




Reduce by How Much? Calibrating Meat Reduction Appeals to Maximize Their Effectiveness

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Supplementary Materials: Data, Materials [see [Index of Supplementary Materials](#)]



Abstract

Meat-rich diets have a negative impact on animal welfare, consumer health, and the environment. In recent years, research has begun to explore which approaches are most effective at reducing consumption. A question that has been the subject of extensive debate is whether appeals are more effective when they ask people to reduce vs. eliminate meat from their diets. On the one hand, the negative externalities resulting from meat consumption are reduced more if a person fully abstains from eating meat. On the other, stronger requests likely lead to lower compliance rates. Thus, to identify which appeal leads to the overall greatest reduction in meat consumption, one has to balance, (a) how many individuals comply with the request and, (b) by how much individuals reduce their consumption if they comply. In two studies, with participants from the US, UK, Australia, and the Netherlands (N = 705), we explored participants' reported meat consumption and willingness to comply with different week-long meat reduction appeals (10–100%) to identify which would lead to the greatest overall reduction in intended meat consumption. As expected, larger requests lead to lower reported willingness to comply. Mid-range requests (40–70%) were more effective than small requests (10%) or elimination requests (100%). Although we find some differences across countries, mid-range requests were most effective in each sample. Our findings provide first insights into how to calibrate appeals to achieve the greatest reduction in overall meat consumption.



Keywords

meat reduction, meat consumption, messaging, request, diet, vegetarian

Non-Technical Summary

Background

High rates of meat consumption have been linked to negative health, environmental, and animal welfare outcomes. This has led to calls for individuals worldwide to reduce their meat consumption.

Why was this study done?

There is some debate over whether advocates should ask individuals to completely eliminate meat from their diet, or just reduce it. While individuals who switch to a vegetarian diet are undoubtedly reducing their meat consumption more than those who simply cut back on meat, the higher costs associated with eliminating meat entirely causes fewer people to agree to such a request. Some previous research suggests that four times as many people will agree to reduce their meat consumption than will agree to go vegetarian. In recent years, new studies have found that asking people to reduce their consumption is more effective than asking people to eliminate meat entirely. However, it is unclear how much advocates should ask people to reduce their consumption by.

Here, our goal was to examine which meat reduction request is most effective. As the demandingness of the request increases, fewer people are likely to agree to it. We were interested in identifying the tipping point; that is, the meat reduction request that leads to the greatest overall reduction in meat consumption.

What did the researchers do and find?

We ran two studies, with individuals in the Netherlands, Australia, the United Kingdom, and the United States. We asked participants whether they would agree to a request to reduce their meat consumption by a series of amounts ranging from 10–100% for a period of one week. We also recorded the amount of meat the participant currently eats in an average week. For each reduction request that a participant agreed to, we calculated the number of meat meals they would cut from their diet per week if they complied with that request. We then used this to calculate which reduction request would lead to the greatest overall reduction in meat meals eaten per week in our sample.

We found that, across both studies, participants were more likely to agree to smaller reduction requests. In addition, participants who already consumed less meat were more likely to agree to larger reduction requests. When taking both factors into account, we found that mid-range requests (i.e., 40–70%) were the most effective. These consistently lead to a greater number of meat meals saved than a very low (a 10% reduction), or a very high (a 100% reduction) request.

What do these findings mean?

These findings suggest that asking individuals to reduce their consumption by a moderate amount may be the most effective approach in reducing overall meat consumption. While more people may agree to smaller requests, the amount by which they reduce their consumption will not be as large as mid-range requests. Furthermore, fewer people may agree to larger requests, meaning a smaller overall reduction in meat consumption. However, more work is needed to confirm these findings. In particular, we did not measure actual meat consumption and cannot be sure that participants would actually reduce their consumption by the specified amount. An important next step would be to experimentally test if mid-range requests (e.g., a 50% reduction) reduce actual meat consumption to a larger extent than requests that are more (e.g., 90–100% reductions) or less demanding (e.g., 10–20% reductions). Meat consumption is linked to many negative outcomes and systematic tests of the effectiveness of different meat reduction requests will help in reducing consumption overall.

Global meat production and consumption has been linked to a range of health, environmental, and ethical issues. In line with this, understanding how to encourage people to reduce their meat consumption is a question of interest for health practitioners, environmentalists, and animal activists alike (Sparkman et al., 2021). In recent years, researchers have begun to investigate the effectiveness of approaches to reduce meat consumption (e.g., Polanco et al., 2021) including choice architecture design (Kurz, 2018), educational interventions (Bryant & Dillard, 2020; Jalil et al., 2019; Schwitzgebel et al., 2020) and changes to social norms (Sparkman et al., 2021). However, one question that remains a source of debate is whether messaging approaches should ask people to *reduce* their meat consumption, or *eliminate* it entirely (i.e., go vegetarian or vegan; Anderson, 2020; De Groot & Rosenfeld, 2022; Macdonald et al., 2016).

On the surface, elimination appeals may seem more effective. Successful elimination appeals will inevitably result in a greater degree of meat reduction than successful reduction appeals, resulting in better health, environmental, and animal-welfare outcomes. Furthermore, elimination appeals may be beneficial in linking diet status to identity. That is, people who give up meat entirely may identify more strongly with their diet than those who merely reduce meat consumption. Indeed, research shows that vegetarian and vegan communities have strong, often moralised, identities (Bagci et al., 2022; Rosenfeld & Burrow, 2017), more so than individuals who reduce but do not eliminate their meat consumption (Rosenfeld et al., 2020). While as many as 84% of people who become vegetarian return to eating meat during their lives (McArthur, 2014), people are more likely to stick to their diet if their choice is strongly linked to their moral identity (Radnitz et al., 2015). Therefore, elimination requests may be better due to their moral component and their potential effect on identity.

