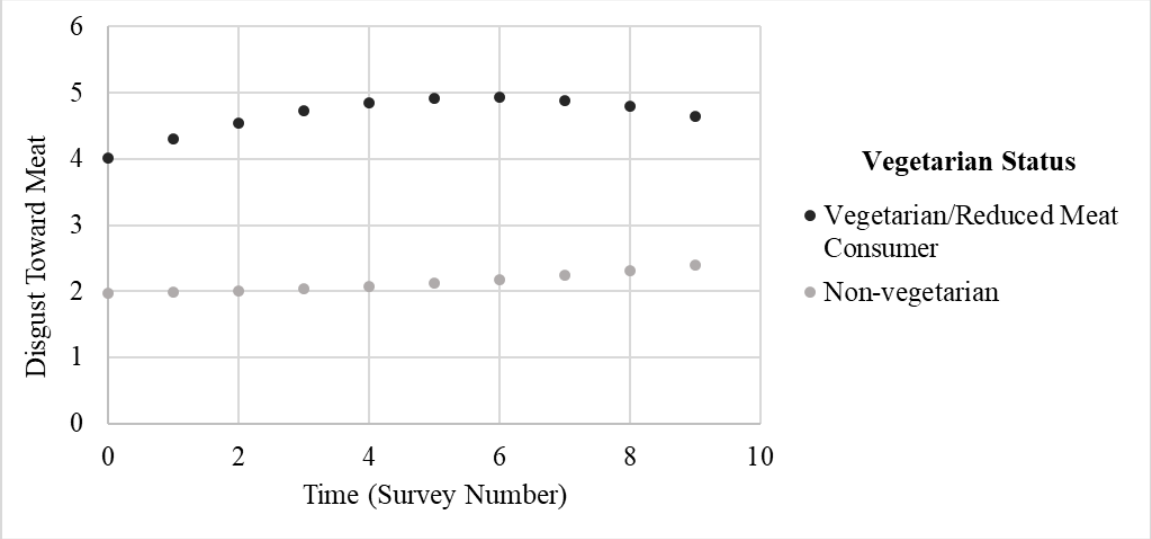
Model	Variable	Estimate	*SE*	*t*	*p*
1	Time	0.06	0.02	2.55	.014
2	Time-squared	0.01	<0.01	2.33	.024
3	Vegetarian Status	2.25	0.23	10.01	<.001
4	Time	0.01	0.05	0.20	.841
	Time-Squared	<0.01	0.01	0.64	.521
	Vegetarian Status	2.04	0.24	8.65	<.001
	Average Disgust Sensitivity	0.24	0.09	2.69	.008
	Vegetarian Status* Time	0.31	0.09	3.44	.001
	Vegetarian Status* Time-squared	-0.03	0.01	-3.31	.001
5	Time	0.30	0.09	3.91	.002
	Time-Squared	-0.03	0.01	-2.87	.005
	Time Since Quitting/Reducing Meat	0.01	<0.01	1.64	.107
	Average Disgust Sensitivity	0.38	0.14	2.68	.010
		<0.01	<0.01	0.40	.693

Time Since Quitting* Time				
Time Since Quitting* Time-squared	>-0.01	<0.01	-0.08	.937

Note. Model 1: Time predicting disgust toward meat; Model 2: Time-squared predicting disgust toward meat; Model 3: Vegetarian status predicting disgust toward meat; Model 4: Vegetarian status, average disgust sensitivity, vegetarian status*time, and vegetarian status*time-squared predicting disgust toward meat; Model 5 (Vegetarian/reduced meat consumer sample only): Time since quitting/reducing meat, average disgust sensitivity, time since quitting*time, and time since quitting*time-squared predicting disgust toward meat. P-values are two-tailed.

Figure 1

Vegetarian Status Moderates Effect of Time on Disgust Toward Meat (Table 2, Model 4)



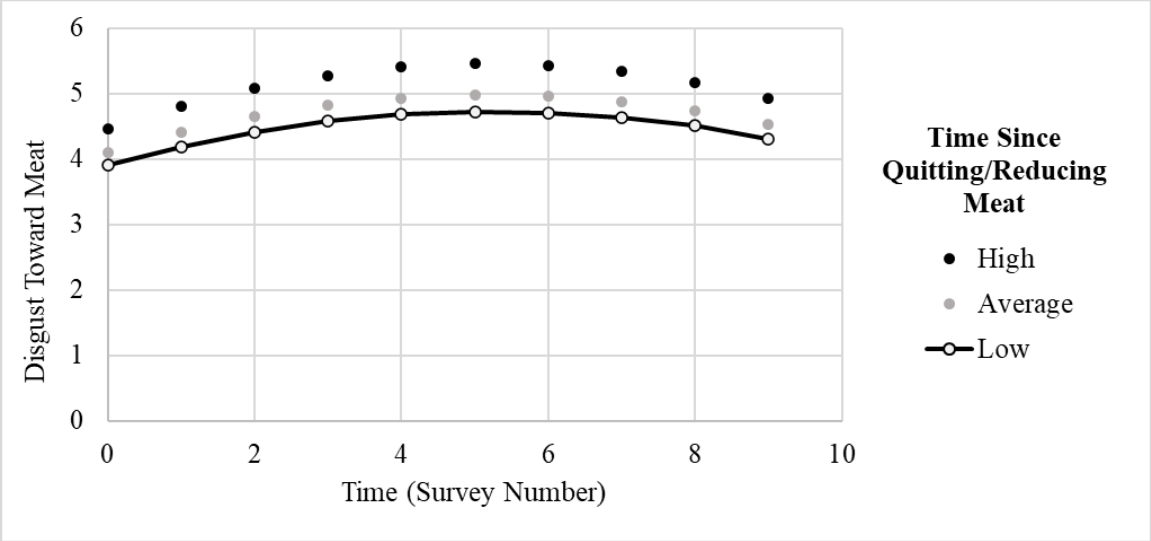
Interactions between Time Since Quitting/Reducing Meat and Time on Disgust Toward Meat

To determine if newer vegetarians/reduced meat consumers experienced changes in disgust differently than more experienced vegetarians/reduced meat consumers, we conducted two interactions testing whether time since quitting/reducing meat moderated the effect of time on disgust toward meat (Table 2, Model 5). First, we conducted an

interaction between time since quitting/reducing meat and time on disgust toward meat. Second, we conducted an interaction between time since quitting/reducing meat and time-squared on disgust toward meat. Both interactions were nonsignificant, meaning that time since quitting/reducing meat did not moderate the effect of time on meat disgust (Figure 2). Because we did not find a moderation effect of time since quitting/reducing meat on the relationship between time and disgust, we did not find support for our hypothesis that newer vegetarians (i.e., participants with lower time since quitting values) would see a decrease in disgust throughout the study compared to more experienced vegetarians (i.e., participants with higher time since quitting values).

Figure 2

Time Since Quitting/Reducing Meat Does Not Moderate the Effect of Time on Disgust Toward Meat Among Vegetarians/Reduced Meat Consumers (Table 2, Model 5)



