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Why Are We Eating so Much Meat?

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There are various reasons why humans may want to reduce their consumption of meat and other animal products. In the following, we lay out important stylized facts about individual meat consumption, and then discuss the challenges and puzzles surrounding effective behavior change toward more sustainable, plant-based diets.

In 2018, world meat production reached a new high of 327 million tons, reflecting a 1% increase over 2017 production mostly due to improvements in productivity (OECD, 2019). Annual worldwide meat production is projected to increase to 376 million tons by 2030 (WHO, 2003). These increases are driven by continued rises in demand for meat and animal products. Average meat consumption has risen to 41.3 kilograms per capita per year in 2015 from about 23.1 kilograms per person and year in 1961, with projections suggesting a further increase to more than 45 kilograms by 2030 (FAO, 2003; Sans and Combris, 2015). Current meat consumption in Germany is high: in 2018, Germans consumed an average of 60 kilograms of meat per capita as food and another 28 kilograms per capita including bones, meat as animal feed, loss in production, and industrial utilization (Bundesanstalt für Landwirtschaft und Ernährung, 2020).

Typically, as countries become richer, consumption of meat, milk, and eggs increases at the expense of staple foods (WHO, 2003). People in richer countries consume not only more calories and more proteins per day than those in poorer countries, but a larger fraction of their protein intake comes from animal-based products, especially, meat (Sans & Combris, 2015). While animal-based proteins constitute less than a quarter of the total protein intake in the poorest countries, on average, the share is almost 60% in the richest countries on average, with protein consumption from meat five times higher in the richest countries than in the poorest ones (Sans & Combris, 2015). Growth in worldwide meat consumption over the last decades was primarily driven by rising demand in developing and emerging countries, with Brazil, China, and Korea becoming major meat consumers (FAO, 2003).

Reduced meat consumption benefits the environment, health, and the animals

The levels of production necessary to satisfy the increasing demand for meat worldwide contribute to environmental problems locally and globally (see, for example, Godfray et al., 2018). Around 70% of agricultural land – about 30% of the global land surface – is used for animal production (FAO, 2006). As animals need space and feed, livestock production is linked to deforestation. For instance, 80% of the deforested land in the Amazon basin is covered in pastures that are used for cattle herding (Veiga et al., 2002). Food production is also water-intensive and depletes scarce freshwater resources. Animal products, for instance, account for 29% of the agricultural use of the world's freshwater resources (Mekonnen and Hoekstra, 2012).

The production of meat and other animal products also directly contributes to climate change. In total, an estimated 8-18% of global anthropogenic greenhouse gas emissions are attributable to livestock (Herrero et al., 2015; FAO, 2006). A global dietary change toward a diet without animal-sourced food is estimated to have potentially large benefits, mitigating climate change by reducing greenhouse gas emissions, reducing land degradation, and increasing food security (IPCC, 2019). Research suggests that there is also large potential to mitigate the environmental impacts of livestock production by increasing efficiency on the production side (Steinfeld and Gerber, 2010), but projected efficiency improvements are insufficient and must be coupled with dietary changes if the world's population is to be fed and environmental impacts of the food system limited (Davis et al., 2016). The reduced consumption of meat would secure plant-based diets for more people by giving human-edible food to humans rather than livestock and by freeing up farmland (Stokstad et al., 2010; Mottet et al., 2017), while also feeding more people using the same water resources (Weindl et al., 2017; Jalava et al., 2014).

In the developing world, undernutrition remains a problem and increased meat intake would improve the nutrition of the population by providing high-value protein and essential micronutrients like iron, zinc, and vitamin A (WHO, 2002; Schönfeldt and Hall, 2012). In contrast, moderate- and high-income countries face an obesity challenge. Globally, child and adolescent obesity is predicted to be more prevalent than moderate and severe undernutrition by 2022 (Swinburn et al., 2019). Excessive consumption of animal products contributes to obesity and other public health challenges, including diabetes, cardiovascular diseases, and cancer, with individual dietary choices not only influencing present health but also affecting the probability of developing these non-communicable diseases much later in life (WHO, 2003). In Germany, the National Nutrition Survey II found that individuals with a meatless diet tended to have better health characteristics than meat eaters and those consuming more meat had worse health outcomes than those consuming little meat (Koch et al., 2019). Though parts of such correlations may be driven by less meat-eating being be a marker for a health-conscious lifestyle (Godfray et al., 2018), average health effects are striking. A vegetarian diet, compared to the global average, omnivorous diet, is associated with a 41% lower risk of type II diabetes, a 10% lower risk of cancer, and 20% lower mortality rates from coronary heart disease on average (Tilman and Clark, 2014). In addition, the emerging antimicrobial resistance, which reduces the efficacy of antibiotics and other drugs in humans, is linked to intensive animal farming (Silbergeld and Dailey, 2017). Overall, the health and environmental benefits of dietary change are projected to increase as the fraction of animal-sourced foods in human diets decreases, while economic benefits of improving diets could reach up to 0.4–13% of global gross domestic product (GDP) in 2050 (Springmann et al., 2016).

