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KEYWORDS

Beef Consumption | Sustainable Diets | Social Norms and Food Consumption | Food Systems Transformation

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Discussion Paper Series

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Discussion paper n. 28/2025

Michela Boldrini (a); Valentina Bosetti (b); Emma Ejelöv (c); Silvia Pianta (d): (a) Bocconi University; (b) Chalmers University; (c) RFF-CMCC European Institute on Economics and the Environment; (d) CMCC Foundation - Euro-Mediterranean Center on Climate Change

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Norms, Culture, and Resistance to Change: Insights from a Six-Country Survey on Beef Consumption

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Abstract

Reducing dietary emissions is critical for climate mitigation. Replacing beef, with its disproportionately high carbon footprint, with alternative proteins can align diets with sustainability goals, ensure nutritional adequacy, and yield health co-benefits. However, as food choices are intertwined with identity, cultural traditions, and social norms, understanding how these factors influence beef consumption is essential. Using survey data from six European countries, we investigate drivers and perceptions of beef consumption and identify barriers and enablers to its reduction. Our analysis confirms a clear relation between norms and consumption, and reveals a significant gap between perceived social norms and actual beef consumption levels, indicating the potential for consumption reductions through norm-based interventions. The findings highlight the need for targeted food demand policies sensitive to cultural contexts to maximize their effectiveness in promoting sustainable diets.

Keywords
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Highlights

- Survey data from 6 European countries reveal widespread beef consumption norm misperceptions
- Individuals overestimate others' beef intake, especially for distant social groups
- Norm misperceptions increase with own beef consumption and affect resistance to change
- Results suggest targeted, culturally sensitive policies may improve policy effectiveness

1. Introduction

Food systems are a major driver of climate change, accounting for roughly one-third of global anthropogenic emissions and representing the largest source of methane emissions (Crippa et al. 2021; Godfray et al. 2018). These emissions alone could jeopardize efforts to limit global warming within the

Paris Agreement target (Clark et al. 2020). Animal products, particularly beef, contribute the most: producing one kilogram of beef generates about eight times the CO_2-equivalent emissions of pork, ten times that of chicken, and twenty times that of eggs (Poore and Nemecek 2018).

Given current consumption trends in developed countries, significant emission reductions can be achieved by partially replacing meat, especially beef, with alternative protein sources, with positive side-effects on human health and nutrition. As a reference, the Planetary Health Diet designed— for both human and environmental health— by the EAT-Lancet Commission includes only minimal (optional) amounts of animal proteins, summing up to roughly one serving of red meat per week, including beef, lamb, and pork (Willett et al. 2019).

In low- and middle-income countries, where per capita meat consumption often remains below nutritional requirements (Parlasca and Qaim 2022), accommodating the Planetary Health Diet recommendation would lead to increased consumption. In contrast, in high-income countries—where consumption far exceeds nutritional needs— following the Planetary Health Diet would require a reduction in meat intake, which would lower emissions and yield significant health benefits (Springmann et al. 2016). Notably, Chapter 5 of the IPCC Land Report (Mbow et al. 2019) highlights the substantial emissions reduction potential of voluntary shifts toward less meat-intensive diets in high-income countries, even without institutional or supply-side changes. Understanding the drivers of beef consumption and its reduction, and how these drivers interact with policies—such as price-based measures (e.g., meat taxes), command-and-control instruments (e.g., meatless days in school canteens, intensive meat farming bans), and behavioral interventions (e.g., altering menu defaults or repositioning meat products in stores)—is crucial for designing effective and publicly acceptable interventions. France's meatless school menus (Henley 2021) and Denmark's belch and manure tax (Sengupta and Fuente 2024) are illustrative examples of policies that, respectively, failed or had a troublesome path due to a lack of wide public acceptance.

Beef consumption has been studied through diverse disciplinary lenses, including economics, psychology, anthropology, and health sciences, with each discipline emphasizing different drivers from different angles. Most of the empirical social science literature has explored, through surveys and administrative data, the role of standard economic drivers, such as income and prices (Godfray et al. 2018; Marques, Fuinhas, and Pais 2018; Sans and Combris 2015), and some key sociodemographics, such as age (Barrena and Sánchez 2009; Pfeiler and Egloff 2018) and gender (Hopwood et al. 2024). Research has also highlighted that factors such as knowledge (Stea and Pickering 2019), cultural traditions (Brulotte and Giovine 2016), religious affiliation (Atkin, Colson-Sihra, and Shayo 2021), identity-related factors (Randers and Thøgersen 2023) and social norms (Wolfswinkel et al. 2024) are important to food choices. Of these, knowledge-based factors and social norms have been identified as among the most important drivers of meat consumption (Fesenfeld et al. 2023; Stoll-Kleemann and Schmidt 2017), while cultural factors such as national identification have been shown to moderate the effect of social norms (Nguyen and Platow 2021).

Dietary choices have also been investigated through the lenses of incentivized economic experiments. These interventions help establish causal links but are mostly conducted on small-scale samples, focusing on specific countries, social groups, and contexts. Most of these experiments have analyzed the effectiveness of information provision interventions targeted at fostering sustainable diets through the introduction of carbon footprint labels (Bilén 2022; Ho and Page 2025; Imai et al. 2022; Lohmann et al. 2022; Perino, Panzone, and Swanson 2014; Reisch et al. 2021; Schulze-Tilling 2025; Vlaeminck, Jiang, and Vranken 2014). Results indicate that while these interventions can be effective, their impact is

limited, suggesting that factors beyond lack of knowledge shape individuals' food choices and should be addressed. While fewer experimental studies have focused on the effects of social norm interventions (Kwasny, Dobernig, and Riefler 2022), most results suggest that providing (either static or dynamic) information about the prevalence of low-carbon diets can, in some contexts, reduce meat consumption intentions and behavior to a small but significant extent (Blondin et al. 2022; Loschelder et al. 2019; Mortensen et al. 2019; Picard and Banerjee 2023; Sparkman and Walton 2017); in a few other cases the correction of norm misperceptions led to no significant changes in eating patterns, due to vast heterogeneity in individuals' responsiveness to the interventions (Dannenberg, Klatt, and Weingärtner 2024) or failure to translate updated beliefs into behavioral change (Moojen, Gillebaart, and Ridder 2024). These results generally align with the broader empirical evidence on the role of descriptive norms - perceptions of what others typically do - in shaping individuals' behavior in a variety of contexts. Indeed, descriptive norms are often misperceived, such that people over- or underestimate the prevalence of some behaviors among other people, and correcting such misperception may lead to changes in behaviours. Outside the domain of dietary choices, experimental research on social norms has studied the effect of correcting misperceptions about others' behavior in order to encourage environmentally friendly, pro-social or healthy behavior and support for related policies (Allcott 2011; Andre et al. 2024; Bicchieri 2006; Bonan et al. 2020; Constantino et al. 2022; Cookson et al. 2021; Mildenberger and Tingley 2019; Neighbors, Larimer, and Lewis 2004).

In the context of beef consumption, we have limited knowledge about individuals' perceptions of others' consumption patterns and the extent to which these perceptions align with reality. Identifying and measuring the scope of norm misperceptions is crucial, not only to assess whether interventions providing accurate information about others' behavior could effectively reduce beef consumption but also to gain deeper insights into social dynamics and belief formation. Even if such interventions do not always lead to immediate behavioral change, understanding these misperceptions can inform better policy design, enhance communication strategies, and identify structural barriers that may hinder change. From a policy perspective, this knowledge is also valuable for determining whether certain sub-groups should be more intensively targeted to maximize overall effectiveness, improve public discourse, and potentially enhance individuals' welfare gains over the long term.

In this paper, we explore cross-cultural differences in beef consumption through a demographically representative survey of six European countries (Denmark, Germany, France, Poland, Spain, and Italy), where food demand and supply account for a relevant share of the population's ecological footprint (Galli et al. 2023).

The survey gathers self-reported data on individual beef consumption, perceptions of others' consumption (descriptive social norms), and perceptions of societal normative prescriptions (injunctive social norms). Given the social nature of food and the observability of dietary choices in shared meals, we assess descriptive norms across different reference groups, from the average person in the country to close family members. Additionally, we collect data on beef consumption drivers, individuals' willingness to reduce beef consumption, past experiences with beef consumption reduction, and attitudes toward a possible tax on high-emissions foods.

The paper is organized as follows. In Sections 2 and 3, we provide the background of our country selection process and the methods. In Section 4 we present results and close with a policy discussion in Section 5.

2. Country Selection

In this paper, we collect novel survey data on beef consumption across six European Union countries (Denmark, Germany, France, Poland, Spain, and Italy). A first motivation for the geographical scope of the study is that the EU has been a frontrunner of climate action and has very ambitious climate mitigation objectives for 2030, as well as a 2050 climate neutrality target. Achieving these goals requires reducing emissions beyond the energy and industrial sectors, which have been the focus of most climate mitigation policy interventions so far. Better understanding challenges and enablers of different climate mitigation strategies across sectors, including consumer demand, is crucial to facilitating the achievement of EU and global climate mitigation goals.

Focusing on EU countries also allows us to study contexts with high emission reduction potential in the food sector. Indeed, in European countries, food systems are responsible for a third of the ecological footprint, a metric that accounts for climate, land, water, and waste impacts (Galli et al. 2023).