However, elimination may not be realistic for the average consumer. Moreover, elimination requests may lead to defensiveness in some meat eaters, who may disengage to alleviate threats to their moral identity (De Groeve & Rosenfeld, 2022). While people reduce their meat consumption for several reasons, including health, environment, and animal welfare, health is typically identified as the most common driver (Hopwood et al., 2020; Miki et al., 2020; Rosenfeld, 2019). Thus, people may be motivated to avoid levels of meat consumption that are associated with adverse health outcomes, but they may not be motivated to completely eliminate meat from their diet (Rosenfeld, 2019). Moreover, research consistently shows that price, taste, and convenience are the key drivers of food purchasing decisions and that other factors, like ethics or the environment, are secondary to these constraints (Stea & Pickering, 2019; Szejda et al., 2020). Taken together, these findings indicate that food choices are overwhelmingly self-focused. Given that appeals that ask people to eliminate meat, by definition, incur higher cost and require greater commitment, it may be that these types of appeals are too costly for the average consumer (de Bakker & Dagevos, 2012).

While arguments can be made for both approaches, a small number of studies have set out to empirically test which approach is more effective. Macdonald and colleagues (2016) and Anderson (2020) showed participants a short intervention video that focused on the animal welfare impacts of meat and recent increases in the number of people who either eliminate or reduce their meat consumption. Participants were then given a restaurant voucher, and it was found that the percentage of individuals using that voucher to order a meatless meal did not differ between those who saw the meat elimination or meat reduction video. However, in the same study, Anderson found that almost four times as many participants were willing to make a pledge to reduce meat than a pledge to become vegetarian (59.4% vs. 15.4%). This demonstrates a much greater willingness to comply with a reduce request relative to an elimination request. More recently, Sparkman and colleagues (2021) examined the longer-term effects of these approaches using an intervention that asked participants to reduce or eliminate their meat consumption. In their study, participants were exposed to an op-ed that detailed the growing trend away from meat consumption, and the health, environmental, and animal welfare benefits of this shift. The language in this op-ed was either framed around reducing or eliminating meat consumption (e.g., many Americans have “reduced their intake of meat”, or have “eliminated meat from their diets”). Five months after reading the op-ed, participants who read the reduction appeal had significantly reduced their meat consumption in dietary reports relative to a control, while the eliminate group had not.

These studies provide evidence that more people are willing to comply with a reduction appeal than with an elimination appeal, and that a reduction appeal could result in longer-term meat reduction. Conversely, in their review of meat-reduction interventions, Mathur and colleagues (2021) found that more forceful elimination messages (i.e., ‘go

vegan'), were more effective in reducing meat consumption than more modest requests (i.e., 'reduce consumption'). They suggest a 'dose-response' relationship, whereby more forceful requests are more effective. However, this relationship is difficult to uncover given that none of these studies specified a reduction amount in their appeals. That is, they did not encourage participants to reduce their meat consumption by any particular amount.

An implicit assumption of this work is that the goal is to reduce meat consumption as much as possible. With a greater reduction in meat consumption comes less animal suffering, fewer environmental impacts, and fewer associated health issues. As such, it is important to understand not simply how to encourage others to eat less meat, but to encourage the *greatest* reduction in meat consumption; that is, to identify the optimal meat reduction request. Previous approaches, including the observation that more people comply with a request to reduce (vs. eliminate) meat consumption, provide little insight into how meat consumption can be minimized. This is because in order to understand how much an intervention reduces meat consumption, we need to quantify not only *how many* people comply with the request, but also by *how much* they reduce their consumption.

To illustrate this problem, imagine a group of 100 individuals who all eat meat 10 times per week, for a total of 1000 meat meals consumed weekly. Imagine that a certain intervention convinces 15 to not eat meat for an entire week, while the other 85 do not comply and continue with their regular diet. Imagine that another intervention that only implores people to reduce, rather than eliminate, their meat consumption for a week is more successful and convinces 70 individuals, while only 30 continue with their regular diet. Which intervention is more effective in reducing overall meat consumption? The answer is that we do not know. Answering this question requires knowledge of the extent to which reducers cut their meat consumption. Imagine individuals would, on average, reduce their consumption by 50%. Thus, the appeal to reduce meat consumption would lead to a reduction of 350 meat meals (70 individuals reducing their normal consumption from 10 to 5 meat meals). The appeal would be more effective than an elimination appeal, which would only lead to a reduction of 150 meat meals (15 individuals reducing their normal consumption from 10 to 0 meat meals). However, when following an appeal to reduce meat consumption, individuals might only cut down by 5%. This would lead to a reduction of 35 meat meals (70 individuals reducing their normal consumption from 10 to 0.5 meat meals), making it less effective than the elimination appeal.

The example above illustrates that to understand which appeal would lead to the greatest reduction in meat consumption, we have to consider how many people comply with the appeal and by how much they reduce their meat consumption. This is not easy because asking for a greater reduction will increase the cost of the request, which could lead to lower compliance rates. Thus, finding the optimal request means balancing the trade-off between level of compliance and level of reduction. In fact, the optimal request

may be neither a weak reduction appeal (leading to high compliance rates but a weak reduction per person) nor a strong elimination appeal (leading to low compliance rates but a strong reduction per person), but may lie somewhere in the middle.