Besides its relevance for the environment and public health, meat consumption also relates to the question of how to treat farmed animals. An increasing number of philosophers argue that non-human animals should receive moral consideration (Gruen, 2017), suggesting that farmed animal suffering is morally relevant to our judgment of the consumption of animal-sourced products (Dawkins, 2008; Proctor et al., 2013). In fact, the stock of farmed animals exceeds that of the human world population manifold. Estimates suggest that the world's average stock of chicken is more than 22 billion, that of cattle about 1.5 billion, and that of pigs about 1 billion, naming three of the most popular farmed animals (FAO, 2017). In Germany alone, the estimates for chicken are at 160 million, for cattle at 12 million, and for pigs at more than 27 million (FAO, 2017). In other measures, livestock makes up an estimated 60% of the world's mammal biomass, the remainder being humans and wild mammals, while the biomass of domesticated poultry (mainly farmed chicken) is three times larger than that of wild birds (Bar-On et al., 2018). Since livestock production is often associated with dismal living conditions for the animals, such as extreme confinement

and pain inflicting procedures before slaughter, these figures suggest that a diet without or with less animal-sourced food has a large potential to reduce farmed animal suffering.

Eating meat is part of our culture and traditions

The vast majority of people consume meat. While about 22% of the world's population is estimated to follow a vegetarian diet, 95% of these vegetarians live in low-income households and are more likely to be vegetarians out of necessity rather than by choice (Leahy, 2010). In Germany, the share of self-defined vegetarians is about 3-6% of the population (Mensink et al., 2016; Pfeiler and Egloff, 2018). The figures for strict vegans are lower.

A potential explanation is that meat is part of our biological and cultural evolution (Smil, 2002; Leroy and Praet, 2015). In most parts of the world, eating meat is part of human traditions. For instance, meat and poultry dishes are traditional food on many holidays, including Christmas, Thanksgiving, and Eid Al-Fitr. Meat consumption in these contexts is linked to bringing people together, affirming a collective identity and belonging. However, meat consumption is also a means to differentiate between groups and individuals. The production of meat is resource intensive, creating differences in the availability and distribution across wealth levels. This can lead to the consumption of meat being seen also as a symbolic act, linking the differences in control over animals as a resource to social hierarchies and differences in status. In emerging economies, like China, meat consumption is associated with affluence, leading to excessive consumption to make up for experienced scarcity or to differentiate from the poor (Garentt and Wilkes, 2014).

In today's Western society, the picture appears to be changing: Meat consumption in high-income countries is found to decrease with education, income, and social class (Gossard and York, 2003; Koch et al., 2019). Vegetarians are shown to have higher incomes on average than omnivores and they are overrepresented among women, the youth, and better educated people (Allès et al., 2017; Pfeiler and Egloff, 2018; Koch et al., 2019). Although some of these differences may arise from differences in income constraints and ethical eating repertoires (Johnston et al., 2011), a vegetarian diet is also linked to greater perceived virtue than an omnivorous diet (Ruba and Heine, 2011). Western cultures also associate meat consumption with masculinity (Rozin et al., 2012). Men who follow a vegetarian diet are rated less masculine than men following an omnivorous diet (Rozin et al., 2012). This association may be driven by, but also contributes to, the pronounced gender divide in meat consumption. In Germany, for instance, men are almost three times less likely to follow a vegetarian diet than women (Mensink et al., 2016; Pfeiler and Egloff, 2018), consuming an average of about twice the amount of meat daily (Koch et al., 2019).

Alongside the consumption of animal products as part of our traditions, the meat industry in moderate- and high-income countries is also institutionalized in a way that facilitates excessive consumption. The product chain for animal products is not fully transparent to the consumer (Hoogland et al., 2005). Industrial livestock production and slaughtering take place out of the consumer's sight in remote, but well-connected, industrial areas (Friedrichsen and Huck, 2018). Products are dissociated from the source animal by removing identifying features and, in some languages, through labeling which evolved with language over time (i.e., "pork" instead of "pig meat", "beef" instead of "cow meat" in the English language).