Within the EU, we selected countries whose food systems have an ecological footprint at or above the EU27 average, which makes them particularly relevant targets for dietary emission reduction policies. In the countries in our sample, emissions from food systems are responsible for between 20% and 44% percent of total emissions (Crippa et al. 2021). According to some scenarios, behavioral changes alone, including shifting to more plant-based diets, could lead to around 41% of emissions reductions (Creutzig et al. 2018). Finally, we selected countries with the objective of ensuring a geographically balanced coverage, including Southern, Northern, Western, and Eastern European countries, which span over a wide range of different diets and cultures.

3. Methods

3.1. Procedures and sample

Participants were recruited through the survey provider YouGov, which managed the whole data collection and payment procedures. The data collection took place online, in the first weeks of October 2024. The survey data used in this study represents a subset of a larger data collection effort aimed at investigating public support for a wide set of environmentally relevant policies. The data originally included also a representative sample of the Swedish population; however, due to a translation error for the items measuring beef consumption, data collected from Swedish respondents are omitted from the current study. Our final sample consists of 6078 participants from Denmark, Germany, France, Poland, Spain, and Italy, with approximately 1000 participants per country. Each country sample was stratified by gender, age, education level, and urban/rural residence to be representative of each country's population. In September 2024, before the data collection started, the survey intervention was pre-registered on AsPredicted (#190447). Ethical approval for the study was granted by the Swedish Ethical Review Authority (DNR: 2024-02559-01).

3.2. Measures

Demographic variables. Demographic information included some background characteristics provided by YouGov, such as gender, age, education level, income, and country of birth. In addition, we gathered data on political orientation using a 10-point left-right scale.

Beef consumption. Beef consumption was gauged by asking participants how many days per week they usually consume beef, with the response alternatives: "Never", "Less than 1 day per week", "1-2 days per week", "3-4 days per week", "5-6 days per week", "Every day". Main food consumption drivers were gauged by a multiple-choice item in which participants could indicate the most important factors to them when buying food. Response options, presented in randomized order across participants, included: religious norms on food consumption, prices, nutrition and health, environmental impact, animal welfare considerations, home country's culinary traditions, personal or family's taste.

Descriptive norms. Perceptions about others' beef consumption levels were gauged by asking participants how many days per week they estimate that the average person in their home country [their family members, their friends, and their colleagues] usually eat beef, with the different social groups presented in randomized order across participants. Response options were the same provided to describe one's own personal consumption.

Injunctive norms. To measure normative perceptions on the acceptability of beef consumption we asked the extent to which they agreed or disagreed with the statement "Everyone should make efforts to reduce their beef consumption". Answers were rated on a 7-points Likert scale ranging from "Completely disagree" (1) to "Completely agree" (7).

Beef consumption reduction. Resistance to beef consumption reduction was gauged by asking participants if they had ever attempted to reduce their beef consumption, and, if so, how difficult they found it [would find it], rated on a 7-points likert scale ranging from "Not at all difficult" (1) to "Extremely difficult" (7). A multiple-choice question was used to understand the drivers and resistance factors to beef consumption reduction; response options (presented in randomized order across participants) included religious beliefs, prices, nutrition and health, environmental impact, animal welfare considerations, and the availability of alternatives.

High-emission food tax support. Participants were asked to report their attitude towards a policy entailing a raised tax on high-emission foods including beef and dairy products, through a 7-points Likert scale ranging from "Very negative" (1) to "Very positive" (7).

Cultural factors. We measured the relevance of national culture in shaping participants' identity by asking them to rate their agreement with the statement "The culture of my home country is an important part of who I am". We then elicited their perception of the importance of food in their home country's culture based on their agreement with the statement "Food is one of the key defining features of the culture of my home country". In both cases, agreement was rated through a 7-points likert scale ranging from "Completely disagree" (1) to "Completely agree" (7).

3.3. Data analysis

We first report unweighted descriptive evidence on all the main variables of interest, with a special focus on cross-country differences. Regression analyses allow us to evaluate the association between our main outcome variables (current beef consumption, difficulty in reducing beef consumption, support for a tax on high-emission foods) and elicited norms, net of the effect of socio-demographic characteristics and cultural factors. We report the estimated regression coefficients in the main text and full regression results in the Supplementary Material. All regression models include country fixed effects and controls for age, gender and education; for a subset of the analyses, we also include controls for income and political orientation (these analyses are conducted on a smaller sample, due to missing data on the latter explanatory variables). All regression results are obtained with robust standard errors and from weighted data; weights are used to correct for sampling biases and ensure that the sample accurately represents the target population on gender, age, education, and region within each country.

4. Results

4. 1 Beef consumption

We find significant variation in beef consumption across the countries in our sample, with respondents from Denmark and France reporting higher average consumption levels (between 1.5 days and 1.6 days per week), followed by Spain and Italy (approximately 1.3), Germany (1.15), and Poland (0.9), as shown in Figure SM1.1 in the Supplementary Material. Figure 1 displays the distribution and average of self-reported weekly consumption within each of the six countries. For reference, the EAT-Lancet Planetary Health Diet recommends limiting red meat—beef, lamb, or pork—consumption to approximately one serving per week. This recommendation translates into consuming beef on fewer than one day per week on average. In most countries in our sample, average consumption is above recommended levels. Average consumption is highest in Denmark and lowest in Poland. Notably, Germany and Poland are the only two countries where the largest share of respondents report consuming beef less than once per week. This cross-country variation reflects the variation in beef supply measured by FAO data (see Section SM1 in the Supplementary Material). As shown in Table SM1.2, and in line with the previous literature, we document that —pooling across countries—frequent beef eaters (who consume beef 3-4 times per week or more) are more likely to be men, individuals with only primary or secondary education, low or medium income earners, and more right-wing.

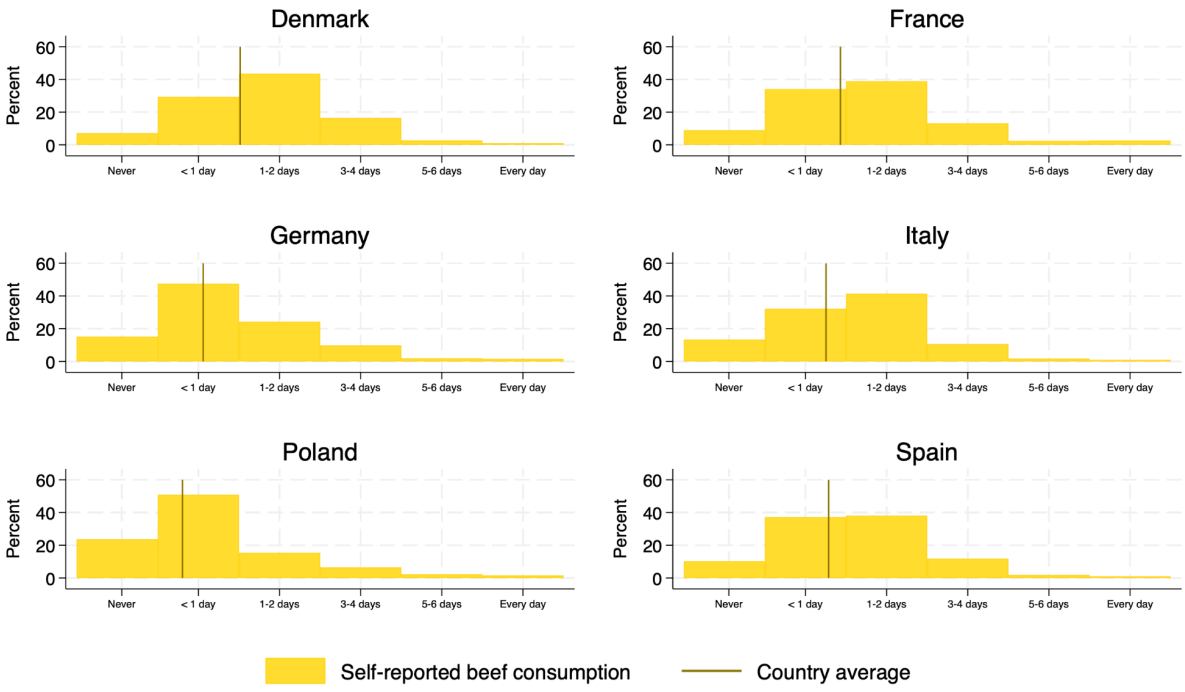

Figure 1 - Distribution of self-reported beef consumption by country (yellow bars) and country averages (black lines).

4.2 Social norms on beef consumption

We measure descriptive social norms regarding beef consumption, eliciting beliefs about the average person's weekly beef consumption in each country. Figure 2 displays average beliefs about others' beef consumption alongside average levels of self-reported consumption among survey respondents from each country. The gap between these two values quantifies the extent of norm misperception and shows that respondents from all countries tend to overestimate how much beef the average person consumes in a week by roughly one day or more. Variation across countries exists, with the smallest gap being in Poland (of roughly less than a day) and the largest gap in Spain and Italy (approximately one day and a half).