Exploratory Plots

Disgust Toward Meat as a Function of Time and Vegetarian Status

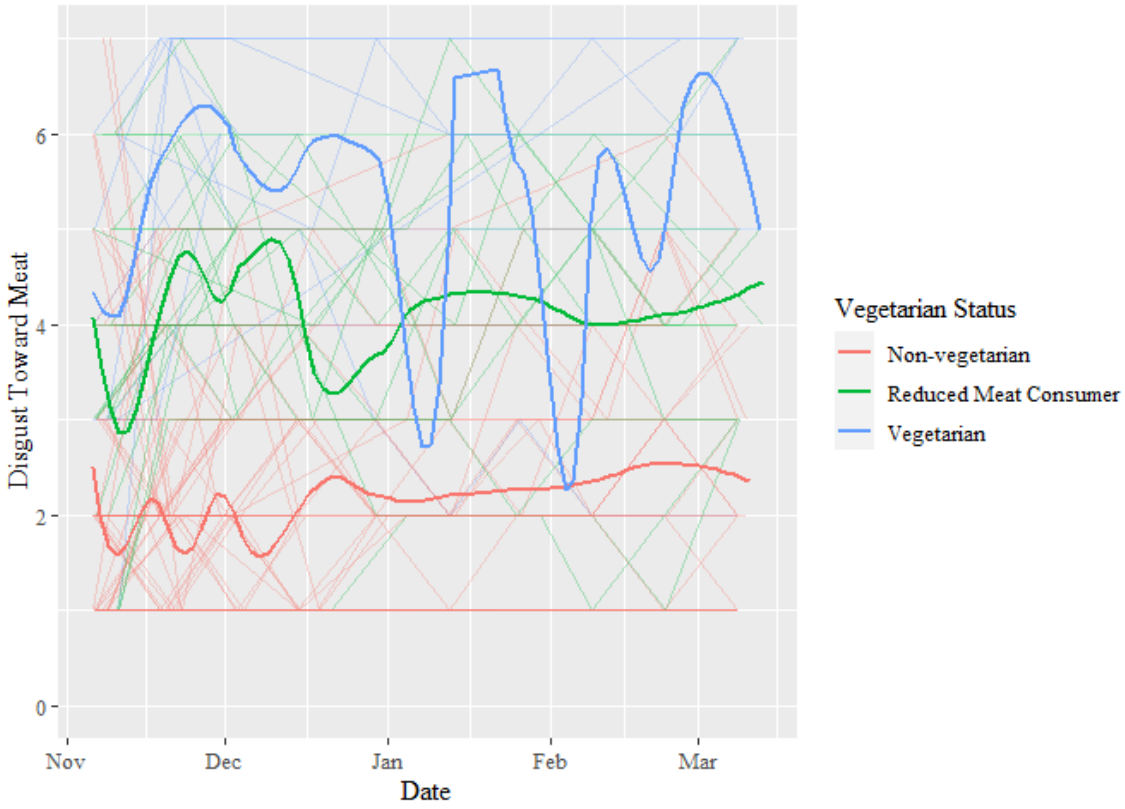
We also plotted the net curves of disgust toward meat as a function of time for vegetarians, reduced meat consumers, and non-vegetarians using the ggplot2 package in

R. Figure 3 includes within-person trends in disgust toward meat with individual spaghetti plots (color-coded by vegetarian status; marked by the transparent lines). These within-person trends represent each participant's disgust toward meat at each survey timepoint. Figure 3 also includes group trends (grouped by vegetarian status) in disgust toward meat (color-coded by vegetarian status; marked by the dark lines). The group trend lines are calculated by "a localized nonparametric regression smoothing technique" called LOESS (Garrison et al., 2018). These group trends represent the groups' average disgust at each survey timepoint.

As shown in Figure 3, the vegetarian net curve appeared to be nonlinear, and net disgust toward meat was unsurprisingly highest for vegetarians (vs. reduced meat consumers and non-vegetarians). The net curve for reduced meat consumers also appeared to be nonlinear, and net disgust toward meat was higher than that of non-vegetarians but lower than that of vegetarians. Finally, the net curve for non-vegetarians appeared to have the least nonlinear variation and the lowest net disgust.

Figure 3

Disgust Toward Meat as a Function of Time and Vegetarian Status

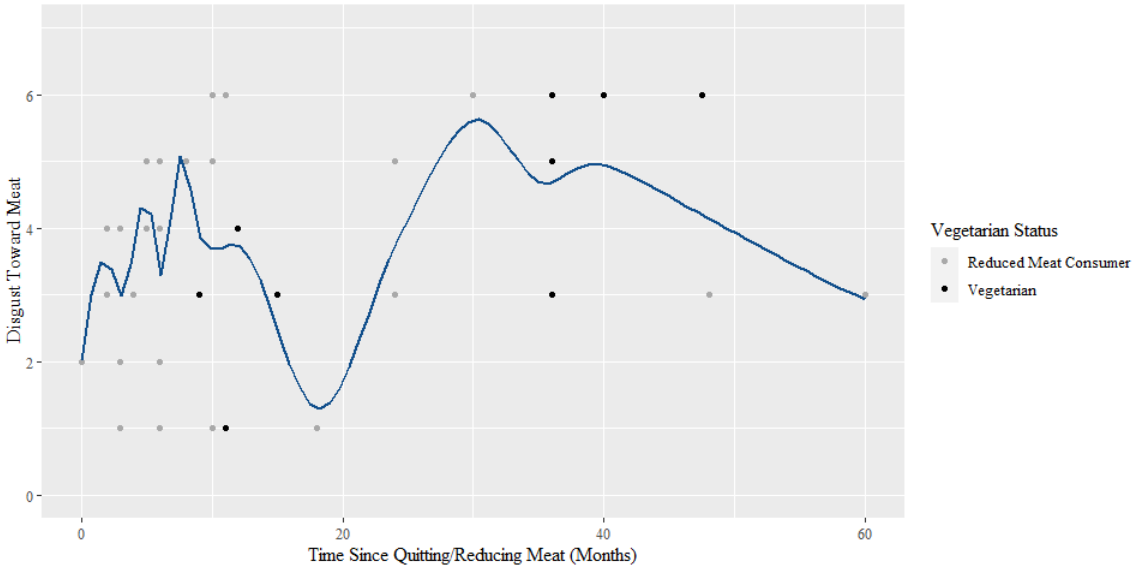


Disgust Toward Meat as a Function of Time Since Quitting and Vegetarian Status

Next, we plotted the relationship between baseline disgust toward meat and self-reported time since quitting or reducing meat (M = 29.26, SD = 50.14). As shown in Figure 4, it appeared that there was a positive association between disgust and time since quitting/reducing meat until around 10 months, a negative association from 10-18 months, another positive association from 18-30 months, followed by another negative association from 30-60 months. There were only three observations beyond 60 months, and all were extreme outliers (up to 250 months since quitting/reducing meat), so we excluded these observations from the plot.

Figure 4

Disgust Toward Meat as a Function of Vegetarian Status and Time Since Quitting/Reducing Meat



Discussion

In Study 1, the longitudinal study, nonlinear mixed modeling analyses revealed multiple patterns in the data. First, there was a significant interaction between vegetarian status and time on disgust toward meat such that when vegetarian status was vegetarian/reduced meat consumer, the positive slope between time and disgust was stronger. Second, we found that there was a significant interaction between vegetarian status and time squared on disgust toward meat such that when vegetarian status was vegetarian/reduced meat consumer, the negative slope between time squared and disgust was stronger. Third, we found significant linear and quadratic effects of time since quitting/reducing meat, such that greater time since quitting/reducing meat and greater time since quitting/reducing meat-squared positively predicted disgust. Fourth, we did not find a significant interaction between time since quitting/reducing meat and time (i.e.,

study duration) on disgust toward meat within our vegetarian/reduced meat consumer sample.

Our first two findings suggest that in vegetarians and reduced meat consumers (who had an average time since quitting/reducing meat of 29.26 months), there existed a quadratic relationship between disgust toward meat and time that involved first an increase, and then a decrease, in disgust toward meat over the five-month study duration. These finding suggests that there is a complex, nonlinear, and dynamic relationship between time and disgust toward meat that is moderated by vegetarian status. Participants who were vegetarians/reduced meat consumers experienced an increase in disgust toward meat at the beginning of the study, and a decrease in disgust toward meat later in the study. Our non-vegetarian participants did not experience these same dynamic changes in disgust. These findings support our theory that people need and recruit disgust differentially based on their goals, in this case vegetarian or reduced meat diets.

Our third and fourth findings suggest that although time since quitting/reducing meat did positively predict disgust toward meat, time since quitting/reducing meat did not moderate the relationship between time and disgust toward meat as we predicted. Therefore, newer vegetarians/reduced meat consumers did not recruit disgust differentially throughout our study compared to more experienced vegetarians/reduced meat consumers.

We also plotted disgust toward meat as a function of vegetarian status and time via exploratory R plots. These exploratory plots demonstrated that vegetarians and reduced meat consumers had higher average disgust toward meat compared to non-vegetarians. Both vegetarians and reduced meat consumers appeared to have nonlinear

net curves, indicating again a dynamic relationship between disgust toward meat and time. Furthermore, after plotting disgust toward meat as a function of vegetarian status and time since quitting/reducing meat, it appeared that vegetarians and reduced meat consumers experienced greater disgust toward meat at baseline if they had quit/reduced meat for under 10 months (vs. those who had quit/reduced meat for 10-18 months). This exploratory finding may offer support for our prediction that newer vegetarians and reduced meat consumers may need and recruit disgust more than experienced vegetarians. However, this exploratory support is complicated by the fact that our nonlinear mixed models did not find that time since quitting/reducing meat moderated the effect of time on disgust toward meat.