Across two studies ($N = 705$) with participants from four Western countries, we aimed to identify the reduction request that results in the largest expected reduction in meat consumption. This facilitates a more nuanced approach to meat reduction advocacy that considers both current consumption and willingness to give up meat. In both studies, we asked participants to indicate their willingness to reduce meat consumption for a week and we varied the percentage they were asked to cut from their diet (from 10% to 100%). This design allowed us to quantify which appeal would lead to the overall strongest reduction in self-reported meat consumption. Given the novel approach and lack of supporting literature, we did not make explicit predictions about what the optimal request would be. Instead, we consider this investigation entirely exploratory.

All data, materials, and analysis scripts are available in the [Supplementary Materials](#) section. We report how our sample sizes were determined and all data exclusions and measures for each study. The studies were not preregistered. Both studies were approved by the Ethics Review Board of the School of Social and Behavioral Sciences at Tilburg University.

Study 1

The main goal of Study 1 was to identify the optimal meat reduction request. We recruited first-year psychology students from a Dutch university and asked them to report their typical weekly meat consumption, and their willingness to cut different amounts of meat from their diet. We used this data to identify the optimal meat reduction request—that is, the request that would lead to the overall greatest reduction in intended meat consumption.

Method

Participants

A total of 265 students from Tilburg University completed the study. The sample size was determined by how many students participated in the study within seven weeks. The study was completed in English, and participants who reported poor or basic English proficiency (1.5% of the sample) were excluded from analysis. An additional 53 participants who reported not eating meat were excluded from analysis, leaving a final sample of 205 participants (84.4% female, mean age of 19.8 years). More detailed sample characteristics are shown in [Table 1](#).

Table 1*Demographic Characteristics of Participants in Study 1 and 2*

Variable	Study 1 (NL)	Study 2 (Full)	Study 2 (US)	Study 2 (UK)	Study 2 (AU)
Sample size	205	500	164	168	168
Gender					
Female (%)	84.39	52.20	55.49	58.93	42.26
Male (%)	15.12	46.20	42.68	39.29	56.55
Non-binary (%)	0.49	1.60	1.83	1.79	1.19
Age					
<i>M</i>	19.85	35.69	33.61	39.05	34.35
<i>Mdn</i>	19.00	32.00	29.50	36.00	31.00
<i>SD</i>	2.58	13.54	12.52	15.39	11.84
Religious (%)					
	—	27.00	36.59	23.21	21.43
Political orientation					
Left (%)	—	52.80	56.71	48.81	52.98
Center (%)	—	29.40	21.95	33.93	32.14
Right (%)	—	17.40	21.34	16.67	14.29

Procedure and Materials

We first provided participants with a paragraph that detailed trends in meat reduction in the Netherlands. This information stated:

“In recent years, meat consumption is increasingly debated because of concerns about environmental sustainability, health and safety, and animal rights and welfare. The number of vegetarians and vegans in the Netherlands has been steadily increasing and many more people are deciding to reduce their meat consumption. This trend is supported by an increasing availability and affordability of meat alternatives, which are now available in most supermarkets. In addition, many books, blogs, and government websites are available to inform people about the negative consequences of meat consumption and about alternative diets and recipes for a healthier and more sustainable lifestyle.”

After reading the information we asked participants to report how willing they would be to reduce their meat consumption for one week. We asked participants to respond to a series of increasing percentages from 10–100% and report “yes” or “no” regarding whether they would be willing to decrease their meat consumption by this amount. We chose to ask participants to decrease their meat consumption for one week, as this is a

more modest request than asking them to decrease their meat consumption for a longer time.

Following this, we measured dietary preferences. First, we asked participants to self-describe their diet or choose one of the provided labels: vegan, vegetarian, restricted omnivore (e.g., pescetarian), omnivore. Then, participants indicated how many of their breakfast, lunch, and dinner meals contain meat in an average week (participants from all countries tested typically follow this three-meal format). For each meal, participants indicated the weekly number of meals containing meat on a scale from zero to seven. These were then summed together to produce the total number of meat meals consumed per week. Finally, we asked participants to report their age, gender, and English proficiency.

Analysis Plan and Sensitivity Analysis

Our primary goal was to identify which request size is associated with the overall greatest reduction in intended meat consumption. To this end, we calculated how many meals containing meat would be saved per participant and request size. For each reduction amount that a participant agreed to, their self-reported meat consumption was multiplied by that amount to calculate their expected meat reduction—the number of meat meals they intended to cut from their diet when complying with the request. For example, a participant who consumed 6 meat meals a week and agreed to a 50% reduction would have an expected meat reduction of 3 meals for that reduction request. If a participant indicates that they are *not* willing to comply with an appeal to reduce their meat consumption by 50%, then their expected reduction was coded as 0.

We did not have an a priori prediction regarding which request size would be the most effective one. We used *t*-tests to compare the request size associated with the largest intended reduction in meat consumption against two salient benchmarks: the 100% request (representing a common appeal to eliminate meat from one's diet entirely) and the 10% request (representing a modest request that is expected to lead to high compliance rates).