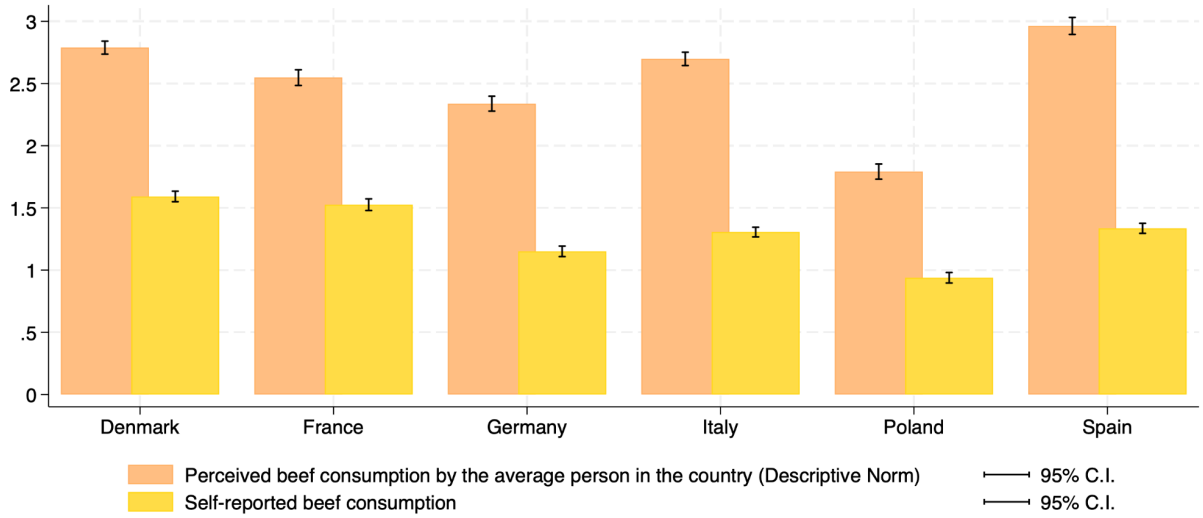

Figure 2 - Norm misperceptions: Perceived average beef consumption in the country, in orange, and average self-reported beef consumption, in yellow. Country averages (bars) and 95% confidence intervals (whiskers). The average descriptive norm misperception is the distance between the two bars within each country.

Moving beyond averages, Figure 3 shows how—across countries—the misperception of others' consumption consistently increases with one's own beef consumption: the more beef individuals consume, the more they tend to overestimate consumption by the average person in their country.

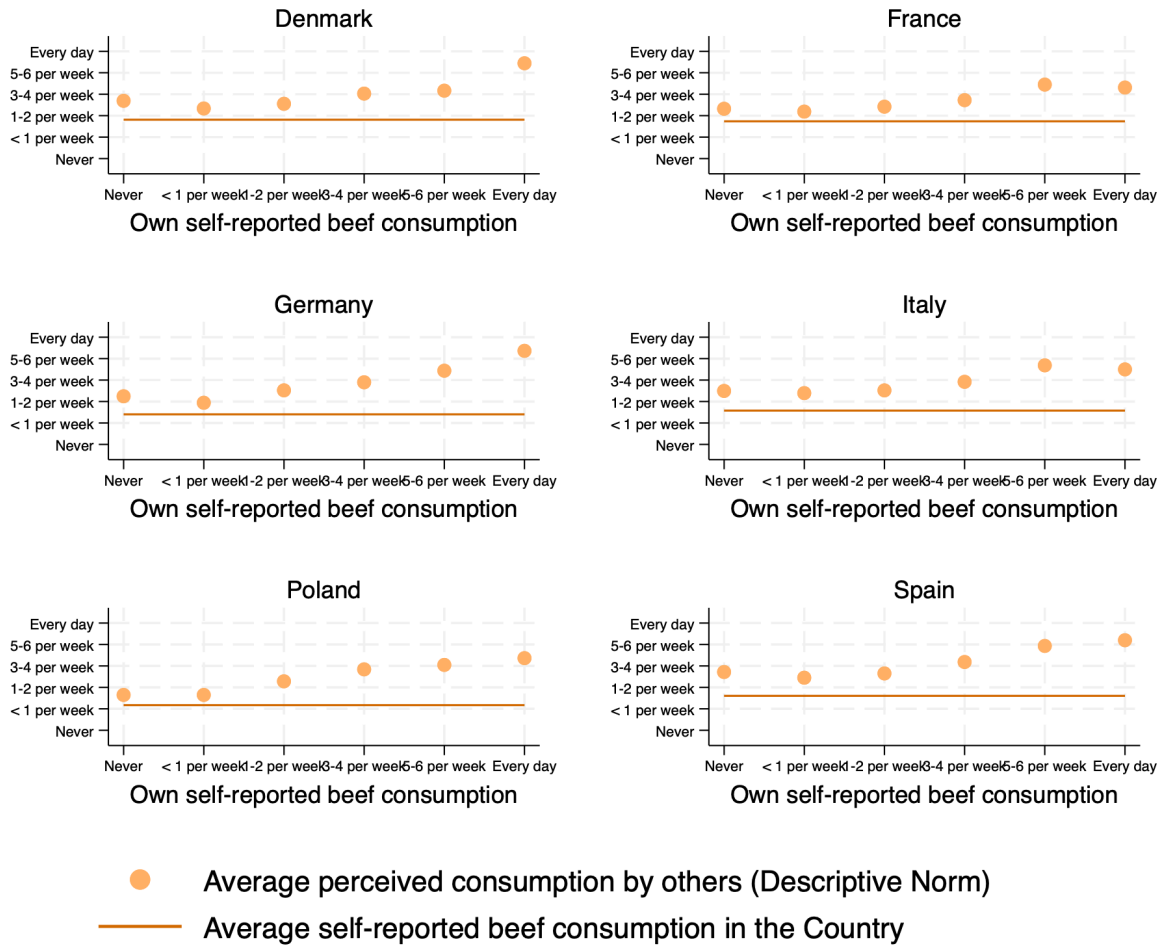

Figure 3: Variation in norm misperceptions: Misperceptions of others' beef consumption based on one's own self-reported consumption. For each consumption level (displayed on the x-axis), respondents' misperception equals the vertical distance between the horizontal line (dark orange), depicting the average self-reported beef consumption in the country, and the dot (light orange), depicting the average perception of others' beef consumption by respondents reporting that given consumption level.

When comparing own beef consumption with perceived beef consumption levels of various reference groups, we observe a consistent narrowing of the perceived consumption gap as social proximity increases (see Figure 4). In other words, across all six countries, the largest gap emerges when comparing respondents' own consumption to their perception of what the average person in their country consumes, and the gap gradually decreases as the reference social group becomes closer - i.e., colleagues, friends, and family. This evidence suggests that people believe those closer to them, especially family and friends, have eating habits more similar to their own. This is in line with a vast and growing literature in public health and behavioral sciences exploring food behaviors and social networks, and suggests two processes may be simultaneously at play. On the one hand, due to homophily, people tend to associate with

individuals with similar food habits (McPherson, Cook, and Smith-Lovin 2001). On the other hand, due to peer influence, people may be more strongly influenced by those surrounding them (Christakis and Fowler 2007). The consensus emerging from the literature is that both factors matter, but their relative importance may vary by age group and type of dietary behavior. While our survey confirms the existence of a clear network effect in beef consumption, more research is needed to explore which of the two mechanism, if not both, are at play in this context.

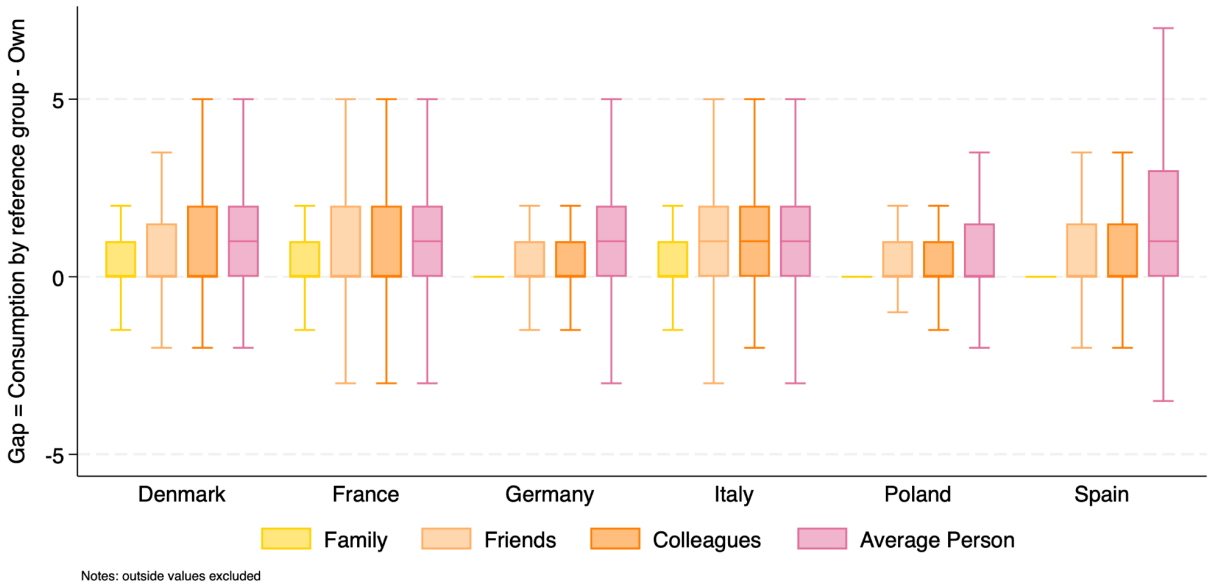

Figure 4. Perceived gap between one's own consumption and that of other social groups: family (yellow), friends (light orange), colleagues (dark orange) and the average person in the country (pink). Box plots: the line inside the box denotes the median, and the upper and lower borders of the box indicate the 75th and 25th percentiles of the distribution, respectively. Whiskers' ends identify the furthest observations within one and a half interquartile range of the upper/lower ends of the box.