STUDY 2: THE EXPERIMENTAL STUDY

The purpose of Study 2 was to experimentally test whether vegetarians use disgust as an instrumental emotion to vegetarianism. Our main questions of interest were twofold. First, do vegetarians upregulate disgust when they are anticipating a meat temptation? Second, do vegetarians explicitly view disgust as an instrumental emotion to vegetarian diets? In this study, vegetarian and non-vegetarian participants were randomly assigned to evaluate delicious meat or vegetarian dish images. Participants had a choice to evaluate their assigned dish images based on either appetizing or disgusting aspects of the images. We anticipated that meat dish images would be perceived as meat temptations by vegetarians, and that vegetarians who were assigned to rate meat dishes would prefer to answer the disgusting questions more than other participants in the study. Formal hypotheses, preregistered at aspredicted.org, are described below.

Hypothesis 1: Vegetarians Will Upregulate Disgust vs. Appetite When Tempted with Meat

We hypothesized that vegetarian participants would seek out experiences of disgust during potential meat temptations. That is, we predicted that when given the option between upregulating disgust or appetite during potential meat temptations, vegetarian participants would prefer disgust. Prior experimental research has found that people actively choose to upregulate negative emotions such as anger, fear, and sadness when those emotions are seen as instrumental to specific goals (Lane et al., 2011; Millgram et al., 2019; Tamir & Ford, 2009).

Hypothesis 2: Meta-emotion Endorsement of Disgust Usefulness

We also hypothesized that vegetarians would endorse the meta-emotion belief that increasing disgust prior to experiencing a food temptation is instrumental to vegetarian success. Other work has suggested that people consciously view negative emotions such as anger, fear, and sadness as instrumental to specific goals (Lane et al., 2011; Millgram et al., 2019; Tamir & Ford, 2009).

Method

Participants

We set a goal sample size of 210 because it offered 95% power to observe a moderate effect size ($f > .25$) as statistically significant. We recruited both undergraduate introductory psychology students at Wake Forest University, who participated in the study as part of a curriculum research participation requirement, as well as participants from online vegetarian/vegan communities (e.g., r/PlantBasedDiets on Reddit), who participated voluntarily with no compensation. We asked all participants about their current dietary restrictions and food goals. Participants who responded that that they were current vegans or vegetarians were included as our vegetarian participants, and participants who did not indicate that they were current vegans or vegetarians were included as our non-vegetarian participants.

We excluded participants' responses from our analyses if they incorrectly answered either of our two screener questions or did not finish the survey. N = 336 correctly answered our screener questions and completed the survey. Our sample was 70.2% female; 7.1% Asian, 77.4% White, 4.8% Mixed, 7.6% Hispanic, 3.0% Black, and 1.8% Other; $M_{age} = 26.80$, $SD = 10.47$).

Procedure

Participants completed the study online after accessing the study on the research pool website or the social media post. After accessing the survey link, participants were told that they would view images of food dishes and answer questions about their perceptions of these food dishes. We asked participants to indicate any diet goals or restrictions that they have, including gluten-free, paleo, vegan/vegetarian, low sodium, low-fat, dairy-free, or pescatarian (see Appendix B for all measures). Participants also answered questions about their emotions (including happy, calm, downhearted, gloomy, angry, fearful, disgusted, repulsed, and hungry)[1], and they answered two attention-check questions throughout the study.

Participants completed three tasks in this study. First, all participants completed an example rating trial in which they answered questions about both appetizing and disgusting features of a photo of a slice of cake. Participants were prompted to think about how the dish may smell or taste. The appetizing questions included rating the dish image according to various adjectives (i.e., Sweet, Salty, Spicy, Moist, Tangy, Savory, Rich, Crispy, Chewy, Peppery, Flaky, Cheesy, Buttery, Tasty), room temperature (i.e., Warm, Cold, Room Temperature), and nutrition content (i.e., high in protein, high in vitamins and minerals, nutritionally valuable). The disgusting questions prompted thinking about kitchen equipment (i.e., dirty, messy, contaminated, greasy), ingredients (i.e., contaminated, foul smelling, greasy), processing (i.e., dirty, messy, contaminated, foul smelling), and nutritional content (i.e., high in fat/oils, high in sugar, unhealthy). For

[1] Our initial intention was to have pre- and post-measures of state emotions to compare changes in disgust and hunger before and after the dish rating tasks. Unfortunately, due a to a computer error, the post-measure was not included in the study, and so the pre-measure was not analyzed.

both the appetizing and disgusting sections, participants were asked to write out three details of the dish image that appeared to be appetizing/disgusting.

Then, in the second task, we randomly assigned participants to view either five meat dishes or five vegetarian dishes[2]. They indicated their preference to answer the appetizing or disgusting questions for each dish (however, they did not answer these questions until the third task). Preference for answering appetizing or disgusting questions was assessed by two questions: "How much do you prefer to focus on the appetizing features of this image?" and "How much do you prefer to focus on the disgusting features of this image?"

During the third task, participants were shown the fifth dish image that they saw in Task 2, and they answered the appetizing or disgusting questions according to whichever preference they had previously indicated. Next, we asked participants if they had a history of disordered eating. We also assessed participants' meta-cognitions of disgust. Two questions assessed perceived usefulness of disgust to food goals: 1) a measure of hypothetical usefulness (i.e., "How useful do you think that the emotion of disgust could be in trying to accomplish specific food goals?"), and 2) a measure of personal usefulness (i.e., "How often, if ever, do you personally use disgust to accomplish specific food goals that you have?"). We also asked participants for examples of hypothetical and personal usefulness of disgust. Lastly, we asked demographics questions.

[2] We conducted a pilot study to identify meat and vegetarian dish images for Study 2. We asked participants (N=53) to rate how delicious, appetizing, and disgusting dishes appeared to be. We selected the top five appetizing dishes to use in Study 2 so that meat dishes would be as tempting as possible. Images of these dishes can be found in Appendix B. The images used in the meat and vegetarian dish conditions were the exact same. The only difference between conditions was the label for each dish. Meat dishes were labeled as meats, and vegetarian dishes were labeled as vegetarian substitutes (e.g., "burger" in the meat dish condition and "impossible burger" in the vegetarian dish condition).

Results

Hypothesis 1: Vegetarians Will Seek Out Disgust When Tempted with Meat

Preference to Answer Disgusting Questions

We conducted a 2 x 2 ANOVA with contrasts to test Hypothesis 1, that vegetarians in the meat dish condition would upregulate disgust. All analyses were conducted in SPSS version 25. Before conducting the ANOVA, we considered whether vegetarians experience meat temptations in their day-to-day lives. If vegetarians do not find meat tempting, then they do not need to recruit disgust to combat temptation. Indeed, we found that vegetarians (N = 168) reported being tempted by meat an average of 2.39 times per month (*SD* = 5.30). Therefore, it was reasonable for us to assume that delicious meat dish images may be tempting to participants, and thus participants may need to upregulate disgust to fight temptation.