Consumers differ in their perceived benefits of reduced meat consumption; health is an important motivator

What are the consumers' views on the benefits of reduced meat consumption? Survey studies from several high-income countries suggest that, on average, people are aware of the benefits of dietary change but not all benefits are motivating dietary change. When asked to judge different diets, even meat eaters consider vegetarian and vegan diets positively in terms of their impact on the environment, health, and their ethicality (Bryant et al., 2019). The perceptions of which diets are healthy and sustainable match strongly with the idea of plant-based eating (Loo et al., 2017). While health is a commonly mentioned motivator for adopting a more plant-based diet (Lea and Worsley, 2003; Mullee et al., 2017), environmental concerns are less commonly mentioned (Neff et al., 2018). One potential explanation for the latter is that consumers underestimate the climate impact of animal production (Vanhonacker et al., 2013). The reduction of animal suffering is not found to be a common motivator to reduce meat consumption (Neff et al., 2018), although consumers recognize this benefit (Lea and Worsley, 2003; Graça et al., 2015). In line with the tradition and institutionalization of eating meat, people also commonly mention habit (Lea and Worsley, 2003; Graça et al., 2015), as well as a lack of interest and awareness (Mullee et al., 2017) as reasons why diets with less meat are not adapted. Additionally, consumers may refrain from changing their behavior as their individual consumption only has a marginal impact on total consumption and production of meat and animal products.

Several studies suggest that consumer views of eating meat are heterogeneous across groups of consumers who have already adapted a meatless diet, those who would like to reduce their meat consumption, and those who would like to continue to follow their regular meat intake. Consumers who plan to reduce their meat intake commonly emphasize the benefits of meat reduction for health, while consumers who do not intend to change their diet commonly emphasize the nutritional benefits of meat (Neff et al., 2018). Similarly, consumers who have already adopted a meat-free diet or aim to reduce their meat intake are likely to mention animal welfare and health as benefits of a more plant-based diet, while consumers who are not willing to reduce their meat intake are more likely to deny the impact of their diet on their health and on animal welfare (Fox and Ward, 2008; Graça et al., 2015). Broadly speaking, individuals who already eat less meat or plan to reduce their meat consumption are more likely to acknowledge the benefits of a more plant-based diet, while individuals who would prefer to follow their regular, meat-based diet are less likely to do so (Lea et al., 2006a). In Germany, the share of meat eaters who are not motivated to change their diet is estimated to be 75% (Cordts et al., 2013).

The meat paradox: People eat animals despite a desire to avoid animal suffering

The phenomenon that many people eat animals but also care about them not suffering is termed the "meat paradox." While the dismal living conditions of livestock regularly feature in mainstream media outlets (for example, Süddeutsche Zeitung, 2019a, 2019b; RBB, 2019 in German media), consumers continue to buy and eat meat even though they recognize that conditions are far from optimal (te Velde et al., 2002). The conflict of beliefs and behavior observed in the meat paradox is suggested as a model for meat-eating behavior in psychology and economics (Bastian and Loughnan, 2017; Hestermann et al., 2019). Based on the theory of cognitive dissonance (Festinger, 1957), these models suggest that people experience discomfort due to cognitive dissonance that arises from the inconsistency between attitudes and behavior. To resolve such dissonance, consumers need to either reduce their meat consumption or adjust their beliefs about the implications of their consumption for animal suffering. The consumers' possibility to decrease their dissonance through changes in their beliefs, rather than their consumption, is facilitated in a society in which eating meat is not just ritualized and institutionalized but also a socially accepted habit. Prominent examples of such changes in beliefs are the denial of harm and the denial of responsibility. Studies show that presenting an animal as food (rather than, for

example, a pet) and the intent to consume an animal negatively affect whether people attribute human-like characteristics to that animal, such as the capacity to suffer, the attribution of mind and the deservingness of moral concern (see Loughnan et al., 2014 for a review; Piazza et al., 2015).

Perceived cost, convenience, and availability constrain consumers in reducing their meat consumption

When asked about the perceived difficulties with dietary change, people commonly state that vegetarian diets are less tasty, less affordable, and more inconvenient in terms of eating-out and cooking (Lea and Worsley, 2003; Mullee et al., 2017; Schenk et al., 2018; Bryant et al., 2019). Some consumers are also worried about the health consequences of shifting to a plant-based diet (Pohjolainen et al., 2015). Vegan diets score even lower in these aspects (Bryant et al., 2019). In fact, worldwide, the IPCC rates technological, institutional and socio-cultural barriers as large barriers to the feasibility of dietary change (IPCC, 2019).

Reduced meat consumption is associated with better public health in Western countries and consumers typically acknowledge these benefits. At the same time, many individuals also consider meat as necessary for a healthy and nutritious diet (Lea and Worsley, 2001; Graça et al., 2015). In shifting to a plant-based diet, individuals risk insufficient intake of some nutrients, including vitamin B12, vitamin B6, iron, vitamin D, calcium, zinc, and iodine. However, studies suggest that these risks can be offset with a varied consumption of food and, if necessary, supplements (Dwyer, 1991; Mann, 2000; Goldfrey et al., 2018). Overall, reviews suggest that plant-based diets are nutritionally adequate (Position of the American Dietetic Association and Dietitians of Canada: Vegetarian diets, 2003; Sabaté, 2003; Willett and Stampfer, 2013; Katz and Meller, 2014; for Germany: Koch et al., 2019). Thus, although plant-based diets can be beneficial for one's health and people are interested in learning more about them (Lea et al., 2006b), a lack of easily accessible information about plant-based diets is a major barrier to adopting one.