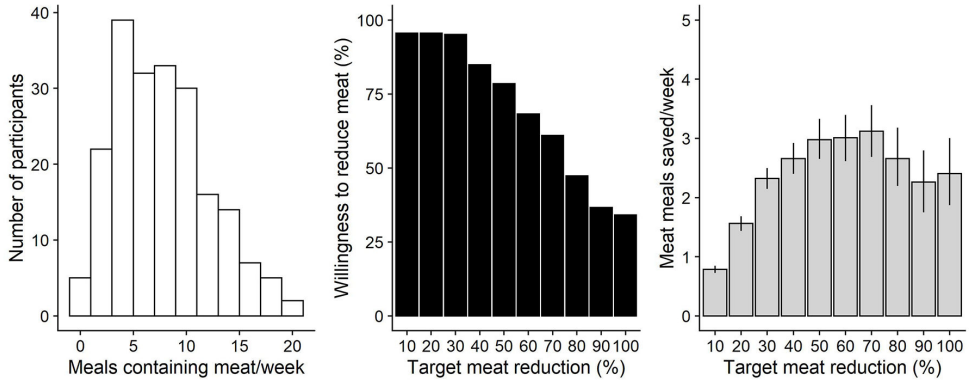
We also conducted a sensitivity analysis in G*Power (Faul et al., 2007) to test which effect size we were able to detect with reasonable statistical power with the current sample. This showed that with our sample of 205 participants, we had 80% power to detect even a small difference ($d = 0.20$) between different request sizes (using a two-tailed paired *t*-test and $\alpha = 5\%$).

Results

On average, participants reported eating 8.23 meals ($SD = 4.37$ meals) containing meat in a typical week (see Figure 1, left panel). Thus, 39.19% of participants' weekly meals contained at least some meat.

Figure 1

Distribution of the Number of Meals Containing Meat in an Average Week (Left), Willingness to Reduce Meat Consumption by a Given Percentage (Center), and Average Number of Meals Containing Meat Saved per Person at Each Level (Right)



Next, we examined participants' willingness to reduce their meat consumption. Not surprisingly, participants were less willing to cut larger percentages of their meat consumption (see Figure 1, center panel). Almost all participants (95.61%) were willing to reduce their meat consumption by 10%. Around two-thirds (78.54%) were willing to cut their meat consumption by half, and around one-third (34.15%) were willing to cut their meat consumption by 100% (i.e., eat fully vegetarian). There was a negative correlation between the total number of meals containing meat consumed in a typical week and willingness to reduce, $r(203) = -.332$, $p < .001$. In other words, participants who consumed more meat were less willing to cut down on it.

Finally, we examined our main research question: Which request would lead to the highest expected reduction in meat consumption? Given that almost all participants were willing to reduce their consumption by 10%, but the majority did not agree to 100%, we expected the optimal request to lie between these two extremes. To identify the request at which intended meat consumption is minimized, we examined how many meals containing meat would be saved per person at each request level (see Figure 1, right panel). This showed that on average, asking participants to decrease their meat intake by 10% would lead to an expected reduction of 0.78 weekly meat meals per person (161.0 total meat meals saved). Asking participants to decrease by 100% would be more effective and lead to an expected reduction of 2.40 weekly meat meals per person (493.0 total meat meals saved). However, neither the weakest nor the strongest request was the most effective one. Asking participants to decrease by 70% would lead to an expected reduction of 3.12 weekly meat meals per person (640.0 total meat meals saved). Thus,

in the current sample, asking for a 70% reduction in meat consumption would be most effective in minimizing total intended meat consumption.

We also tested whether the optimal request that was identified in the current sample would lead to a significantly larger expected reduction in meat consumption compared to a request to eat fully vegetarian (100% reduction) and compared to a modest request that most people would comply with (10% reduction). The 70% request was associated with a larger expected reduction in meat consumption per person ($M = 3.12$, $SD = 3.43$) when compared to the 100% request ($M = 2.40$, $SD = 4.24$), $t(204) = 3.02$, $p = .003$, $d = 0.18$, and when compared to the 10% request ($M = 0.78$, $SD = 0.46$), $t(204) = 10.12$, $p < .001$, $d = 0.81$.

Discussion

In Study 1 we identified that the optimal reduction request was 70%. That is, by asking participants to reduce their meat consumption by 70% for one week, you see the largest expected reduction in overall meat meals consumed. This request resulted in an expected reduction of three meat meals per week. Given that almost half the sample consumes 4 meat meals per week, this appears to reflect a meaningful reduction.

We also found that, as expected, fewer people were willing to commit to higher meat reduction requests. While more than 90% were willing to reduce meat consumption by 10–30%, less than 50% of the sample were willing to reduce their meat consumption by 90–100% per week. Although this is still a substantial proportion of the sample, we note that this may have been due to the fact that our sample was mostly young and female (and probably politically liberal). These are two demographics that are consistently associated with higher rates of vegetarian and flexitarian diets (see Ruby, 2012). To explore how the optimal request may vary in populations with more typical diets we recruited non-university participants from three countries in Study 2.

Study 2

We conducted a replication of the previous study, with one difference in methodology. Instead of recruiting university students from the Netherlands, we collected online samples of more demographically diverse participants from three countries: Australia, the US and UK.

Method

Participants

We recruited 598 Australian, British, and US American participants via Prolific. Data from 18 participants who did not provide answers to all items and from 80 participants who reported not eating meat were excluded from analysis, leaving a final sample of 500 participants (52.2% female, mean age of 35.7 years). This sample comprised 168

participants from Australia (42.3% female, mean age of 34.4 years), 168 participants from the UK (58.9% female, mean age of 39.1 years), and 164 participants from the US (55.5% female, mean age of 33.6 years). More detailed sample characteristics are shown in Table 1.

Procedure and Materials

The study procedure and materials were identical to Study 1, except that participants reported additional demographics (religiosity, political orientation, and nationality) at the end of the survey.