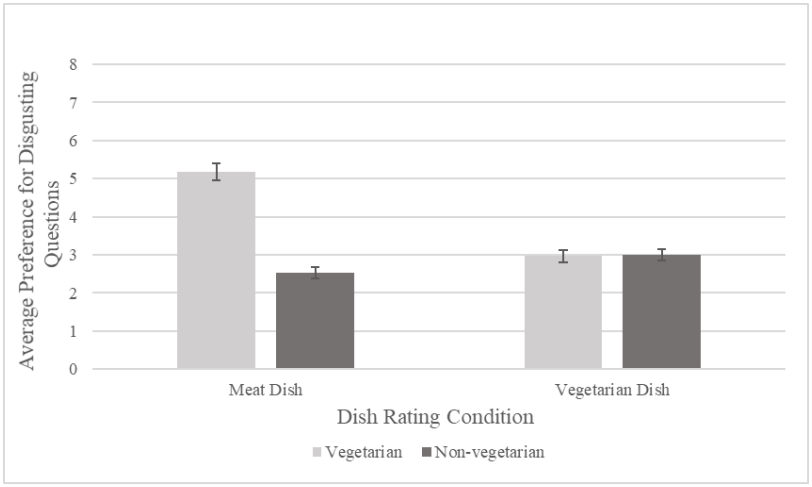
The omnibus ANOVA was statistically significant, $F(3, 331) = 44.84$, $p < .001$, as was the Vegetarian Status X Dish Condition interaction, $F(1, 331) = 58.53$, $p < .001$. I then conducted a contrast to test whether the group differences corresponded to my prediction that vegetarians in the meat dish condition would have a significantly greater preference for disgusting questions compared to the other three groups (vegetarians who rated vegetarian dishes, non-vegetarians who rated meat dishes, and non-vegetarians who rated vegetarian dishes). The contrast revealed that vegetarians who rated meat dishes had a significantly greater preference to answer the disgusting questions compared to the other three groups, $t(331) = 11.38$, $p < .001$, one-tailed (Figure 5). Interestingly, among the other three groups (i.e., vegetarians who rated vegetarian dishes, non-vegetarians who rated meat dishes, and non-vegetarians who rated vegetarian dishes), non-vegetarians

who rated meat dishes preferred to answer the disgusting questions even *less* than the other two groups (i.e., vegetarians and non-vegetarians who rated vegetarian dishes), $t(331) = -2.16$, $p = .031$, two-tailed.

Because our hypothesis was specifically that vegetarians who experienced meat temptations would seek out disgust, we also conducted a pairwise comparison between vegetarians in the meat dish condition (i.e., vegetarians who experienced meat temptations) and vegetarians in the vegetarian dish condition (i.e., vegetarians who did not experience meat temptations). This pairwise comparison revealed that vegetarians in the meat dish condition significantly preferred disgust compared to vegetarians in the vegetarian dish condition, $t(331) = 8.92$, $p < .001$, one-tailed.

Figure 5

Interaction between Vegetarian Status and Dish Rating Condition on Preference to Answer Disgusting Questions



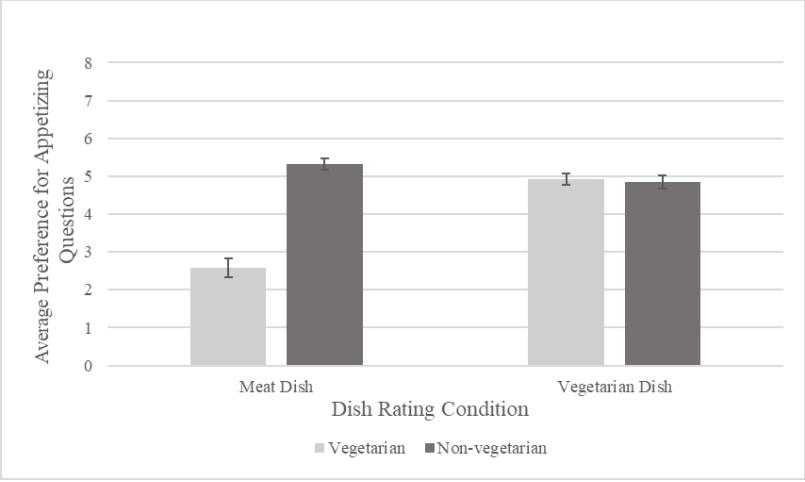
Preference to Answer Appetizing Questions

We also tested for a Vegetarian Status x Dish Condition interaction preference to answer appetizing questions. We did not have any formal predictions about this

interaction. The omnibus ANOVA was statistically significant, $F(3, 331) = 47.43$, $p < .001$, as was the Vegetarian Status X Dish Condition interaction, $F(1, 331) = 63.02$, $p < .001$. Based on the group means (Figure 6), vegetarians who rated meat dishes had the lowest average preference to answer the appetizing questions compared to the other three groups. Non-vegetarians who rated meat dishes had the highest average preference to answer the appetizing questions.

Figure 6

Interaction of Vegetarian Status and Dish Condition on Preference to Answer Appetizing Questions



Hypothesis 2: Meta-emotion Endorsement of Disgust Usefulness

We conducted two independent samples t-tests to assess differences between vegetarian and non-vegetarian perceptions of disgust usefulness. Contrary to our prediction, we found that vegetarians did not score significantly higher on either the measure of perceived hypothetical usefulness, $t(333) = 0.33$, $p = .371$, one-tailed, or the measure of perceived personal usefulness, $t(333) = 1.16$, $p = .124$, one-tailed (Figures 7

and 8, respectively). However, the means were in the predicted directions in both analyses.

Figure 7

Perceived Hypothetical Usefulness of Disgust in Vegetarians vs. Non-vegetarians

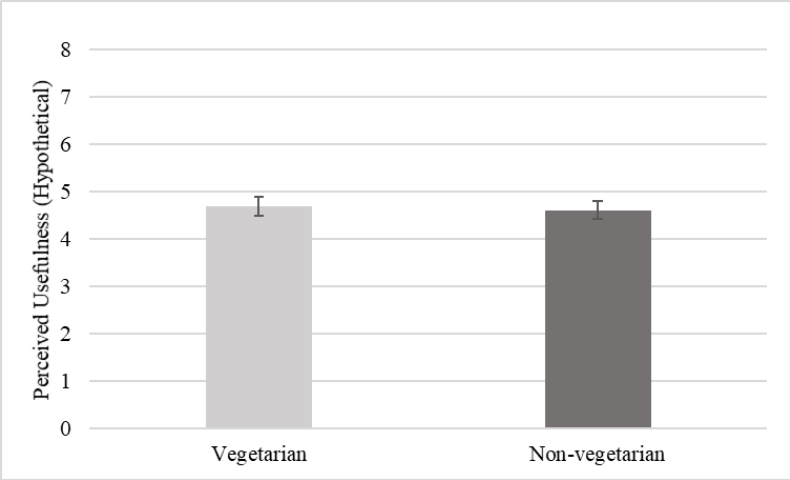
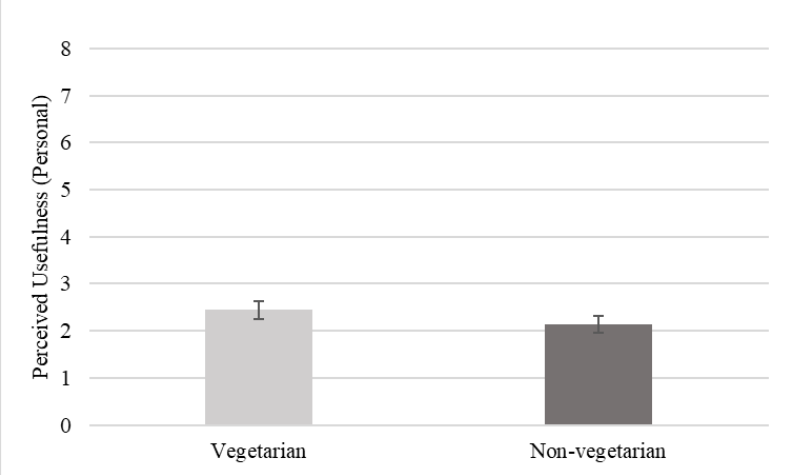


Figure 8

Perceived Personal Usefulness of Disgust in Vegetarians vs. Non-vegetarians



Discussion

In Study 2, the experimental study, we found that first, vegetarians reported experiencing monthly meat temptations. Second, we found that when presented with

delicious meat dish images, vegetarians preferred to upregulate disgust more than appetite. This preference for disgust was significantly greater than the disgust preference in the other three groups in the study. Third, we found that vegetarians did not endorse the meta-emotion belief that disgust is useful to goal pursuit over and above non-vegetarians. Therefore, we found support for Hypothesis 1, that vegetarians would upregulate disgust when tempted with meat. However, we did not find support for Hypothesis 2, that vegetarians would endorse the meta-emotion belief that disgust is useful to goals to a greater extent than non-vegetarians. Together, these findings suggest that disgust is likely an effective tool that vegetarians upregulate to fight meat temptation, but vegetarians may not be aware that they upregulate disgust in the face of meat temptations.