The sign of this gap varies by consumption level: infrequent beef eaters tend to believe that others consume more than they do, whereas frequent beef eaters—respondents who declare to eat beef more than once per week—perceive others as consuming less (see Figure SM2.1 in the Supplementary Material).

We also measure injunctive norms by collecting information on respondents' agreement with the statement that everyone should make an effort to reduce their beef intake, using a 7-point scale. This can be considered as a proxy for the perception of the socially approved behaviour. Across all countries, agreement with the statement is generally moderate, being the highest in Italy (with an average of 4.49) and the lowest in Poland (with an average of 3.61). Across countries, those who never eat beef or consume it less than once per week show highest levels of injunctive norms.

4.3 Cultural drivers of beef consumption

Finally, wee asked respondents to assess the importance of food in their national culture and the role of their national culture in shaping their identity. The results, presented in Figure 5, indicate that national culture is generally perceived as important in shaping identity in all countries, with an average rating of 5 on a 1-7 scale, with slightly higher levels in Italy and lower levels in Germany. In contrast, we observe larger cross-country differences in the perceived importance of food within national culture. In Germany and Denmark, the average rating is just above 4, whereas in Spain and Italy, it is significantly higher, around 5.5.

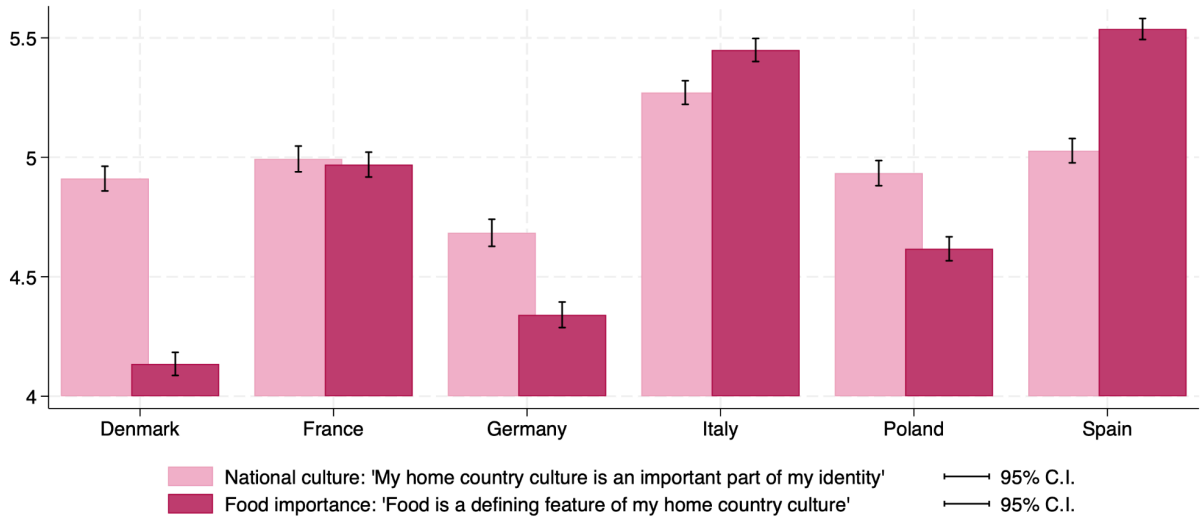

Figure 5 - Cultural factors: relevance of national culture in shaping identity (light pink) and importance of food in home country culture (dark pink), by country. Country averages (bars) and 95% Confidence Intervals (whiskers).

4.4 Explaining beef consumption choice

We analyze the association between norms, cultural factors, and beef consumption, controlling for socio-economic characteristics (Figure 6). Both injunctive and descriptive norms are strongly associated with consumption, with a negative association of injunctive norms and a positive association of descriptive norms: respondents who believe everyone should reduce their beef intake report eating less beef, whereas those who perceive higher average beef consumption in their country tend to eat more beef. In contrast, cultural factors—measured by the role of national culture in respondents' personal identity and the perceived importance of food in their home country's culture – do not show a significant correlation with consumption.

Regarding sociodemographic factors, our findings align with previous research: men, younger individuals, and those with lower education levels consume more beef, while income has no clear directional effect. Political orientation is significantly linked to consumption, with right-wing respondents reporting higher beef intake, even after controlling for key demographic characteristics.

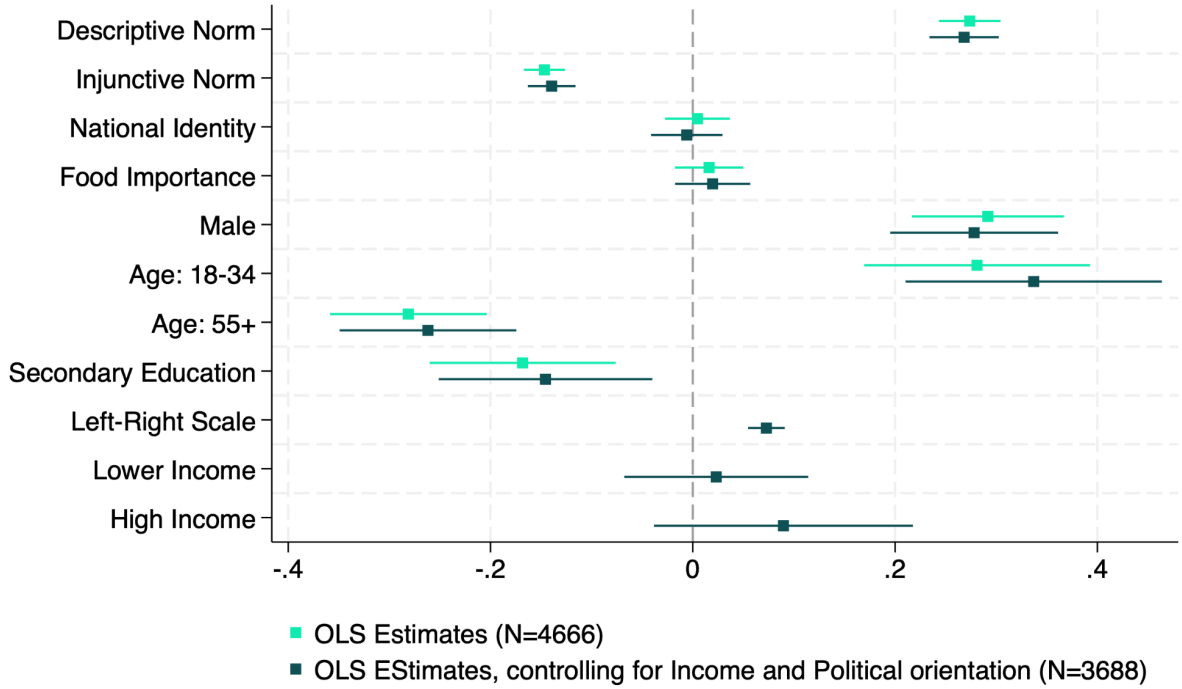

Figure 6 - Predicting beef consumption levels. Estimated coefficients from OLS regression models predicting beef consumption levels, with country-fixed effects and robust standard errors. Pooled sample, weighted data. Table SM4.1 in the Supplementary Material reports full regression results and additional analyses.

4.5 Experience and difficulty with reducing beef consumption

To assess respondents' experience and difficulty with reducing beef consumption, we first asked whether they have ever reduced or attempted to reduce their consumption. Overall, roughly 45% of our respondents report having reduced or tried to reduce their beef consumption in the past. Yet, some differences emerge across countries: beef reduction efforts appear stronger in Italy and France, where 55% and 51% of respondents, respectively, have reduced or tried to reduce their beef consumption. Conversely, substantially weaker figures emerge in Poland and Spain, where the share of beef reduction efforts drops to 33% and 39%, respectively. We also ask respondents to rate how difficult they found it - or would find it, should they have never tried - to reduce their beef consumption on a 1-7 scale. Interestingly, the average rate of difficulty reported is slightly above 3, with some significant yet small differences across countries, with France, Denmark, and Spain scoring above the mean. Among respondents who have, or tried to, reduce consumption in the past, the difficulty rating is consistently lower. Looking at the factors that did or would motivate respondents to reduce their beef consumption, the two most important ones are prices and health considerations (see Figure SM5.1 in the Supplementary Material) which, together with taste, are also the two most important drivers of food choices (see Figure

SM 6.1). This is true for both respondents who did and for respondents who did not make reduction efforts. For the latter group, these are the only substantial pull factors, with prices soundly overtaking health considerations. Among respondents who have made beef reduction efforts, prices and health considerations are still the most, and equally, important, followed closely by animal welfare and environmental considerations.