Analysis Plan and Sensitivity Analysis

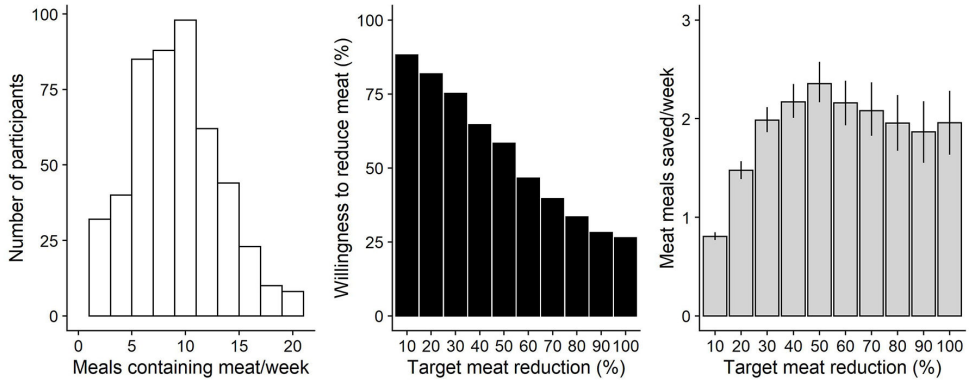
As in Study 1, our primary goal was to identify which request size is associated with the overall greatest expected reduction in meat consumption. Therefore, we again used participants' personal meat consumption and the reduction requests they agreed to calculate the expected meat reduction for each level of reduction. We then compared the most effective request against two salient benchmarks: the 100% request (representing a common appeal to eliminate meat from one's diet entirely) and the 10% request (representing a modest request that is expected to lead to high compliance rates). A sensitivity analysis in G*Power (Faul et al., 2007) showed that with our sample of 500 participants, we had 80% power to detect even a very small difference ($d = 0.13$) between different request sizes (using a two-tailed paired t -test and $\alpha = 5\%$). When conducting the same test for each country sample (with the smallest sample size being 164), we still had 80% power to detect relatively small differences ($d = 0.22$) between request sizes. In our initial analysis we investigated levels of meat consumption, compliance with meat reduction requests, and the most effective meat reduction requests across all countries in our sample. As an exploratory analysis we also investigated cross-country differences in these factors.

Results

On average, participants reported eating 9.45 meals ($SD = 4.24$ meals) containing meat in a typical week (see Figure 2, left panel). Thus, 45% of participants' weekly meals contained at least some meat. Not surprisingly, participants were less willing to reduce larger percentages of their meat consumption (see Figure 2, center panel). Most participants (88.20%) were willing to reduce their meat consumption by 10%. More than half (58.40%) were willing to cut their meat consumption by half, and around one-quarter (26.40%) were willing to cut their meat consumption by 100% (i.e., eat fully vegetarian).

Figure 2

Distribution of the Number of Meals Containing Meat in an Average Week (Left), Willingness to Reduce Meat Consumption by a Given Percentage (Center), and Average Number of Meals Containing Meat Saved per Person at Each Level (Right)



To test our main research question, we again calculated which request would lead to the largest expected reduction in meat consumption (see Figure 2, right panel). On average, asking participants to decrease by 10% would lead to an expected reduction of 0.81 meat meals per person (403.0 total meat meals saved). Asking participants to decrease by 100% would be more effective and lead to an expected reduction of 1.96 meat meals per person (979.0 total meat meals saved). Again, neither the weakest nor the strongest request was the most effective one. Asking participants to decrease by 50% would lead to an expected reduction of 2.36 meat meals per person (1178.0 total meat meals saved). Thus, in the current sample, asking for a 50% reduction in meat consumption would be most effective in minimizing total meat consumption.

We also tested whether the optimal request that was identified in the current sample would lead to a significantly larger expected reduction in meat consumption compared to a request to eat fully vegetarian (100% reduction) and compared to a modest request that most people would comply with (10% reduction). The 50% request was associated with a larger expected reduction in meat consumption per person ($M = 2.36$, $SD = 2.44$) when compared to the 100% request ($M = 1.96$, $SD = 3.85$), $t(499) = 2.58$, $p = .010$, $d = 0.12$, and when compared to the 10% request ($M = 0.81$, $SD = 0.48$), $t(499) = 14.90$, $p < .001$, $d = 0.77$.