GENERAL DISCUSSION

Disgust toward meat, a negative emotion that even some meat-eaters experience (Kubberød et al., 2002), may be instrumental to vegetarianism. We conducted two studies, one longitudinal and one experimental, to test this theory. In the longitudinal study, Study 1, we hypothesized that there would be curvilinear relationships between time since quitting meat and disgust toward meat, and time and disgust toward meat, in vegetarians and reduced meat consumers. We also predicted that newer vegetarians and reduced meat consumers would have higher disgust toward meat because they may need to recruit disgust more when meat temptations are newer or more threatening. We found mixed support for these predictions.

Nonlinear mixed modeling revealed that both newer and more experienced vegetarians/reduced meat consumers had increased disgust toward meat. This finding suggests that there is a curvilinear relationship between disgust toward meat and time since quitting meat, as predicted. Nonlinear mixed modeling also revealed a dynamic and quadratic relationship between time and disgust toward meat for vegetarians and reduced meat consumers, but not for non-vegetarians.

As shown in an exploratory R plot, newer vegetarians and reduced meat consumers (0-10 months since quitting or reducing meat) appeared to have higher disgust toward meat at baseline compared to more experienced vegetarians and reduced meat consumers (10-18 months since quitting or reducing meat), who experienced lower disgust toward meat. Together, the longitudinal study findings suggest the existence of a dynamic and nonlinear relationship between disgust toward meat and time in vegetarians and reduced meat consumers, supporting our predictions. Therefore, we have evidence

that vegetarians and reduced meat consumers use disgust differently depending on time and/or experience pursuing vegetarianism or reduced meat consumption.

However, we did not find that time since quitting/reducing meat moderated the relationship between time and disgust toward meat. Thus, we did not find nonlinear mixed modeling support for our hypothesis that over the course of our study, newer vegetarians would experience changes in disgust that were materially different from more experienced vegetarians. Implications of this finding are discussed in limitations and directions for future research.

In the experimental study, Study 2, we hypothesized that vegetarians would willingly upregulate disgust prior to experiencing meat temptations. We also hypothesized that vegetarians would endorse the meta-emotion belief that disgust is instrumental to food goals more than non-vegetarians. Our first hypothesis was supported because vegetarians did in fact choose to upregulate disgust over appetite during meat temptations. Other groups (non-vegetarians rating vegetarian dishes, non-vegetarians rating meat dishes, and vegetarians rating vegetarian dishes) did not prefer disgust to the extent that vegetarians in the meat dish condition preferred disgust. Therefore, our findings demonstrate that vegetarians do seek out disgust when faced with meat temptations, and thus, disgust is likely useful to the pursuit of vegetarian and vegan goals.

However, Study 2 did not find support for our second hypothesis, that vegetarians would think disgust is more hypothetically and personally useful than non-vegetarians. Both vegetarians and non-vegetarians found disgust to be moderately hypothetically useful, and neither vegetarians nor non-vegetarians found disgust to be personally useful. This finding suggests that vegetarians may not be consciously aware that they use disgust

in their everyday lives to pursue their food goals compared to non-vegetarians. Therefore, vegetarians may not *believe* that disgust is personally useful to their vegetarian pursuits. However, they *behave* like it is.

Although Study 2 did not find support for premeditated and conscious upregulation of disgust by vegetarians, the evidence supporting our first hypothesis, that vegetarians did choose to upregulate disgust in the face of meat temptations, contributes to previous literature demonstrating that people upregulate negative emotions during goal pursuit in order to increase goal success (Lane et al., 2011; Millgram et al., 2019; Tamir & Ford, 2009). Therefore, disgust should be added to the list of instrumental negative emotions (including anger, fear, and sadness) that have been identified in previous research as being useful to goals.

Limitations and Directions for Future Research

There were notable limitations across our studies that should be discussed and should inform future research endeavors. First, in the longitudinal study (Study 1), the vegetarian sample was smaller than we anticipated. University research pools at smaller universities have limited access to vegetarians, and this is an important limitation to using student participants. Another limitation of the longitudinal study was study duration. Five months is likely too brief to draw definitive conclusions about the nature of the relationship between disgust toward meat and time in vegetarians. This limitation is underscored by the fact that some vegetarians adhere to vegetarian diets for many years if not the majority of their lives. Thus, longitudinal studies over longer periods of time would likely be more informative. Further, it is likely that our study duration was not long enough to detect moderation effects of time since quitting on the relationship

between time and disgust toward meat. In other words, five months was not long enough to determine whether newer vegetarians recruit disgust differently than more experienced vegetarians.

Additionally, although exploratory plots suggested that newer vegetarians/reduced meat consumers (0-10 months since quitting/reducing meat) had higher disgust toward meat at baseline compared to more experienced vegetarians (10-18 months), we are not certain why there would continue to be positive and negative trends in disgust toward meat throughout one's experience as a vegetarian or reduced meat consumer. That is to say, our theory that newer vegetarians need more disgust, and recruit more disgust, when meat temptations are more threatening does not explain continuing trends in disgust toward meat, such as the positive trend in disgust for those who had been vegetarians/reduced meat consumers for 18-30 months. Future research should examine other constructs that may cause multiple trends in disgust across time. For example, one study found that social identity motivations (i.e., "I resist eating meat because it helps me fit in with others") predicted participants' tendency to cheat on their vegetarian diets over and above vegetarian identity salience (i.e., frequency that one thinks about being a vegetarian; Plante et al., 2019). It may be possible that social identity motivations become stronger and/or weaker throughout one's experience as a vegetarian, and this change may drive changes in disgust toward meat.

The experimental study (Study 2) was limited in that it did not find support that vegetarians are consciously aware that disgust is personally useful to them. In fact, immediately following the experimental manipulation in which many vegetarian participants chose to upregulate disgust, many vegetarian participants reported that

disgust was not very personally useful. Therefore it is unlikely that vegetarians consciously upregulated disgust during the study. This may suggest that the process of disgust upregulation is more automatic than it is deliberate for vegetarians. One explanation may be that meta-emotion beliefs about negative emotions, such as disgust, are predominantly negative. For example, it may be harder to view negative emotions as useful if they are perceived as harmful. Previous work has found that people generally perceive negative emotions to be more unfavorable and less favorable than positive emotions (Saffrey et al., 2008). Furthermore, the experience of disgust in particular is perceived as distressing by some individuals (Markovitch et al., 2016). Therefore, participants may be reluctant to label personal experiences of disgust as useful. Alternatively, because both vegetarian and non-vegetarian mean perceptions of disgust's hypothetical usefulness were above the scale's midpoint, it seems possible that disgust may be perceived as useful to other food goals (unrelated to meat consumption). Whether disgust is useful to the pursuit of other food goals, such as Kosher, low-sugar, or low-fat diets, should be considered in future research.

Another limitation in the experimental study involved a missing manipulation check due to a computer error. Because did not measure emotions following the final dish rating task, we are uncertain whether choosing to answer the disgusting questions actually increased state disgust, or whether choosing to answer the appetizing questions actually increased state hunger. However, it was more important for the objectives of this study that participants acted as if disgust was useful to them. That is, the primary goal of Study 2 was to determine whether participants would choose to upregulate disgust in the face of potential meat temptations, not whether participants would feel more disgusted

after answering the disgust-evoking questions. That being said, we hope to replicate this experiment and include a manipulation check to show that an attempt to upregulate disgust does indeed increase disgust.

One final limitation of the experimental study is that our meat temptation did not physically tempt vegetarians to *eat* meat. Rather, our meat temptation tempted vegetarians to *think* about delicious or appetizing pictures of meat. With this in mind, vegetarians who are tempted to actually eat meat may be even more inclined to upregulate disgust. Future studies should strive to (ethically) test disgust's usefulness to vegetarians in the presence of physical meat temptations. Social settings in which vegetarians report feeling particularly tempted by meat (i.e., family gatherings and special occasions; Rosenfeld & Tomiyama, 2019) would be especially relevant to experimental, physical meat temptations.

