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Food systems determine obesity and climate change

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An Editorial on the Frontiers in Science Lead Article
Obesity and climate change: co-crises with common solutions

Key points

- The pandemics of obesity and climate change are connected by the food system.
- Beef and ultra-processed food (UPF) production in the United States food supply chain simultaneously drive globally unsustainable diets.
- Reductions in beef, shifts toward the consumption of plant-rich diets, and reductions in UPF consumption represent double-duty solutions: they improve the health of people and the planet.

Obesity and climate change have increased in parallel. As we argued in the Lancet Commission on the global syndemic of obesity, undernutrition, and climate change, these interrelated crises adversely impact each other through the food system (1, 2). Both obesity and climate change are costly, preventable, and resistant to policy. In their lead article, Behrens et al. propose that the global food system, dominated by the production and promotion of foods that jeopardize the health of people and the planet, is the root cause of these crises (3). We agree.

The urgency of food systems transformation

Food systems are the leading driver of planetary boundary transgressions, exceeding the biophysical limits that define a safe operating space for humanity, including climate change, biodiversity loss, land use change, and nitrogen and phosphorus pollution (4, 5). Food system reform is urgently needed because crossing these boundaries increases the risk of irreversible environmental damage and instability.

Experts in public health, environmental science, and economics, including the EAT-Lancet Commission, have supported the shift to plant-rich diets to improve health outcomes, reduce the burden of diet-related chronic disease globally, and minimize the climate and environmental impact of food systems (5, 6). The 2019 EAT-Lancet Commission presented

the Planetary Health Diet (PHD) framework, emphasizing whole and minimally processed grains, vegetables, fruit, legumes and nuts, while limiting meat and dairy (6). The updated 2025 EAT-Lancet Commission reaffirmed the PHD and the need to prioritize region-specific actions to achieve equitable food system transformation (5). PHD adoption in high and upper-middle income countries is a high priority because this wealthiest third of the global population disproportionately consumes meat and dairy and accounts for more than 70% of the food system's share of planetary pressure.

The United States' role in food systems transformation

Food systems generate one-third of greenhouse gas (GHG) emissions globally. The United States is the second major contributor to total GHG emissions, and fourth in per capita diet-related emissions behind China, India, and Brazil. Unsustainable patterns of agricultural production and dietary consumption in the United States reinforce food systems that prioritize profit over human and planetary health. Specifically, United States' food and agriculture are dominated by beef and ultra-processed foods (UPFs), whose interrelated supply chains exacerbate climate change and obesity domestically and globally.

The beef and UPF industries are large-scale and consolidated. Overproduction and subsidization of commodity crops, animal feed, and sweeteners provide cheap inputs that fuel both supply chains. As a result, UPFs, beef, and other resource-intensive animal-sourced foods (i.e., dairy) are produced at scale and consumed in large quantities in the United States and increasingly around the world.

Beef

The United States food system generates approximately 10% of national GHG emissions, most of which are related to meat production. Beef production is by far the biggest source of agricultural emissions. Emissions per gram of protein from beef are almost 250-fold those from other protein sources, such as legumes. While climate action often focuses on carbon dioxide (CO_2) emissions, these represent a small portion of agricultural GHG emissions. Nearly half of United States agricultural emissions come from methane (CH_4) mostly generated by cattle; nitrous oxide (N_2O) accounts for the other half and is derived from fertilizer applied to high-yield commodity crops used to feed livestock. Compared with CO_2, CH_4 and N_2O are respectively 36- and 265-fold more powerful GHGs. However, CH_4 has a much shorter lifespan in the atmosphere than CO_2, providing an opportunity for significant short-term reductions in global warming. In contrast, NO_2 has a much longer lifespan, making its contribution more difficult to reverse. A dietary shift reducing both CH_4 and N_2O emissions offers one of our biggest potential levers to reduce climate change.

The United States is a top producer and consumer of beef globally; American dietary patterns produce nearly double the GHG limits set by the EAT-Lancet Commission (6). Compounding its climate impact, excess red meat consumption increases the risk of obesity, cardiovascular disease, and colorectal and other cancers. Despite evidence linking red meat consumption with increased health risks, high rates of beef consumption are woven into American dietary and social norms, ultimately sustaining demand and high rates of production. For example, fast food plays a key role in beef's dominance: more than one in three American adults consume fast food on any given day and fast food represents more than 20% of beef consumption.