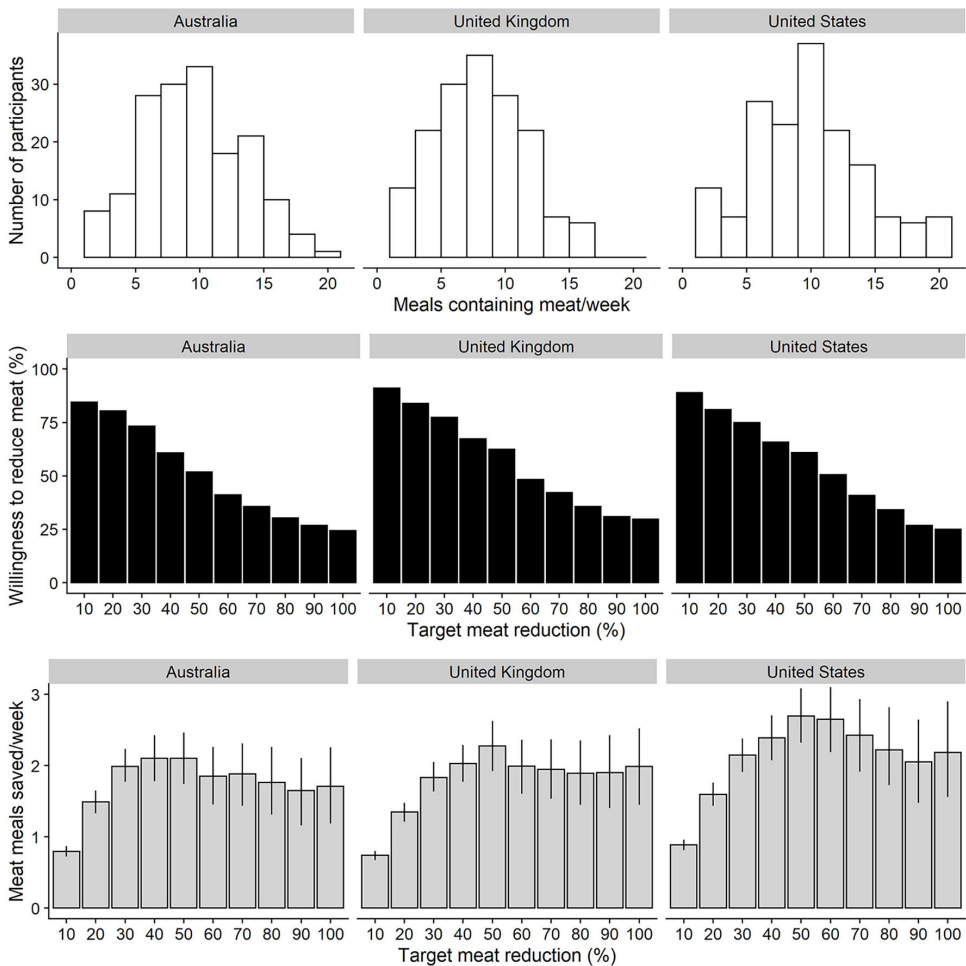
Cross-Country Comparisons

We also explored differences between countries. Compared to the UK ($M = 8.29$, $SD = 3.81$), meat consumption was significantly higher in Australia ($M = 9.75$, $SD = 4.18$), $t(331.2) = 3.35$, $p < .001$, $d = 0.37$, and in the United States ($M = 10.32$, $SD = 4.47$), $t(319.6)$

= 4.47, $p < .001$, $d = 0.36$ (see Figure 3, left panels). The difference between Australia and the United States was not significant, $t(327.4) = 1.21$, $p = .229$, $d = 0.49$.

Figure 3

Distribution of the Number of Meals Containing Meat in an Average Week (Top Row), Willingness to Reduce Meat Consumption by a Given Percentage (Middle Row), and Average Number of Meals Containing Meat Saved per Person at Each Level (Bottom Row) per Country



We did not observe any significant differences in willingness to reduce meat consumption across the three countries, Australia: $M = 52.62$, $SD = 35.19$, United Kingdom: $M = 57.56$, $SD = 34.68$, United States: $M = 55.18$, $SD = 34.91$; Australia vs. United Kingdom:

$t(333.9) = 1.30$, $p = .196$, $d = 0.14$, Australia vs. United States: $t(329.9) = 0.67$, $p = .506$, $d = 0.07$, United Kingdom vs. United States: $t(329.7) = 0.62$, $p = .534$, $d = 0.07$; see Figure 3, center panels.

This optimal request was surprisingly consistent across the three countries (see Figure 3, right panels). For participants from the United Kingdom ($n = 168$), 50% was the optimal request, leading to an expected reduction of 2.27 meat meals per person (382.0 total meat meals saved). For participants from the United States ($n = 164$), 50% was also the optimal request, leading to an expected reduction of 2.70 meat meals per person (398.0 total meat meals saved). For participants from Australia ($n = 168$), 40% was the optimal request, leading to an expected reduction of 2.10 meat meals per person (353.2 total meat meals saved). The 50% request was the second most effective, leading to an expected reduction of 2.10 meat meals per person (353.0 total meat meals saved).

We again tested whether the optimal request identified in each country would lead to a significantly larger expected reduction in meat consumption compared to the 100% request and the 10% request. Overall, the pattern of significant differences was less consistent when analyzing each country separately, perhaps due to the smaller sample sizes. In Australia, the 40% request was associated with a significantly larger expected reduction in meat consumption ($M = 2.10$, $SD = 2.11$) when compared to the 10% request ($M = 0.80$, $SD = 0.50$), $t(167) = 8.87$, $p < .001$, $d = 0.69$, but not when compared to the 100% request ($M = 1.71$, $SD = 3.57$), $t(167) = 1.39$, $p = .166$, $d = 0.13$. In the United Kingdom, the 50% request was associated with a significantly larger expected reduction in meat consumption ($M = 2.27$, $SD = 2.25$) when compared to the 10% request ($M = 0.74$, $SD = 0.43$), $t(167) = 9.33$, $p < .001$, $d = 0.80$, but not when compared to the 100% request ($M = 1.99$, $SD = 3.62$), $t(167) = 1.16$, $p = .248$, $d = 0.09$. In the United States, the 50% request was associated with a significantly larger expected reduction in meat consumption ($M = 2.70$, $SD = 2.61$) when compared to the 10% request ($M = 0.88$, $SD = 0.50$), $t(167) = 9.32$, $p < .001$, $d = 0.84$, but not when compared to the 100% request ($M = 2.18$, $SD = 4.34$), $t(167) = 1.77$, $p = .078$, $d = 0.13$.