CONCLUSION

Two studies, one longitudinal and one experimental, explored whether and how disgust is used as an instrumental, negative emotion in the pursuit of vegetarian diets. Specifically, the longitudinal study found that the relationship between disgust toward meat and time, as well as disgust toward meat and experience as a vegetarian/reduced meat consumer, is dynamic and nonlinear compared to non-vegetarians. However, the longitudinal study did not find support that time since quitting/reducing meat moderated the effect of time on disgust toward meat. The experimental study found that vegetarians faced with meat temptations actually upregulate experiences of disgust, but they do not perceive disgust as being more personally useful to their food goals compared to non-vegetarians. This suggests that vegetarians may be automatically, rather than deliberately, upregulating disgust. Given that previous research has found positive effects (real and perceived) of other negative emotions on goal pursuit, this work demonstrates that disgust should be further explored as an instrumental, negative emotion. Moreover, considering that vegetarianism is becoming an increasingly popular diet with environmental, health, and moral implications, disgust should be seen as a useful and effective emotional tool to vegetarianism.

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APPENDIX A: STUDY 1 MEASURES

Survey 1

Vegetarians

1. What is your WFU username?
2. Please indicate whether 1) you are a current vegetarian/vegan OR 2) you are not a current vegetarian/vegan but you are trying to reduce your meat consumption:
    - I am currently a vegan and/or vegetarian
    - I am currently trying to reduce my meat consumption

Disgust items

1. How disgusted did you feel about meat when you first quit?
    0 (not at all disgusted) – 6 (extremely disgusted)
2. How disgusted do you feel now toward meat?
    0 (not at all disgusted) – 6 (extremely disgusted)
3. How long has it been since you quit? _____
4. How many times a month do you eat meat? _____
5. How many times since quitting have you eaten meat? _____
6. How immoral is it to eat meat?
    0 (not at all immoral) – 6 (extremely immoral)
7. How disgusted would you be at the sight of raw meat (at a restaurant, grocery store, etc.)?
    0 (not at all disgusted) – 6 (extremely disgusted)
8. How disgusted would you be at the smell of cooked meat?
    0 (not at all disgusted) – 6 (extremely disgusted)
9. How disgusted are you by the treatment of animals by the meat industry?
    0 (not at all disgusted) – 6 (extremely disgusted)
10. How disgusted are you by the environmental impact of the meat industry?
    0 (not at all disgusted) – 6 (extremely disgusted)

Three Domain Disgust Sensitivity (Tybur)

The following items describe a variety of concepts. Please rate how disgusting you find the concepts described in the items, where 0 means that you do not find the concept disgusting at all, and 6 means that you find the concept extremely disgusting.

1. Shoplifting a candy bar from a convenience store
    0 (not at all disgusting) – 6 (extremely disgusting)
2. Hearing two strangers having sex
3. Stepping on dog poop
4. Stealing from a neighbor
5. Performing oral sex
6. Sitting next to someone who has red sores on their arm
7. A student cheating to get good grades
8. Watching a pornographic video
9. Shaking hands with a stranger who has sweaty palms
10. Deceiving a friend
11. Finding out that someone you don't like has sexual fantasies about you

12. Seeing some mold on old leftovers in your refrigerator
13. Forging someone's signature on a legal document
14. Bringing someone you just met back to your room to have sex
15. Standing close to a person who has body odor
16. Cutting to the front of a line to purchase the last few tickets to a show
17. A stranger of the opposite sex intentionally rubbing your thigh in an elevator
18. Seeing a cockroach run across the floor
19. Intentionally lying during a business transaction
20. Having anal sex with someone of the opposite sex
21. Accidentally touching a person's bloody cut

Political disgust (Tybur)

1. Democrats' values
   0 (not at all disgusting) – 6 (extremely disgusting)
2. Abortion in the first trimester of pregnancy
3. Tax cuts for the wealthy
4. Republicans' value

Motivation to abstain (Halkjelsvik & Rise, 2015)

Motivation to abstain from eating meat in the future
0 (not motivated at all) – 6 (very motivated)
The likelihood of eating meat within the next 6 months
0 (not very likely) – 3 (very likely)
Personal importance of avoiding meat
0 (not important at all) – 6 (very important)

Explicit attitudes toward meat

Measured on 7-point semantic differential scales:
Good–bad, harmless–harmful, not foolish–foolish, safe–unsafe, pleasant–unpleasant, nice–awful

Demographics

Please indicate your race/ethnicity: _____
Please indicate your gender: _____
Please indicate your sexual orientation: _____
How old are you? _____

Gift card lottery questions

1. What is your email address so that we can reach you for participation in future surveys (for gift card lottery entry)? _____
2. If you choose to participate and enter into the gift card lottery, and you win a $50 gift card, which of the following gift cards would you like to receive?
   - Amazon
   - Starbucks
   - Target

Reduced Meat Consumers

Disgust items

1. How disgusted did you feel about meat when you first reduced your meat consumption?
   0 (not at all disgusted) – 6 (extremely disgusted)
2. How disgusted do you feel now toward meat?
   0 (not at all disgusted) – 6 (extremely disgusted)
3. How long has it been since you reduced your meat consumption? _____
4. How many times a month do you eat meat? _____
3. How immoral is it to eat meat?
   0 (not at all immoral) – 6 (extremely immoral)
4. How disgusted would you be at the sight of raw meat (at a restaurant, grocery store, etc.)?
   0 (not at all disgusted) – 6 (extremely disgusted)
5. How disgusted would you be at the smell of cooked meat?
   0 (not at all disgusted) – 6 (extremely disgusted)
6. How disgusted are you by the treatment of animals by the meat industry?
   0 (not at all disgusted) – 6 (extremely disgusted)
7. How disgusted are you by the environmental impact of the meat industry?
   0 (not at all disgusted) – 6 (extremely disgusted)

Three Domain Disgust Sensitivity (Tybur)

The following items describe a variety of concepts. Please rate how disgusting you find the concepts described in the items, where 0 means that you do not find the concept disgusting at all, and 6 means that you find the concept extremely disgusting.

1. Shoplifting a candy bar from a convenience store
   0 (not at all disgusting) – 6 (extremely disgusting)
2. Hearing two strangers having sex
3. Stepping on dog poop
4. Stealing from a neighbor
5. Performing oral sex
6. Sitting next to someone who has red sores on their arm
7. A student cheating to get good grades
8. Watching a pornographic video
9. Shaking hands with a stranger who has sweaty palms
10. Deceiving a friend
11. Finding out that someone you don't like has sexual fantasies about you
12. Seeing some mold on old leftovers in your refrigerator
13. Forging someone's signature on a legal document
14. Bringing someone you just met back to your room to have sex
15. Standing close to a person who has body odor
16. Cutting to the front of a line to purchase the last few tickets to a show
17. A stranger of the opposite sex intentionally rubbing your thigh in an elevator
18. Seeing a cockroach run across the floor
19. Intentionally lying during a business transaction
20. Having anal sex with someone of the opposite sex

21. Accidentally touching a person's bloody cut

Political disgust (Tybur)
1. Democrats' values
   0 (not at all disgusting) – 6 (extremely disgusting)
2. Abortion in the first trimester of pregnancy
3. Tax cuts for the wealthy
4. Republicans' value

Motivation to abstain (Halkjelsvik & Rise, 2015)
Motivation to abstain from eating meat in the future
   0 (not motivated at all) – 6 (very motivated)
Personal importance of avoiding meat
   0 (not important at all) – 6 (very important)

Explicit attitudes toward meat-eating
Measured on 7-point semantic differential scales:
Good–bad, harmless–harmful, not foolish–foolish, safe–unsafe, pleasant–unpleasant, nice–awful

Demographics
Please indicate your race/ethnicity: _____
Please indicate your gender: _____
Please indicate your sexual orientation: _____
How old are you? _____

Gift card lottery questions
1. What is your email address so that we can reach you for participation in future surveys (for gift card lottery entry)? _____
2. If you choose to participate and enter into the gift card lottery, and you win a $50 gift card, which of the following gift cards would you like to receive?
   - Amazon
   - Starbucks
   - Target

Non-vegetarians
1. What is your WFU username?

Disgust items
1. How disgusted do you feel now toward meat?
   0 (not at all disgusted) – 6 (extremely disgusted)
2. How many times a month do you eat meat? _____
3. How immoral is it to eat meat?
   0 (not at all immoral) – 6 (extremely immoral)

4. How disgusted would you be at the sight of raw meat (at a restaurant, grocery store, etc.)?

0 (not at all disgusted) – 6 (extremely disgusted)

5. How disgusted would you be at the smell of cooked meat?

0 (not at all disgusted) – 6 (extremely disgusted)

6. How disgusted are you by the treatment of animals by the meat industry?

0 (not at all disgusted) – 6 (extremely disgusted)

7. How disgusted are you by the environmental impact of the meat industry?

0 (not at all disgusted) – 6 (extremely disgusted)

Three Domain Disgust Sensitivity (Tybur)

The following items describe a variety of concepts. Please rate how disgusting you find the concepts described in the items, where 0 means that you do not find the concept disgusting at all, and 6 means that you find the concept extremely disgusting.