Ultra-processed foods

UPF consumption increases the risks of obesity and other diet-related chronic diseases, reduces dietary quality, and displaces traditional dietary patterns. The prevalence of obesity in the United States began to rise in the 1970s, simultaneously and in parallel across men and women in different age groups, followed by a lag in parallel increases globally (7). This observation suggested a common, population-wide exposure.

The ubiquitous use of high fructose corn syrup (HFCS) in processed foods and drinks, and chemicals such as perfluorooctane sulfonic acid (PFOS) and polyfluroalkyl substances (PFAS) in packaging, began concurrently with the rise in obesity and may be causally related. HFCS consumption in the United States increased 10-fold between 1970 and 1990, and in 1994–1996 accounted for 16% (318 kcal/person/day) of caloric intake (8). The rise in HFCS production preceded then roughly paralleled the increase in the prevalence of obesity (9). Just as corn production for cattle feed bolsters the beef industry, its production for HFCS bolsters the UPF industry. The scale of both industries and the associated climate and health impacts are, at least in part, a product of the agricultural system that prioritizes profit.

PFOS and PFAS in packaging may also have contributed to the rising obesity prevalence. These compounds have been associated with obesity, diabetes, liver disease, and impaired immune function and were not present in blood samples before 1969–1971. As with HFCS, the rise in the production of these and other chemicals roughly follows the rise in the prevalence of obesity. Together with HFCS and UPFs, the chemicals in packaging may provide a double exposure that leads to obesity. Moreover, the contribution to climate change of UPF production, processing, and packaging has received limited attention and remains an important area for future research.

Bridging obesity and climate change

The impact of agricultural production systems differs in certain localized contexts. UPF- and meat-centric diets are two sides of the same food supply system, one that is resource-intensive, promotes overconsumption, and drives poor health outcomes. Obesity and climate change are both driven by food systems that incentivize unhealthy and unsustainable options. Their shared root causes

provide an opportunity to identify double-duty solutions. For example, from a demand perspective, the transition to healthy and sustainable diets has direct health benefits and is likely more feasible than the transition to reduced car use.

As Behrens et al. emphasize, concentrated global food supply chains challenge the transition to healthy and sustainable diets by structuring what is available, accessible, and ultimately demanded. Thus, the transition from high rates of beef and UPF consumption to plant-rich diets requires shifting both supply and demand. We need practical strategies to incentivize this shift. We cannot continue to propose "eating healthy and sustainably" without transforming our systems to make that behavior easier.

Practical strategies for food system transformation

Activating local policy to shape food environments

Food system approaches can be used to influence behavior as a mechanism for shifting demand for plant-rich diets. Local policy action can demonstrate the impact of various interventions and motivate change at a larger scale. One notable example is food procurement by institutions such as government agencies, large businesses, schools, hospitals, and universities leveraging their purchasing power to facilitate healthy and sustainable consumption, as well as to encourage production of plant-rich foods. Analysis across 19 United States universities showed current food procurement exceeded planetary health targets for animal-based products and failed to meet targets for legumes and nuts, vegetables, and whole grains. Aligning university procurement with EAT-Lancet Planetary Health Diet is a triple-duty solution that would increase Healthy Eating Index scores while significantly reducing GHG emissions and food costs (10). Applying this strategy to school meals is particularly important given their influence on children and adolescents' eating habits into adulthood.

Shifting mindsets

While individual-level actions are often touted as part of an industry-driven narrative to limit policy change, individuals and communities represent change agents. Shifting consumer demand through exposure to healthy and sustainable options and information campaigns is key to political and systemic food system change but is challenging. Dietary behavior is deeply embedded in social, economic, environmental, and political factors, and our food systems are complex. Tailored approaches for incentivizing reductions in beef and UPF consumption by consumer segment should be a priority. However, population-level campaigns that emphasize the gains from plant-rich food consumption, rather than the losses, may be compelling. Future efforts should assess the effectiveness of flipping the narrative on dietary change to align with consumer values on taste, affordability, health, tradition, and community.

Food systems in developed countries confer a major moral obligation to reduce their outsized contribution to global warming and the obesity crisis. Reductions in beef, shifts toward the consumption of plant-rich diets, and reductions in UPF consumption represent double duty solutions: they improve the health of people and the planet. Changing food environments to promote healthy and sustainable options, and changing how we communicate about food systems and their impact on humans and the planet, are actionable steps toward food system transformation.

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WHD: Conceptualization, Writing – original draft, Writing – review & editing.

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