We also evaluate how norms and cultural factors influence respondents' self-reported difficulty in changing their eating habits (see Table SM4.2 in the Supplementary Material). Controlling for socio-economic factors and country-fixed effects, we find that descriptive and injunctive norms have opposing effects: believing that others consume more beef increases the perceived difficulty in cutting back, while strongly believing that everyone should reduce beef consumption reduces the perceived difficulty. Here, cultural factors also play a key role—individuals who view food as central to their country's culture and individuals with a stronger national identity report greater difficulty in reducing beef consumption. In terms of socio-economic characteristics, as shown in Table SM4.3, we observe that those who report having reduced or at least tried to reduce beef consumption are more likely to be women, individuals aged 55 or more, with secondary or higher education, middle or high income, and more left-wing.

4.6 Support for a tax on high-emission foods

Finally, we examine support for a tax on high-emission foods like beef. Support is, on average, relatively low across all countries, averaging 3.3 on a 7-point scale (1 = Very negative, 7 = Very positive), with 4 indicating the neutral mid-point. Infrequent beef eaters (≤1 day/week) show significantly higher support (3.4) than frequent eaters (3.2), though the difference is very small in magnitude. Country-level differences are also small, with the lowest support in Poland (3.09) and the highest in Spain (3.51). Figure SM3.1 in the Supplementary Material displays these descriptive statistics.

When evaluating the effect of social norms on tax support, we find that injunctive norms are positively associated with tax support, meaning that those who believe beef consumption should be reduced are more likely to endorse the policy, while descriptive norms have no significant association with tax support. We report regression analyses exploring the association of norms with tax support in Table SM4.3 in the Supplementary Material.

5. Discussion and policy implications

Exploiting survey data across six high-income European countries, this paper provides novel insights on beef consumption patterns and individuals' perception of others' consumption (descriptive norms). This allows us to identify infrequent and frequent beef eaters and to observe how consumption habits shape perceptions and other attitudes, within and across countries.

First, we provide a measure of beef over-consumption with respect to the recommendations of the EAT-Lancet Planetary Health Diet. While our data share the typical limitations of self-reported

consumption measures (e.g. people may underestimate their beef intake when it is part of composite meals or may underreport their actual consumption to align with perceived health norms or researchers' expectations), they provide valuable information on the within-country distribution of individuals' consumption and perceptions obout others' dietary habits. In addition, they provide a valuable complement to FAO data on average per capita food supply estimates, which may overstate actual consumption by including food waste at the retail or household level.

By comparing average self-reported consumption with the perception of what the average person consumes, we identify a systematic misperception of descriptive norms. This misperception increases with one's own level of consumption, such that the more individuals consume, the more they (mistakenly) perceive others to consume as well. As the correction of norms misperception can have important implications on behaviours, as shown in other domains (Bursztyn, González, and Yanagizawa-Drott 2020), our data suggest a huge potential for such interventions in the surveyed countries. In addition, as norms misperception is significantly associated with self-reported beef consumption and perceived difficulty in reducing consumption, individuals who would be most affected by such interventions (those with the largest norms misperception), would also be those with the largest room for reducing consumption and with the most sizable expected health benefits.

Through the analysis of descriptive norms across different reference groups, we document patterns consistent with homophily or peer influence: the closer the social group of reference the smaller the distance between self-reported consumption and the consumption habit attributed to the reference group. While our data doesn't allow us to test which of these two mechanisms is driving the association, it substantiates the idea that the impact of norm-based interventions might spread beyond the targeted population through the network of targeted individuals.

While prices emerge as the most common enabler of beef consumption reduction, support for a market-based policy (a tax on high-emission foods) is overall low across all countries and consumption groups. However, we find that infrequent beef eaters do show a significantly higher support, despite the size the of the difference being small in magnitude, in line with previous research showing that meat consumption tends to correlate strongly with support for meat reduction policies (Ejelöv et al. 2025; Grimsrud et al. 2020; Pechey et al. 2022). In this light, initially employing social norm interventions to reduce beef consumption at least to a small extent, might facilitate later support for more effective price-based policies by triggering an initial reduction in consumption.

Finally, while cultural factors do not explain differences in consumption behavior after accounting for country-specific effects, they do affect resistance to dietary change. The role of cultural factors in shaping resistance further underscores the importance of tailoring food policy to institutional and cultural contexts to enhance public acceptability and policy feasibility. For example, in the European context, this suggests that while overarching guidance on dietary shifts can be set at the EU level, the design and implementation of specific demand policies should be adapted at the national or even regional level to account for cultural and institutional differences, thereby enhancing public acceptability and policy effectiveness. For instance, highlighting traditional non-beef dishes or variations of national recipes that substitute beef with other proteins could help promote the replacement of beef with lower-carbon animal alternatives.

Further research could examine the long-term impact of sustained social norms interventions across diverse contexts and conditions. Existing studies so far report mixed findings, with the correction of norm

misperceptions having either significant but small or negligible short-term effects on high-emission food consumption choices. Beyond sociodemographic characteristics, dietary habits and cultural factors may act as key moderators of these effects and changes in both these domains may take time to materialize. Dietary shifts are indeed often gradual processes, also due to the relevance of the social dimension of eating in our society, as also highlighted by our results on norm misperceptions and social proximity. Relatedly, further research on how network effects propagate and what mechanisms dominate could help in the design of tailored policies with maximal propagation effects. Moreover, testing norm-based interventions across different contexts and subpopulations would also help clarify the conditions under which they are most effective. Finally, additional research on the impact of norms interventions on policy support could also shed light on the factors that enable broader public backing for ambitious measures to reduce food-related emissions.

Data Availability

Survey data used in the analysis will be shared and made available upon request after the publication and/or during the refereeing process.

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Supplementary Material

SM1. Beef consumption

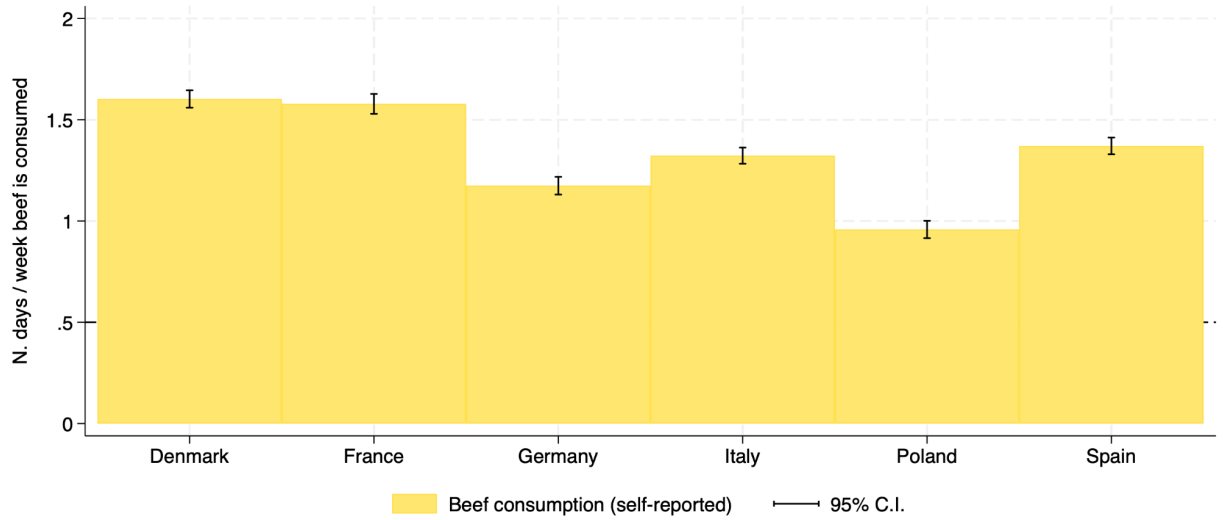


Figure SM1.1 - Beef consumption (self-reported), by country. Country averages (yellow bars), 95% Confidence Intervals (black whiskers).

FAO Beef data

FAO (2023) reports annual per capita beef supply for 2021 as follows: Germany (14.04 kg), Denmark (23.66 kg), Spain (12.67 kg), France (23.01 kg), Italy (15.98 kg), and Poland (1.70 kg). Converting these values into weekly servings, assuming an average portion of 120 grams, we find that the ranking of countries in our self-reported data—aside from minor reshufflings in the middle—largely aligns with FAO statistics. However, self-reported consumption in the survey is generally lower than FAO figures, with an average discrepancy of about one serving per week. This difference may arise because FAO data reflect per capita supply rather than actual consumption (including food waste and non-human consumption), and/or because of differences in the unit of measurement (imputed servings vs. number of days per week beef is consumed). Additionally, survey respondents may underestimate beef consumption when it appears in composite meals (e.g., minced meat, fillings, sauces). Lastly, we cannot exclude that the gap might reflect a recent shift in beef consumption trends, which may not yet be fully captured in FAO data.

	Infrequent beef eaters		Frequent beef eaters
	Less than once per week	*1-2 times per week*	*3-4 times per week or more*
Gender: Share of Men	40.2%	54.4%	58.2%
Age: - Share of 18-34 - Share of 35-54	18.7% 33.1%	22.3% 36.4%	35.4% 40.7%
Education: - Primary - Secondary	27.8% 46.1%	36.7% 37.9%	40.6% 35.1%
Income: - Lower (< 75% median) - Middle (75-200% median)	40.7% 48.2%	35.1% 52.0%	39.5% 45.3%
Political orientation Left-Right 10-point scale	5.1	5.6	6.3

Table SM1.2 - Socio-demographic characteristics by beef consumption habit, pooled sample (all countries). *Notes:* The overall sample counts N=6.078 observations, except for income and political orientation, due to the incidence of 'Don't know/Prefer not to say' answers. For income [political orientation], the sample counts N=5006 [5232] observations, and there is a non-response rate of 18.3[15]%, 17.15[12.4]%, and 16.5[13.6]%, respectively, by consumption category (from the least to most frequent beef eaters).