Additional Analyses

Finally, we explored relationships between meat consumption, willingness to reduce, and demographic indicators. We regressed meat consumption on gender (0 = female, 1 = male), age, political conservatism, and religiosity. This revealed positive effects for gender, $\beta = 1.56$, $SE = 0.38$, 95% CI [0.81, 2.30], $p < .001$, and conservatism, $\beta = 0.29$, $SE = 0.13$, 95% CI [0.03, 0.55], $p < .001$, a negative effect for age, $\beta = -0.04$, $SE = 0.01$, 95% CI [-0.07, -0.01], $p = .005$, and no significant effect for religiosity, $\beta = 0.62$, $SE = 0.43$, 95% CI [-0.23, 1.46], $p = .15$. Thus, we found that younger, male, and more conservative participants reported consuming more meat. We also regressed participants' willingness to reduce meat consumption on the same demographic variables. This revealed negative effects for gender, $\beta = -12.64$, $SE = 3.07$, 95% CI [-18.66, -6.62], $p < .001$, and conservatism,

$\beta = 4.47$, $SE = 1.08$, 95% CI [-6.59, -2.34], $p < .001$, but no significant effects for age, $\beta = -0.21$, $SE = 0.11$, 95% CI [-0.43, 0.014], $p = .067$, and religiosity, $\beta = -2.13$, $SE = 3.48$, 95% CI [-8.97, 4.71], $p = .541$. Thus, we found that male and more conservative participants were less willing to reduce their meat consumption.

Discussion

In Study 2, we recruited a larger and more demographically diverse sample of participants from three countries and found that the optimal request for reducing overall intended meat consumption is 50%. In the current sample, this request would lead to a substantially stronger expected decrease in meat consumption (2.36 meals containing meat per person and week) compared to a weak reduction request of 10% (0.81 meals per person per week), or a strong request to fully eliminate meat consumption (1.96 meals per person per week). This finding was surprisingly consistent across the three countries examined. For participants from the UK and US, 50% was the most effective request. For participants from Australia, 40% was the most effective request, with 50% closely behind.

Similar to Study 1, we found lower compliance with higher reduction requests. On average, just over 75% of the sample were willing to reduce their meat consumption by 10%, while only 25% were willing to reduce their meat consumption by 90 or 100%. This is notably lower than Study 1, and likely reflects the different demographic characteristics of the samples.

General Discussion

A growing literature is documenting the negative outcomes of meat consumption for animal welfare, consumer health, and the environment (World Health Organization, 2021). Reducing meat consumption can lead to many important benefits and researchers have started to investigate how people can be convinced to reduce their meat intake (Jalil et al., 2019; Schwitzgebel et al., 2020; Sparkman et al., 2021). One intensely debated issue centers around the question of whether it is more effective to ask people to reduce their meat consumption (i.e., a reduction request) or to eliminate meat from their diet entirely (i.e., an elimination request; Anderson, 2020). We argue that previous research and discussion on this topic has neglected an important consideration: In order to identify which request leads to the greatest reduction in meat consumption, one needs to consider how many people comply with the appeal and by how much they actually reduce their meat consumption. Here we tested this question empirically by measuring participants' willingness to comply with different levels of meat reduction, ranging from 10% to 100%. This allowed us to identify the optimal meat reduction request, that is, the request that would lead to the overall greatest reduction in meat consumption.

Across two studies ($N = 705$) with participants from four countries, we consistently find that a mid-range request (40–70%) is optimal for reducing overall intended meat consumption. The optimal request did vary as a function of the country, with the Dutch sample being more likely to comply with higher requests, followed by the US, UK, and then Australia. We note that the higher tolerance in the Dutch sample was likely due to a more pro-vegetarian demographic makeup of this sample (i.e., primarily female, younger university students; Ruby, 2012). Across all four countries we also found that fewer people agreed to higher requests. For example, while well over half the participants surveyed agreed to reduce their meat consumption by 10% for a week, less than one quarter agreed to reduce meat consumption by 70%. This is unsurprising, but nonetheless informative, as an initial benchmark for understanding willingness to reduce meat consumption in the general public. However, given that the cross-country analyses reported here were exploratory, we recommend caution in interpreting them until they can be replicated in more representative samples.

In Study 2, we also found that certain demographic characteristics were predictive of meat consumption and willingness to reduce meat consumption. In line with past research, males and those on the political right ate more meat and were less willing to reduce their meat consumption (Allen et al., 2000; Kiefer et al., 2005; Rosenfeld & Tomiyama, 2021; Rothgerber, 2013; Ruby, 2012). Older participants also tended to eat less meat, but did not significantly differ in their willingness to reduce their meat consumption. Religiosity was unrelated to either meat consumption or willingness to give up meat. Finally, we found nationality differences for meat consumption (but not willingness to reduce meat consumption) with participants in Australia and the US eating more meat than those in the UK. These results are largely consistent with previous research, which suggests that the optimal request identified here may also generalize to other samples. However, future studies should test if the current findings replicate in countries other than the ones tested here, which are all typically WEIRD (Henrich et al., 2010). The expected effectiveness of different reduction appeals may be different in countries whose diets are already more plant-based (e.g., India).