1. Shoplifting a candy bar from a convenience store

   0 (not at all disgusting) – 6 (extremely disgusting)

2. Hearing two strangers having sex
3. Stepping on dog poop
4. Stealing from a neighbor
5. Performing oral sex
6. Sitting next to someone who has red sores on their arm
7. A student cheating to get good grades
8. Watching a pornographic video
9. Shaking hands with a stranger who has sweaty palms
10. Deceiving a friend
11. Finding out that someone you don't like has sexual fantasies about you
12. Seeing some mold on old leftovers in your refrigerator
13. Forging someone's signature on a legal document
14. Bringing someone you just met back to your room to have sex
15. Standing close to a person who has body odor
16. Cutting to the front of a line to purchase the last few tickets to a show
17. A stranger of the opposite sex intentionally rubbing your thigh in an elevator
18. Seeing a cockroach run across the floor
19. Intentionally lying during a business transaction
20. Having anal sex with someone of the opposite sex
21. Accidentally touching a person's bloody cut

Political disgust (Tybur)

1. Democrats' values

   0 (not at all disgusting) – 6 (extremely disgusting)

2. Abortion in the first trimester of pregnancy
3. Tax cuts for the wealthy
4. Republicans' value

Motivation to abstain (Halkjelsvik & Rise, 2015)
Motivation to abstain from eating meat in the future
0 (not important at all) – 6 (very important)
Personal importance of avoiding meat
0 (not important at all) – 6 (very important)

Explicit attitudes toward meat-eating
Measured on 7-point semantic differential scales:
Good–bad, harmless–harmful, not foolish–foolish, safe–unsafe, pleasant–unpleasant, nice–awful

Demographics
Please indicate your race/ethnicity: _____
Please indicate your gender: _____
Please indicate your sexual orientation: _____
How old are you? _____

Gift card lottery questions
1. What is your email address so that we can reach you for participation in future surveys (for gift card lottery entry)? _____
2. If you choose to participate and enter into the gift card lottery, and you win a $50 gift card, which of the following gift cards would you like to receive?
- Amazon
- Starbucks
- Target

Surveys 2-10
All Participants
1. What is your WFU username? _____
2. How disgusted do you feel now toward meat?
0 (not at all disgusted) – 6 (extremely disgusted)
3. How many times have you eaten meat in the last two weeks? (open-ended)

APPENDIX B: STUDY 2 MEASURES

Attention check #1

Which of the following words is most similar in meaning to the word 'gloomy'?

1. Dreary
2. Happy
3. Lucky
4. Funny
5. Smart

Emotion questions (adapted from Lane et al., 2011)

1. Right now, do you feel:
   0 (very negative) – 5 (neutral) – 9 (very positive)
2. Right now, how **disgusted** do you feel?
   0 (not at all) – 5 (neutral) – 9 (very)
3. Right now, how **gloomy** do you feel?
   0 (not at all) – 5 (neutral) – 9 (very)
4. Right now, how **excited** do you feel?
   0 (not at all) – 5 (neutral) – 9 (very)
5. Right now, how **downhearted** do you feel?
   0 (not at all) – 5 (neutral) – 9 (very)
6. Right now, how **repulsed** do you feel?
   0 (not at all) – 5 (neutral) – 9 (very)
7. Right now, how **calm** do you feel?
   0 (not at all) – 5 (neutral) – 9 (very)
8. Right now, how **fearful** do you feel?
   0 (not at all) – 5 (neutral) – 9 (very)
9. Right now, how **angry** do you feel?
   0 (not at all) – 5 (neutral) – 9 (very)
10. Right now, how **hungry** do you feel?
    0 (not at all) – 5 (neutral) – 9 (very)

Dietary restrictions/food goals

1. Do you have any food goals and/or dietary restrictions? Select all that apply.

a. Gluten-free
b. Paleo
c. Vegan/vegetarian
d. Low sodium
e. Low fat
f. Dairy-free
g. Pescatarian

2. Please write a 2-3 sentence description of your day-to-day food/dietary goals.

_____

Task 1
Your first task is to answer questions about the dish in the image below.

First, let's focus on the **appealing and appetizing** aspects of the cake. When doing this, imagine how the dish would smell, taste, and feel in your mouth if you were eating it.

On a scale of 1 (not at all) to 5 (extremely), how much is the food you are eating:
1. Sweet
2. Salty
3. Spicy
4. Moist
5. Tangy
6. Savory
7. Rich
8. Crispy
9. Chewy
10. Peppery
11. Flaky
12. Cheesy
13. Buttery
14. Tasty

Think of the food temperature of this dish. How much do you think this dish is:
1. Warm
    1 (not at all) to 5 (extremely)
2. Cold
3. Room temperature

Think of the nutritional content in this dish. How much do you think this dish is:
1. High in protein
    1 (not at all) to 5 (extremely)
2. High in vitamins and minerals
3. Nutritionally valuable

After you have spent some time thinking about the dish, please write out three features of the dish that you find appetizing.
    1. _____
    2. _____
    3. _____

Second, let's focus on the **unappealing and disgusting** aspects of the cake.

Think of any kitchen equipment that was used to prepare this dish (mixing bowls, cutting boards, skillets, baking tins, whisks, etc.). How much do you think those things are:
1. Dirty
    1 (not at all) to 5 (extremely)

2. Messy
3. Contaminated with germs or bacteria
4. Greasy

Think of the ingredients in this dish before they were cooked. How much do you think those are:
1. Contaminated with germs or bacteria
    1 (not at all) to 5 (extremely)
2. Foul smelling
3. Greasy

Think of the process by which the ingredients in this dish were harvested and/or processed (e.g., on farms or in factories). How much do you think those are:
1. Dirty
    1 (not at all) to 5 (extremely)
2. Messy
3. Contaminated with germs or bacteria
4. Foul smelling

Think of the nutritional content in this dish. How much do you think this dish is:
1. High in fat/oils
    1 (not at all) to 5 (extremely)
2. High in sugar
3. Unhealthy

After you have spent some time thinking about the dish, please write out three features of the dish that you find unappetizing.
    1. _____
    2. _____
    3. _____

For your second task, you will view five more food dishes. Unlike the first task, however, now you will have the option between rating the dishes on their **appealing/appetizing** qualities OR its **unappealing/disgusting** qualities. After you tell us which qualities you would prefer to think about for each of the five dishes, you will complete a third task in which you actually answer the appetizing or disgusting questions about one of the five dishes.

So far, we know that your food goals include [goals they previously indicated].

Preference for focus
[For each image]
Below is an image of _____. While viewing the image, please pay attention to details of this dish and think about how the dish may smell, taste, or feel in your mouth.

1. How much do you prefer to focus on the **appetizing** features of this image?

0 (not at all) – 8 (extremely)

2. How much do you prefer to focus on the **disgusting** features of this image?

0 (not at all) – 8 (extremely)

3. Now it's time to make your decision: will you focus on the appetizing or disgusting features of this image in the next task?

a. Appetizing

b. Disgusting

Task 3

Now, for the third task, we will randomly select one of the five dishes for you to rate. You will rate the dish according to your preference to answer questions about its appetizing or disgusting qualities.

[For one of the five dish images]

Below is an image of _____. While viewing the image, please pay attention to details of this dish and think about how the dish may smell, taste, or feel in your mouth.

[If appetizing was selected]

Imagine taking a bite of this food. Describe your experience of the taste of the first bite of food you take in a sentence below. Remember to focus on [appetizing/disgusting] qualities of the image.