SM2. Social Norms

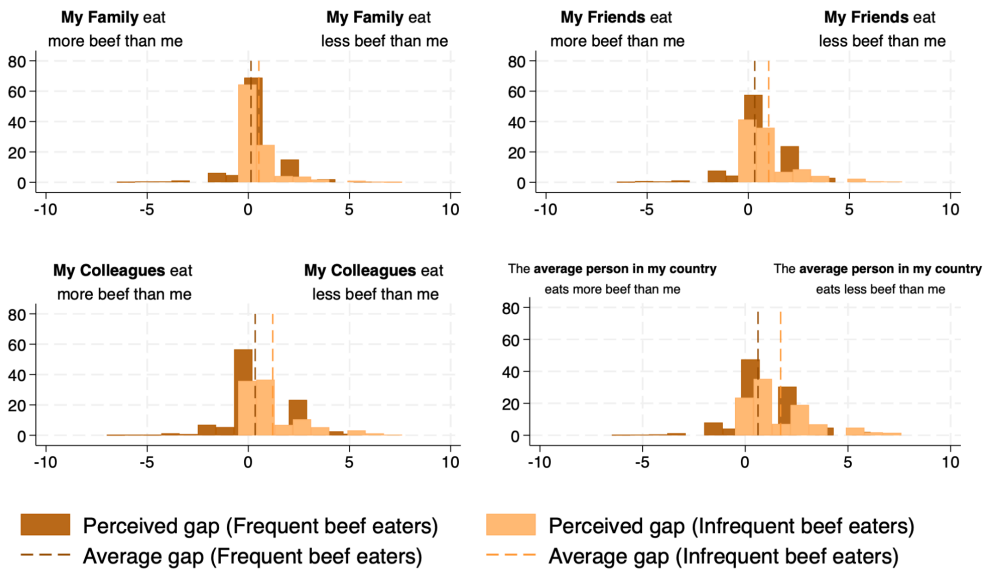


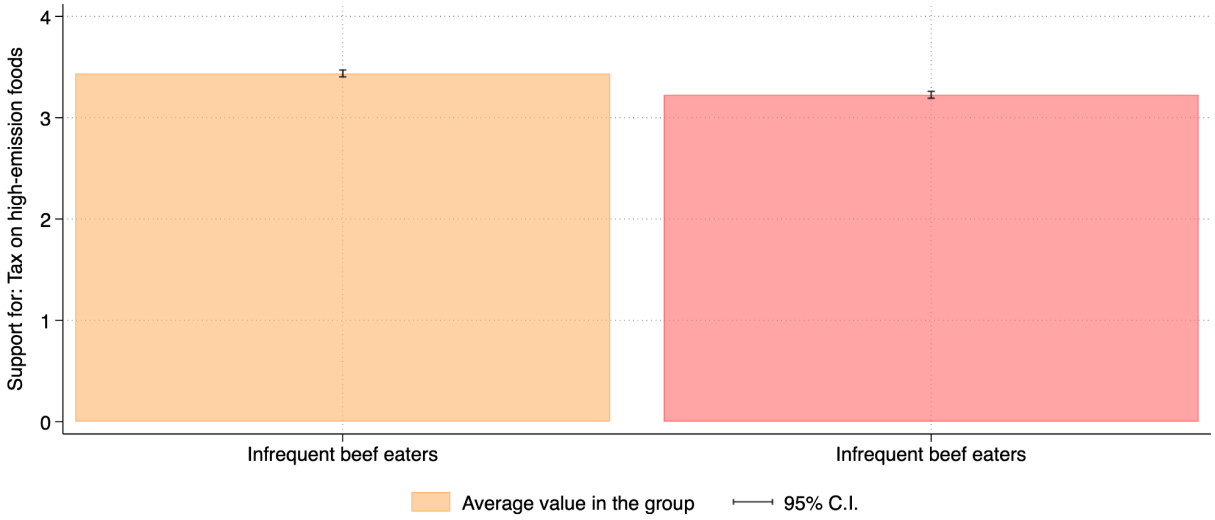
Figure SM2.1. The perceived gap between own consumption and that of other social groups, separately by own consumption habit: Frequent beef eaters (average beef consumption above once per week, dark orange) vs. Infrequent beef eaters (light orange). Pooled data from all countries distribution (bars) by consumption habit group and average (dashed lines).

SM3. Exploring subsample variation in support of a tax on high-emission foods

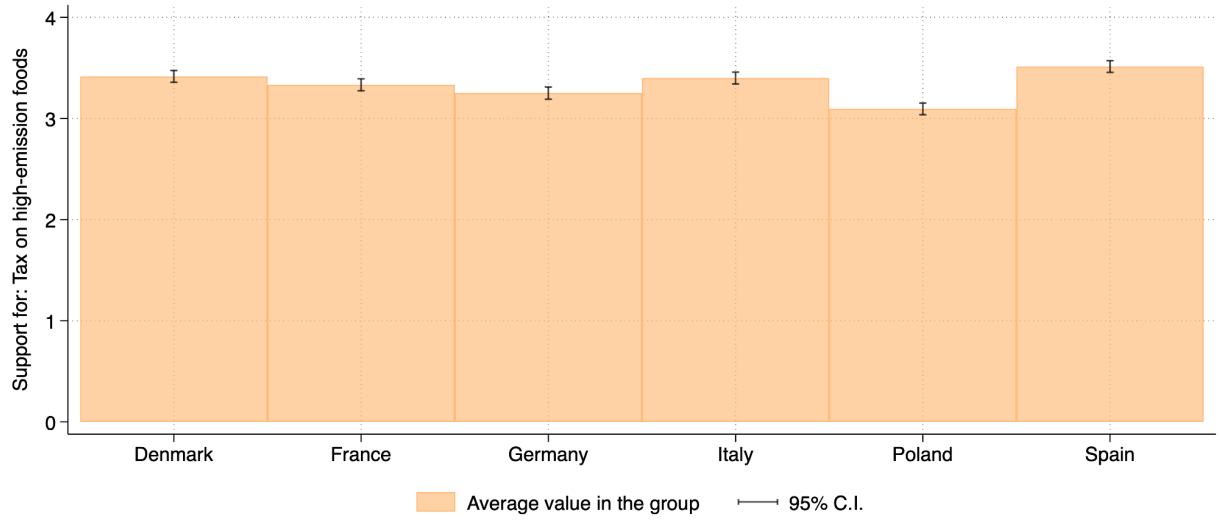
We further explore variation in support for a tax on high-emission foods among frequent beef eaters (those who report eating beef at least once per week) and infrequent beef eaters (those who report eating beef less than one day per week) and variation across countries. Support for such a tax is higher among infrequent beef eaters compared to frequent beef eaters. The difference is statistically significant but quite small in magnitude (see Panel A of Figure SM3.1). Across countries, limited heterogeneity emerges, with the highest levels of support in Spain, followed by Denmark and Italy, and the lowest levels of support in Poland (see Panel B of Figure SM3.1).

Figure SM3.1 - Policy support for a tax on high-emission foods by beef consumption habits & Country

Panel A: Average tax support by current consumption habit



Panel B: Average tax support by country



SM4. The role of norms and cultural factors

In this section, we explore the role of descriptive norms, injunctive norms, national identity, and the perceived centrality of food in one's culture. We examine to what extent these factors are associated with beef consumption, the difficulty of reducing beef consumption, and support for a tax on high-emission foods. Tables SM1-3 report the results of OLS regression analyses. All models include country fixed effects and controls for age, gender, and education.

Norms, cultural factors, and beef consumption

	Weekly Beef Consumption			
	(1)	(2)	(3)	(4)
Descriptive Norm	0.274***		0.274***	0.412***
	(0.016)		(0.016)	(0.036)
Injunctive Norm	-0.147***		-0.147***	-0.060***
	(0.010)		(0.010)	(0.018)
Descriptive*Injunctive Norms				-0.033***
				(0.008)
Food Relevance		0.025	0.016	0.015
		(0.016)	(0.017)	(0.017)
National Identity		0.010	0.005	0.003
		(0.015)	(0.016)	(0.016)
Country Fixed Effects	✓	✓	✓	✓
Sociodemographic Controls	✓	✓	✓	✓
Ajusted R-squared	0.210	0.085	0.210	0.217
Observations	4666	6078	4666	4666
Standard Errors	Robust	Robust	Robust	Robust

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Panel A

	Weekly Beef Consumption			
	(1)	(2)	(3)	(4)
Descriptive Norm	0.269***		0.268***	0.427***
	(0.018)		(0.017)	(0.041)
Injunctive Norm	-0.139***		-0.140***	-0.044*
	(0.012)		(0.012)	(0.019)
Descriptive*Injunctive Norms				-0.037***
				(0.009)
Food Importance		0.029	0.020	0.019
		(0.018)	(0.019)	(0.019)
National Identity		-0.004	-0.006	-0.007
		(0.017)	(0.018)	(0.018)
Left-Right Scale	0.073***	0.082***	0.073***	0.072***
	(0.009)	(0.008)	(0.009)	(0.009)
Lower Income	0.023	0.021	0.023	0.016
	(0.046)	(0.045)	(0.046)	(0.046)
High Income	0.090	0.066	0.090	0.087
	(0.065)	(0.063)	(0.065)	(0.065)
Country Fixed Effects	✓	✓	✓	✓
Sociodemographic Controls	✓	✓	✓	✓
Ajusted R-squared	0.238	0.116	0.238	0.247
Observations	3688	4498	3688	3688
Standard Errors	Robust	Robust	Robust	Robust

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Panel B

Table SM4.1. Results of OLS regressions predicting weekly beef consumption. Weighted data and robust standard errors. All models include country fixed effects and controls for age, gender and education. Models in Panel B also include positioning of the left-right scale and income as predictors.