We observed relatively high rates of reported willingness to reduce meat. Between half and three quarters of each sample were willing to give up 50% of their meat consumption. This may reflect a shift in attitude and consumption, with recent years seeing a rise in flexitarian diets (Derbyshire, 2017) and increased concern for farmed animal welfare (Anthis & Ladak, 2021). However, it may also be due to the limited time frame to which the request applied—one week. We expect that compliance would be lower for longer requests. Speculatively, one would expect a linear decrease where requests to reduce meat consumption for a longer time receive lower compliance, and therefore the optimal request for a longer-term reduction may be different than the 50% reduction identified here. However, the exact relationship between compliance and time frame remains an open question. We consider this an important area of future research;

both to identify optimal requests for longer time periods, and to explore the shape of the relationship between time frame and willingness to reduce meat consumption.

Limitations and Future Directions

The current study captured the ‘tipping point’ in meat reduction requests, whereby the request becomes too strong, and more people resist the appeal, leading to lower levels of overall meat reduction. This measure, which takes into account self-reported meat consumption to identify the request that leads to the most meat reduced, is an important first step into investigating the expected efficacy of different reduction appeals. However, we do note several limitations of this measure that could be improved on by future research. First, we measured behavioral intentions and not behavior, and therefore expected meat reduction, but not actual meat reduction. Past research has shown that people’s self-reported diets are not always reflective of their actual meat consumption. For example, many Americans report an intention to decrease their meat consumption despite an increase in consumption over recent years (Rothgerber, 2020), and in a survey of more than 11,000 self-identified vegetarians, almost half reported having consumed meat, poultry, or seafood in the previous 48 hours (McArthur, 2014). These data suggest that participants likely have stronger intentions to give up meat than their behavior would reflect.

It is also possible that the gap between intentions and behaviour is not consistent across our whole sample. For example, participants who currently consume less meat may find it easier to further reduce their consumption compared to individuals who consume meat more frequently. As those who consumed more meat tended to agree to smaller reduction requests, this potential difference in behaviour translation may disproportionately reduce the efficacy of small to mid-range appeals. Relatedly, this difference in compliance with reduction requests may mean that different reduction requests may be more effective for different populations. Given that interventions targeted towards individuals’ current level of intended meat reduction are more effective than broader interventions (Lacroix & Gifford, 2020), future work could explore whether different populations have different ‘tipping points’.

Similarly, there may be nuance in real-life meat consumption that could not be captured with the current measure. For example, the binary measure used here assumed that those who refused a meat reduction request would not alter their meat consumption. However, one could imagine an individual who is open to reducing their meat consumption but finds a request of 50% too strong. Such an individual may still reduce their consumption by a smaller amount, especially if the reduction request is paired with information about the health, animal welfare, or environmental impacts of meat. Such behaviour is not captured in the current measure.

Additionally, in the current study participants were asked whether they would agree with increasingly large reduction requests, from 10–100%. This may have artificially

inflated compliance with larger requests via the foot-in-the-door effect (Dillard et al., 1984; Freedman & Fraser, 1966). Participants may not agree to a 60% reduction if they are asked this as a stand-alone question but they may be more willing to comply after agreeing to a 40% and 50% request.

Finally, this measure investigated behavioural intentions for one week, but in the long term there may be indirect effects that impact the effectiveness of different reduction requests. For example, while requests to reduce consumption by 100% (i.e., go vegetarian) were not the most effective in this study, they may be more effective in the long term. The stronger identity effects of being a vegetarian compared to a flexitarian may mean that people maintain their vegetarian diet for longer (Rosenfeld et al., 2020). Furthermore, vegetarians may be more likely to convince others around them to reduce their meat consumption. In this way a small number of vegetarians may have a greater overall effect on meat consumption. Alternatively, a greater number of flexitarians may help create a norm of meat reduction (Sparkman & Walton, 2017), that could increase the efficacy of future meat reduction requests. Such questions about long-term meat consumption behaviour are complex and should be subject to further research.

We see the present results as an important first step to identify the most effective way to reduce meat consumption. Previous investigations on the effectiveness of different appeals have mostly focused on comparing ambiguous reduction appeals with appeals to fully eliminate meat consumption (Anderson, 2020; Macdonald et al., 2016). The present findings suggest that a request to reduce meat consumption by approximately 50% might be most effective in reducing intended meat consumption. While we explored meat reduction intentions in the current work, future work could investigate the effectiveness of ambiguous reduction appeals, weak reduction appeals (10%), strong elimination appeals (100%), and our proposed 50% appeal on actual meat consumption. Based on the current findings, we would predict that although weaker or ambiguous reduction appeals would lead to higher compliance rates, the 50% appeal might lead to an overall stronger reduction in meat consumption.

Conclusion

Research suggests that meat reduction interventions will be more successful in reducing overall meat consumption by asking people to reduce how much meat they eat, rather than eliminating it from their diets entirely. But by how much should we ask people to reduce their meat intake? This study takes the first step to answering this question. Across two studies and involving participants from four countries, we have identified the optimal meat reduction request. That is, when considering both willingness to reduce and current diet, asking participants to reduce their meat consumption by 40–70% resulted in the greatest overall expected reduction in meat meals. This has implications for our own dietary identities, and importantly, offers concrete, data-driven knowledge to

activists and advocates who are interested in reducing meat consumption as effectively as possible.

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Data Availability: Data is freely available, see Cameron, Wilks, and Jaeger (2022)

Supplementary Materials

The supplementary materials provided are the data, materials, and analysis scripts for this study (for access see [Index of Supplementary Materials](#) below).

Index of Supplementary Materials

Cameron, S., Wilks, M., & Jaeger, B. (2022). *Supplementary materials to "Reduce by how much? Calibrating meat reduction appeals to maximize their effectiveness"* [Data, materials, analysis scripts]. OSF. <https://osf.io/w5n93/>

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