The adoption of vegetarian and vegan diets is also constrained by their perceived cost and availability. The willingness to consume less meat is higher than the consumers' willingness to pay for alternative diets and the willingness to consume plant-based meat or alternative sources of protein (such as insects and hybrid meats) is low (Vanhonacker et al., 2013). At the same time, reducing the costs of one's diet is also a commonly mentioned reason for reducing one's meat consumption (Neff et al., 2018). This suggests that, besides information about how to prepare meatless meals that are affordable and nutritious, dietary change is also linked to the availability and convenience of meatless alternatives, such as meatless options in restaurants and vegetarian/vegan product alternatives in stores. With regards to technological change, the development and availability of meat substitutes and even artificial meat are highly debated options that have the potential to address perceived constraints to reduced meat consumption, including taste. Studies of consumer attitudes suggest that meat eaters avoid meat substitutes mainly because they are not familiar with them and because of their (expected) lack of sensory appeal (Hoeck et al., 2011).

Which measures could reduce the demand for meat?

The demand for meat and other animal-sourced food products may be reduced by targeting barriers and enablers of dietary change. One such approach is to inform consumers about the consequences of eating meat and animal products and about the benefits of switching to more plant-based diets. Lectures on the effects of meat consumption on climate change and health are found to reduce meat consumption (Jalil et al., 2019). Further, it is found that information on the negative effects of meat

consumption on animal welfare, health, and the climate increases individuals' intentions to decrease their meat consumption in the future (Cordts et al., 2014). However, the evidence surrounding the meat paradox suggests that consumers may avoid or disregard unpleasant information about the negative effects of their meat consumption to avoid feelings of discomfort with respect to their own behavior (Rothgerber, 2020; Gaspar et al., 2016).

Behavioral interventions may be more effective than information and educational interventions, though the latter are less well studied (Bianchi et al., 2018a). Consumption behavior can be understood as influenced by the psychological and physical capability to perform a given behavior, the opportunity to do so – including social aspects like norms but also physical aspects like availability – and the individual motivation, comprising both deliberate reasoning and habits (Graça et al., 2019). Accordingly, research has explored interventions that target different barriers or enablers of dietary change. Previous research suggests that individual purchasing behavior can be influenced by grocery store-level interventions that manipulate prices, suggest product swaps, or manipulate item availability (Hartmann-Boyce et al., 2018). Individuals can also be supported in their attempts to reduce their meat consumption by encouraging self-monitoring their meat consumption, through individual lifestyle counselling, and through changes in their eating habits and food repertoire, including the serving of smaller meat portions or meat alternatives (Bianchi et al., 2018a; Bianchi et al., 2018b; Taufik et al., 2019; Reinders et al., 2020).

Taxation of animal products could facilitate behavior change

The production and consumption of meat have severe external effects and are associated with ethical problems. Therefore, some researchers argue that state intervention into the market for animal products is required to facilitate and complement changes in consumers' diets (Spiller, 2019). Taxation of meat and animal products or animal welfare contributions are examples of state interventions. A tax on animal products would increase the price of meat. As consumer surveys suggest that dietary choices are sensitive to cost arguments, a tax would have a direct, negative effect on meat consumption. Moreover, the theoretical analyses of the meat paradox suggest that lower meat consumption levels would lead to increased concern for animal welfare (through debiasing consumers' beliefs about animal suffering), which may have an additional indirect, negative effect on meat consumption.

The total effects of such a tax would depend on many factors, including the level of the tax and its coverage, whether it is ad valorem or based on the weight of the product, as well as the elasticities of demand. Further, the aggregate effect will depend on substitution patterns toward products with lower taxes and on the market structures. Indeed, studies from several European countries suggest that CO_2-taxes on animal products can contribute to reducing total CO_2-emissions but that positive effects are not certain, rather depending on many factors (Säll and Gren, 2015; Bonnet et al., 2018; Dogbe and Gil, 2018; Forero-Cantor et al., 2020). As an alternative to a tax, some suggest an animal welfare contribution, the proceeds of which could be used to support farmers in investing in measures that improve livestock living conditions and animal welfare (see FÖS (2020) for a detailed discussion with a focus on Germany). Generally, an increase in prices for animal products will have heterogeneous effects on consumption depending on the consumer's income, information, involvement, time constraints, cooking skills, and tastes.

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