Descriptive norms are positively and significantly associated with beef consumption, indicating that people who eat more beef tend to think that other people in their country also eat more beef. Injunctive norms are instead negatively and significantly associated with beef consumption, indicating that people who eat more beef tend to disagree more with the idea that everyone should make efforts to reduce their beef consumption. The interaction between descriptive and injunctive norms is negative and significant, suggesting people eat less [more] beef whenever a higher [lower] imperative to reduce beef consumption couples with the perception that the prevalent consumption pattern in their country is (still) high. National identity and the perception of food as central to one's cultural identity have no statistically significant association with beef consumption.

	Has reduced or tried to reduce	**Never reduced or even tried**
Weekly beef consumption Modal answer (share)	Less than once per week (44.3%)	1-2 times per week (37.2%)
Gender: Male	42.1%	52.1%
Age: - Share of 18-34	24.0%	21.0%

- Share of 35-54	32.6%	37.5%
Education: - Primary - Secondary	 30.5% 41.5%	 34.4% 41.8%
Income: - Lower (< 75% median) - Middle (75-200% median)	 39.0% 48.3%	 38.2% 49.7%
Political orientation Left-Right 10-point scale	 5.2	 5.7

Table SM4.2. - Characteristics by beef consumption reduction experience, pooled sample (all countries). *Notes:* The overall sample counts N=6.078 observations, except for income and political orientation, due to the incidence of 'Don't know/Prefer not to say' answers.

Norms, cultural factors, and the difficulty to reduce beef consumption

	Difficulty to Reduce Beef Consumption			
	(1)	(2)	(3)	(4)
Descriptive Norm	0.107***		0.102***	0.158***
	(0.018)		(0.018)	(0.046)
Injunctive Norm	-0.301***		-0.299***	-0.264***
	(0.017)		(0.016)	(0.029)
Descriptive*Injunctive Norms				-0.013
				(0.010)
Food Relevance		0.098***	0.088***	0.087***
		(0.021)	(0.022)	(0.022)
National Identity		0.054**	0.059**	0.058**
		(0.020)	(0.021)	(0.021)
Country Fixed Effects	✓	✓	✓	✓
Sociodemographic Controls	✓	✓	✓	✓
Ajusted R-squared	0.137	0.056	0.149	0.149
Observations	4200	5307	4200	4200
Standard Errors	Robust	Robust	Robust	Robust

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Panel A

	Difficulty to Reduce Beef Consumption			
	(1)	(2)	(3)	(4)
Descriptive Norm	0.117***		0.112***	0.175***
	(0.020)		(0.020)	(0.051)
Injunctive Norm	-0.294***		-0.294***	-0.255***
	(0.019)		(0.019)	(0.032)
Descriptive*Injunctive Norms				-0.015
				(0.011)
Food Importance		0.114***	0.101***	0.101***
		(0.024)	(0.025)	(0.025)
National Identity		0.049*	0.049*	0.048*
		(0.023)	(0.023)	(0.023)
Left-Right Scale	0.076***	0.094***	0.066***	0.066***
	(0.013)	(0.012)	(0.013)	(0.013)
Lower Income	0.064	0.035	0.082	0.079
	(0.069)	(0.066)	(0.069)	(0.069)
High Income	0.054	-0.063	0.042	0.040
	(0.098)	(0.094)	(0.097)	(0.097)
Country Fixed Effects	✓	✓	✓	✓
Sociodemographic Controls	✓	✓	✓	✓
Ajusted R-squared	0.156	0.078	0.168	0.168
Observations	3359	4042	3359	3359
Standard Errors	Robust	Robust	Robust	Robust

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Panel B

Table SM4.2. Results of OLS regressions predicting the difficulty of reducing beef consumption. Weighted data and robust standard errors. All models include country-fixed effects and controls for age, gender and education. Models in Panel B also include positioning of the left-right scale and income as predictors.

Across different models, descriptive norms are positively and significantly associated with self-reported difficulty in reducing beef consumption, indicating that people who estimate beef consumption to be more widespread tend to perceive beef reduction efforts as harder. Injunctive norms are instead negatively and significantly associated with self-reported difficulty in reducing beef consumption, indicating that people who agree more that everyone should make efforts to reduce their beef consumption perceive beef consumption reduction to be easier. The interaction between descriptive and injunctive norms is not statistically significant. A stronger national identity and perception of food as central to one's cultural identity display a positive and statistically significant association with self-reported difficulty in reducing beef consumption.

Norms, cultural factors, and support for a tax on high-emission foods

	Beef Tax Support			
	(1)	(2)	(3)	(4)
Descriptive Norm	0.007		0.009	-0.030
	(0.016)		(0.016)	(0.036)
Injunctive Norm	0.452***		0.451***	0.426***
	(0.014)		(0.014)	(0.025)
Descriptive*Injunctive Norms				0.009
				(0.008)
Food Relevance		-0.020	-0.024	-0.024
		(0.020)	(0.021)	(0.021)
National Identity		-0.050**	-0.046*	-0.046*
		(0.019)	(0.020)	(0.020)
Country Fixed Effects	✓	✓	✓	✓
Sociodemographic Controls	✓	✓	✓	✓
Ajusted R-squared	0.226	0.020	0.229	0.229
Observations	4666	6078	4666	4666
Standard Errors	Robust	Robust	Robust	Robust

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Panel A

	High-Emission Food Tax Support			
	(1)	(2)	(3)	(4)
Descriptive Norm	0.021		0.022	-0.020
	(0.018)		(0.018)	(0.042)
Injunctive Norm	0.453***		0.453***	0.428***
	(0.016)		(0.016)	(0.028)
Descriptive*Injunctive Norms				0.010
				(0.009)
Food Importance		-0.030	-0.020	-0.020
		(0.023)	(0.023)	(0.023)
National Identity		-0.040	-0.041	-0.040
		(0.023)	(0.023)	(0.023)
Left-Right Scale	-0.016	-0.069***	-0.012	-0.012
	(0.012)	(0.012)	(0.012)	(0.012)
Lower Income	0.005	0.045	-0.001	0.001
	(0.062)	(0.062)	(0.062)	(0.062)
High Income	0.127	0.195*	0.134	0.135
	(0.088)	(0.095)	(0.088)	(0.088)
Country Fixed Effects	✓	✓	✓	✓
Sociodemographic Controls	✓	✓	✓	✓
Ajusted R-squared	0.235	0.036	0.237	0.237
Observations	3688	4498	3688	3688
Standard Errors	Robust	Robust	Robust	Robust

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Panel B

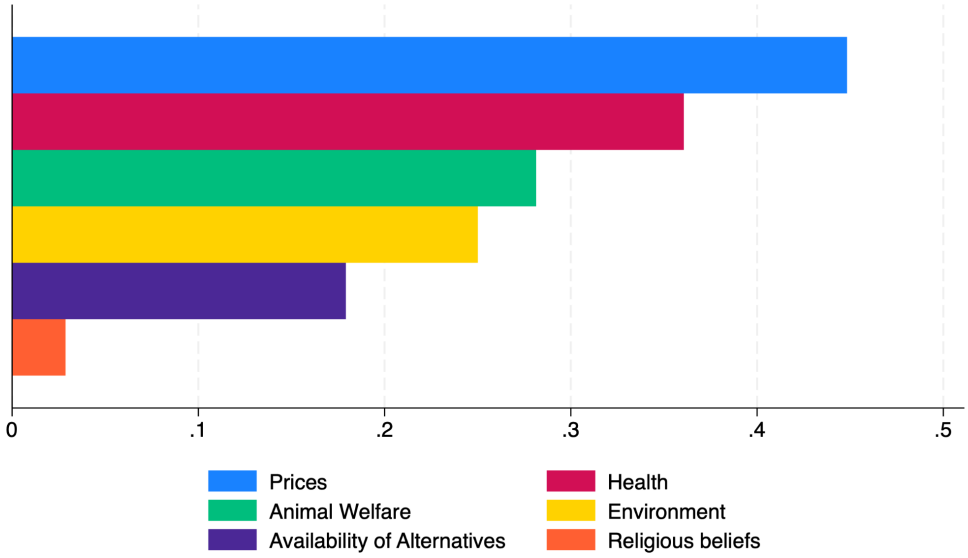
Table SM4.3. Results of OLS regressions predicting support for a tax on high-emission foods. Weighted data and robust standard errors. All models include country-fixed effects and controls for age, gender and education. Models in Panel B also include positioning of the left-right scale and income as predictors.