_____

On a scale of 1 (not at all) to 5 (extremely), how much is the food you are eating:

1. Sweet
2. Salty
3. Spicy
4. Moist
5. Tangy
6. Savory
7. Rich
8. Crispy
9. Chewy
10. Peppery
11. Flaky
12. Cheesy
13. Buttery
14. Tasty

Think of the food temperature of this dish. How much do you think this dish is:

1. Warm

1 (not at all) to 5 (extremely)

2. Cold
3. Room temperature

Think of the nutritional content in this dish. How much do you think this dish is:

1. High in protein

1 (not at all) to 5 (extremely)
2. High in vitamins and minerals
3. Nutritionally sustaining

After you have spent some time thinking about the dish, please write out three features of the dish that you find appetizing.

1. _____
2. _____
3. _____

[If disgusting was selected]

Imagine taking a bite of this food. Describe your experience of the taste of the first bite of food you take in a sentence below. Remember to focus on [appetizing/disgusting] qualities of the image.

Think of any kitchen equipment that was used to prepare this dish (mixing bowls, cutting boards, skillets, baking tins, whisks, etc.). How much do you think those things are:
1. Dirty
2. Messy
3. Contaminated with germs or bacteria
4. Foul smelling
5. Greasy

Think of the ingredients in this dish before they were cooked. How much do you think those are:
1. Contaminated with germs or bacteria
2. Foul smelling
3. Greasy

Think of the process by which the ingredients in this dish were harvested and/or processed (e.g., on farms or in factories). How much do you think those are:
1. Dirty
2. Messy
3. Contaminated with germs or bacteria
4. Foul smelling

Think of the nutritional content in this dish. How much do you think those are:
1. High in fat/oils
2. High in sugar
3. Unhealthy

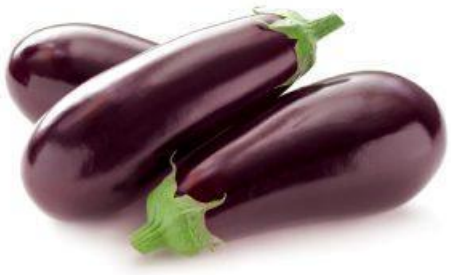
After you have spent some time thinking about the dish, please write out three features of the dish that you find unappetizing.

1. _____
2. _____

3. _____

Disordered eating, and meta-emotion
You have completed the dish-rating task. We will ask you a few more questions and then the study will end.

Attention check #2



What vegetable is pictured above?

1. Eggplant
2. Broccoli
3. Carrot
4. Tomato
5. Apricot

Disordered Eating and Meta-Emotion
1. Do you have a history of disordered eating? (y/n)
2. How useful do you think that the emotion of disgust could be in trying to accomplish specific food goals, such as veganism/vegetarianism?
   0 (not at all) – 8 (extremely)
3. If you responded that disgust could be useful in trying to accomplish specific food goals, please give an **example of how someone could use disgust to accomplish specific food goals.**
4. How often, if ever, do you **personally** use disgust to accomplish specific food goals that you have?
   0 (not at all) – 8 (extremely often)
5. If you responded that you personally use disgust to accomplish specific food goals, please give an **example of how you personally use disgust to accomplish your specific food goals.**

Vegetarian questions (only shown if vegan or vegetarian was identified as a food goal)
1. How long has it been since you decided to quit eating meat?
2. How many times per month do you eat meat?
2. How many times per month do you see a meat dish that seems tempting or tasty?
3. What was your main reason for becoming a vegetarian/vegan?

Demographics

1. Please indicate your race/ethnicity: _____
2. Please indicate your gender: _____
3. Please indicate your sexual orientation: _____
4. How old are you? _____

Dish Images from Google Images

1) Chocolate cake

2) “Impossible burger”/”Burger”

3) “Faux chicken biscuit”/”Fried chicken biscuit”

4) “Beyond meatballs”/”Beef meatballs”

5) “Tempeh sausage”/”Pork sausage”

6) “Seitan steak”/”Steak”

CURRICULUM VITAE

EDUCATION

Master of Arts in Psychology *May 2021*
WAKE FOREST UNIVERSITY, Winston Salem, NC

- GPA: 3.91
- First Year Project: "Eating Unhealthy Food with Friends Increases Interpersonal Closeness"
- Major Area Paper and Thesis: "The (Meat and) Potatoes of Disgust and Vegetarianism"
- Thesis: "Hold the Meat but Pass the Disgust: Disgust as an Instrumental Negative Emotion"

Bachelor of Science in Psychology & Bachelor of Arts in Religion *May 2019*
Minor in French
UNIVERSITY OF GEORGIA, Athens, GA

- GPA: 3.99; Summa Cum Laude
- Psychology Honors Thesis: "Gratitude in Communal and Exchange Relationships"

RESEARCH EXPERIENCE

Assistant Researcher *August 2019 – Present*
NATIONAL SCIENCE FOUNDATION (NSF) GRANT, WFU
Principal Investigators: Dr. Eric Stone (WFU) and Dr. Andrew Parker (RAND)

- Project Description: Theoretical Framework of the Consequences of Confidence
- Engineer four to six studies over two years to accomplish goals of grant principal investigators
- Recruit and guide participants through survey collection, qualitatively code and statistically analyze data using SPSS & R
- Author manuscripts with grant principal investigators based on findings (pending publication 2021)

Co-Principal Investigator *August 2019 – Present*
WFU DEPT. OF PSYCHOLOGY MASICAMPO SOCIAL PSYCHOLOGY LAB, Winston Salem, NC
Principal Investigator: Dr. E.J. Masicampo (WFU)

- Construct independent research studies including creation of variables, organization of materials, registration of the study with the Institutional Review Board, and statistical analysis of data
- Resulted in writing of First Year Project, Major Area Paper, and upcoming Thesis

Co-Principal Investigator *January 2018 – May 2019*
UGA CENTER FOR UNDERGRADUATE RESEARCH OPPORTUNITIES INDEPENDENT RESEARCH ASSISTANTSHIP, Athens, GA
Principal Investigator: Dr. Michelle vanDellen (UGA)

Assistant Researcher *August 2017 – May 2019*
UGA DEPT. OF PSYCHOLOGY MOTIVATION AND BEHAVIOR LAB, Athens, GA
Principal Investigator: Dr. Michelle vanDellen (UGA)

PRESENTATIONS AND PUBLICATIONS

Somerville, A., Parker, A. M., & Stone, E. R. (2020, December). Contrasting Lay and Expert Perceptions of Highly and Lowly Confident Individuals. Society for Judgment and Decision Making (SJDM) Conference.

vanDellen, M. R, Minnen, M. E., **Somerville, A.**, Haskins, L.B., Wright, J., Doss, M., Wilcher, C., Labadidi, A. A., Bush, J., & Hernandez, G. (Pending publication). Thanks But No Thanks: Benefactor Self-Control Is Associated with Both More and Less Gratitude in Recipients.

Somerville, A., & Masicampo, E.J. (2020, April). Eating unhealthy food with friends increases interpersonal closeness. Wake Forest University Department of Psychology First Year Graduate Student Poster Presentation.

Somerville, A., & vanDellen, M. R. (2019, October). Trait perception of romantic partners influences relationship satisfaction through gratitude. Society of Southeastern Social Psychologists (SSSP) Conference. Johnson City, TN.

Somerville, A., vanDellen, M. R., & Minnen, M. E. (2019, April). Perceived self-control of roommate influences gratitude. The Center for Undergraduate Research Opportunities (CURO) Conference. Athens, GA.

Bhavnani, T., **Somerville, A.**, Lynch, B. P., Haskins, L. B., & vanDellen, M. R. (2018, April). Positivity Priorities: When do I choose Me over Us? Poster presentation. The Center for Undergraduate Research Opportunities (CURO) Conference. Athens, GA.

Somerville, A., & vanDellen, M. R. (2018, October). Favors from low self-control individuals boost recipients' momentary gratitude. Society of Southeastern Social Psychologists (SSSP) Conference. Raleigh, NC.

HONORS AND AWARDS

WAKE FOREST UNIVERSITY

- Provost Scholar Award ($5,000): 2019, 2020
- Travel Award ($300): Fall 2019

UNIVERSITY OF GEORGIA

- Phi Beta Kappa: Spring 2019
- William L. Power Religion Scholarship ($1,000): Spring 2019
- UGA CURO Research Assistantship Grant ($1,000): Spring 2019
- Presidential Scholar: Fall 2016, Fall 2017, Fall 2018, Spring 2019
- Dean's List: Spring 2018