Across all specifications, we find that descriptive norms are not significantly associated with support for a tax on high-emission foods. As expected, injunctive norms are, instead, positively and significantly associated with tax support, indicating that people who more strongly agree that everyone should make

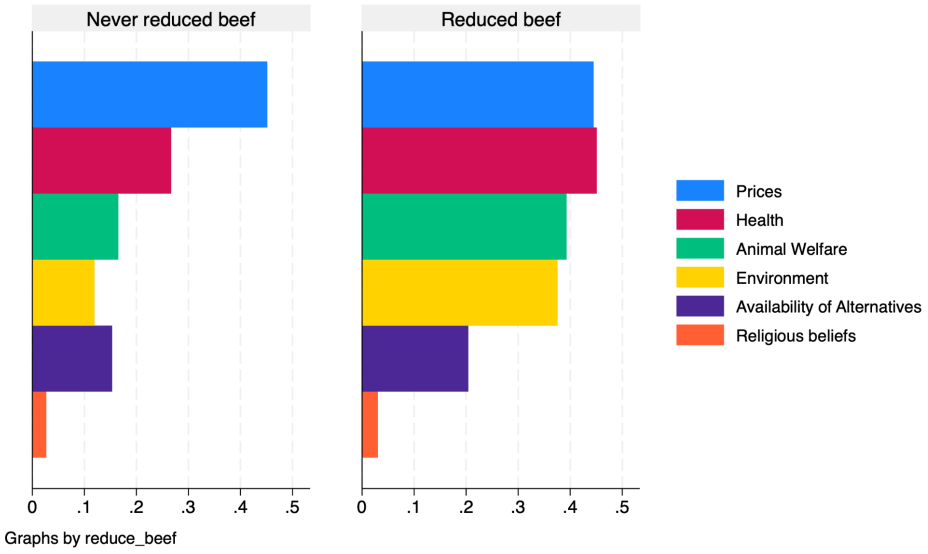
efforts to reduce their beef consumption are more likely to be supportive of a tax on high-emission foods. The interaction between descriptive and injunctive norms is not statistically significant. The perception of food as central to one's cultural identity displays no statistically significant association with tax support, while a stronger national identity is negatively associated with tax support.

SM5. Self-reported enablers of beef consumption reduction

Figure SM5.1 - Self-reported enablers of beef consumption reduction.



Panel A. Average from pooled data (all countries).



Panel B. Average for respondents who have (right) and have not (left) made efforts to reduce beef consumption in the past. Pooled data from all countries.

We explore self-reported enablers of beef consumption reduction. Figure SM5.1 reports the frequency of answers to the question: "Which among the following did/would motivate you most to reduce your beef consumption? You can select multiple options". As shown in Panel A, across the whole sample, prices are

reported to be the most common enabler of beef consumption reduction, followed by health, animal welfare, and environmental considerations. This is in line with previous research (Neff et al., 2018). The availability of alternatives ranks fifth among our list of enablers, while religious beliefs do not seem to be a very common enabler. Looking at the results of those who have not tried to reduce their beef consumption yet, prices and health considerations are the only substantial pull factors, with prices soundly overtaking health considerations.

SM6. Self-reported drivers of food choice

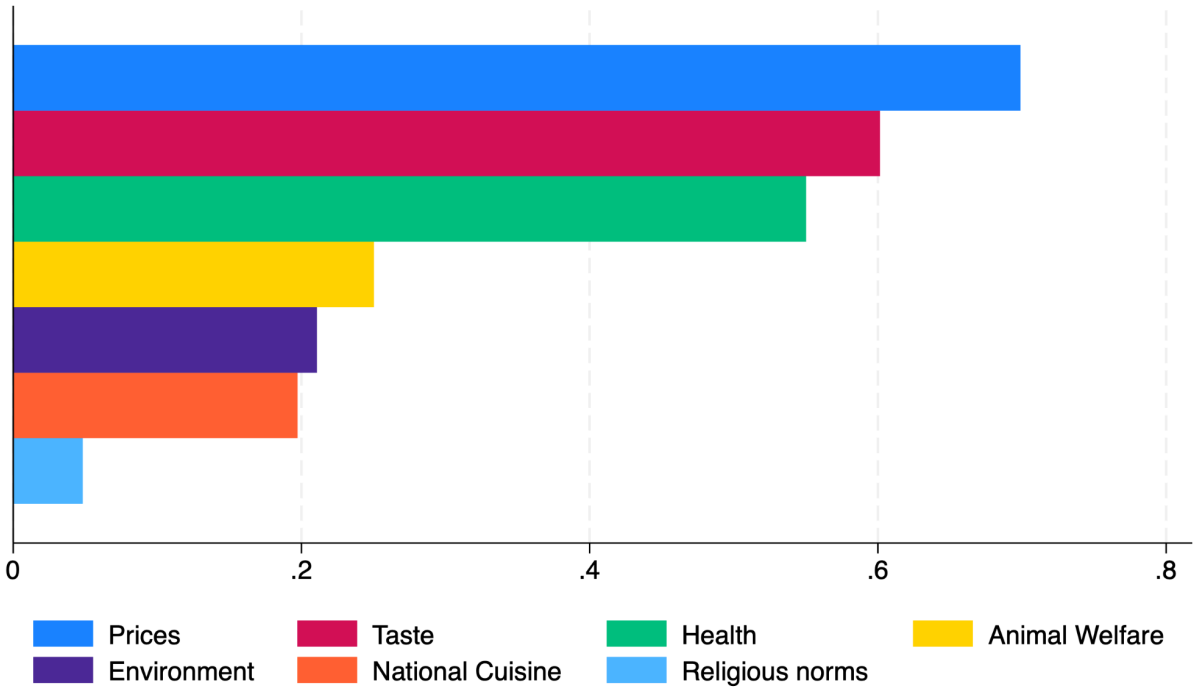


Figure SM6.1 - Self-reported drivers of food choice. Average, pooled data from all countries.

We also ask directly our respondents to indicate what factors drive their food choices. The question was the following: “When you buy food, which of the following are most important to you? You can select multiple options.” As shown in Figure SM6.1, consistently across all six countries surveyed, people mostly care about prices, their (and their family's) taste, and health considerations when buying food. Only a residual share of respondents declare that animal welfare, environmental and religious considerations, and national culinary tradition play a considerable role in their choices.

Questionnaire

English transcription of the survey items used in the analysis.

- Some consumption behaviors can have negative effects on either public health or the climate. These effects could potentially be reduced by the use of different types of policies. What is your attitude toward these proposals?

  "Raised tax on high-emission foods, such as beef and dairy products."

  1. Very negative
  2.
  3.
  4.
  5.
  6.
  7. Very positive

- How many days per week do you usually eat beef?

  1. Never
  2. Less than 1 day per week
  3. 1-2 days per week
  4. 3-4 days per week
  5. 5-6 days per week
  6. Every day

- How many days per week do you estimate that people in your home country usually eat beef?

  1. Never
  2. Less than 1 day per week
  3. 1-2 days per week
  4. 3-4 days per week
  5. 5-6 days per week
  6. Every day
  7. Don't know

- How many days per week do you estimate that your family members usually eat beef?

  1. Never
  2. Less than 1 day per week
  3. 1-2 days per week
  4. 3-4 days per week
  5. 5-6 days per week
  6. Every day
  7. Don't know

- How many days per week do you estimate that your friends usually eat beef?

  1. Never
  2. Less than 1 day per week
  3. 1-2 days per week

4. 3-4 days per week
5. 5-6 days per week
6. Every day
7. Don’t know

- How many days per week do you estimate that your colleagues usually eat beef?

1. Never
2. Less than 1 day per week
3. 1-2 days per week
4. 3-4 days per week
5. 5-6 days per week
6. Every day
7. Don’t know

- Have you ever reduced or attempted to reduce your beef consumption in the past?

1. No
2. Yes
3. Not relevant

- How difficult did you find it to reduce your beef consumption?

1. - Not at all difficult
2.
3.
4.
5.
6.
7. - Extremely difficult

- How difficult would you find it to reduce your beef consumption?

1. - Not at all difficult
2.
3.
4.
5.
6.
7. - Extremely difficult

- Which among the following did motivate you most to reduce your beef consumption? You can select multiple options.

1. Religious beliefs
2. Prices
3. Nutrition and health

4. Environmental impact
5. Animal welfare considerations
6. Availability of alternatives
7. Other (please specify):
8. Don't know

- Which among the following would motivate you most to reduce your beef consumption? You can select multiple options.

1. Religious beliefs
2. Prices
3. Nutrition and health
4. Environmental impact
5. Animal welfare considerations
6. Availability of alternatives
7. Other (please specify):
8. Don't know

- To what extent do you agree or disagree with the statement: "Everyone should make efforts to reduce their beef consumption"?

1. - Completely disagree
2.
3.
4.
5.
6.
7. - Completely agree

- How worried are you about climate change?

1. - Not at all worried
2.
3.
4.
5. - Extremely worried

- To what extent do you agree or disagree with the following statements:
  - "The culture of my home country is an important part of who I am."
  - "Food is one of the key defining features of the culture of my home country."

1. - Completely disagree
2.
3.
4.

5.
6.
7. - Completely agree

- When you buy food, which of the following are most important to you? You can select multiple options.

    1. My religion’s norms on food consumption
    2. Prices
    3. Nutrition and health
    4. Environmental impact
    5. Animal welfare considerations
    6. My home country's culinary traditions
    7. My personal taste or my family’s taste
    8. Other (please specify):
    9. Don’t know