

Ultra-processed foods should be central to global food systems dialogue and action on biodiversity

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INTRODUCTION

The worldwide spread of a ‘globalised diet’, characterised by an abundance of branded ultra-processed foods, has, in many countries, come at the expense of the cultivation, manufacture, retail and consumption of fresh and minimally processed foods that comprise traditional diets. Supermarket shelves are often packed with highly advertised ultra-processed products that are made from ingredients derived from a handful of high-yielding crops (eg, glucose syrup, gluten and soy protein extracted from maize, wheat and soy, respectively).^{1–3} These products already account for more than half of the energy intake in the USA and in the UK; more than a third of the energy intake in Australia and France and are rising rapidly in lower-income countries within Asia, Africa and Latin America.^{4,5} Some subsections of populations have moved towards vegetarianism or veganism, but dietary patterns overall are now becoming higher in animal-sourced foods, usually from industrial production systems that use animal feed inputs from the same crops. This commentary highlights the impact of global diets characterised by a high intake of ultra-processed foods on agrobiodiversity. It calls for prioritising and addressing ultra-processed foods in global food system dialogues and policy, and country-level action.

AGROBIODIVERSITY IS UNDER SEVERE THREAT

Agrobiodiversity is ‘the variety and variability of animals, plants and microorganisms that are used directly or indirectly for food and agriculture’,⁶ and is crucial for resilient and sustainable food systems. Agrobiodiversity comprises the diversity of genetic resources and species used for food, fodder, fuel and pharmaceuticals. It includes the diversity of non-harvested species that support food

Summary box

- ▶ The global industrial food system and consequent rapid rise of ultra-processed foods is severely impairing biodiversity. Yet although the impacts of existing land use and food production practices on biodiversity have received much attention, the role of ultra-processed foods has been largely ignored.
- ▶ An increasingly prominent ‘globalised diet’, characterised by an abundance of branded ultra-processed food products made and distributed on an industrial scale, comes at the expense of the cultivation, manufacture and consumption of traditional foods, cuisines and diets, comprising mostly fresh and minimally processed foods.
- ▶ Ultra-processed foods are typically manufactured using ingredients extracted from a handful of high-yielding plant species, including maize, wheat, soy and oil seed crops. Animal-sourced ingredients used in many ultra-processed foods are often derived from confined animals fed on the same crops.
- ▶ The contribution of ultra-processed foods to agrobiodiversity loss is significant, but so far has been overlooked in global food systems summits, biodiversity conventions and climate change conferences. Ultra-processed foods need to be given urgent and high priority in the agendas of such meetings, and policies and action agreed.

production, and those in the wider environment that support and diversify agroecosystems.⁶

Global agrobiodiversity is declining, especially the genetic diversity of plants used for human consumption. More than 7000 edible plant species have been identified and used for human food since the origin of agriculture,⁷ but fewer than 200 species had significant production in 2014, and just nine crops accounted for more than 66% by weight of all crop production.⁸ A total of 90% of humanity’s energy intake comes from just 15 crop plants, and more than four billion people rely on just three of them: rice, wheat

and maize.⁹ Such decline in biological diversity in food systems,¹⁰ disrupts and damages biospheric processes and ecosystems that support reliable and sustainable food production, decreases diet diversity and poses a barrier to healthy, resilient and sustainable food systems.

THE GLOBAL RISE OF ULTRA-PROCESSED FOODS IS DAMAGING AGROBIODIVERSITY

Ultra-processed foods are ready-to-eat or heat formulations made by assembling food substances, mostly commodity ingredients, and ‘cosmetic’ additives through a series of industrial processes.¹¹ They include many products, such as sweetened or salty snacks, soft drinks, instant noodles, reconstituted meat products, pre-prepared pizza and pasta dishes, packaged breads, biscuits and confectionery.¹¹ Such products are the mainstay of a ‘globalised diet’ and are becoming dominant in the global food supply, with sales and consumption growing in all regions and almost all countries, now most rapidly in upper-middle-income and lower-middle-income countries.⁵ This means that dietary patterns worldwide are becoming increasingly more processed and less diverse. This transition has been mainly driven by the industrialisation of food systems, technological change and globalisation, including the expansion and growing market and political power of transnational food and beverage corporations, and their global sourcing and production networks.⁵ Developments in the retail sector have also contributed to growing and diversifying ultra-processed food markets, particularly in lower-income and middle-income settings.⁵

Displacement of traditional dietary patterns based on a rich variety of fresh and minimally processed foods and freshly prepared meals by ultra-processed foods, is undermining the diversity of edible plant species available for human food. Ultra-processed foods are manufactured with ingredients obtained from just a few high-yielding plant species.³ An ongoing study of 7020 ultra-processed foods sold in the main Brazilian supermarket chains found that their five main ingredients included food substances derived from sugar cane (52.4%), milk (29.2%), wheat (27.7%), corn (10.7%) and soy (8.3%) (unpublished data). In Australia, the top ingredients in the 2019 packaged food and drink supply (24229 products, mostly ultra-processed), included sugar (40.7%), wheat flour (15.6%), vegetable oil (12.8%) and milk (11.0%).¹² Subsequently, diets are less diverse, with ultra-processed foods displacing the variety of wholefoods necessary for a balanced and healthy diet.

The homogeneity of agricultural landscapes linked with the intensive use of cheap standardised ingredients is negatively affecting cultivation and consumption of long established plant food sources, including rich varieties of grains, pulses, fruits, vegetables and other whole foods, commonly produced by agrobiodiverse production systems.¹⁰ Some commodities used in ultra-processed

food production, such as cocoa and some vegetable oils, have particularly high per kilogram species extinction rates.¹³ Ultra-processed food production also uses large quantities of land, water, energy, herbicides and fertilisers; and causes eutrophication and environmental degradation from greenhouse gas emissions and accumulation of packaging waste (Anastasiou *et al*, unpublished data).¹⁴ As well as species loss, all this is liable to cause ecosystem collapse, further affecting biodiversity.

Ultra-processed reconstituted meat products, such as hot dogs and chicken nuggets, cause additional agriculture biodiversity loss. Such ingredients of animal origin usually come from confined animals (mostly from a small number of livestock breeds)¹⁰ fed on concentrates largely made with ingredients from the same few high-yielding crops used in the manufacture of plant-based ultra-processed foods. A study of the Brazilian agri-food system found that the production of beef uses pasture and feedlot rations from just six plant varieties: *brachiaria* (the most prevalent forage plant), corn, soybean, cotton, sorghum and wheat.¹⁵ Feedlot rations for US beef production rely on just five plant species (maize, sorghum, barley, oats and wheat).¹⁶ The high demand for pastureland and for monocultures required in the production of animal-sourced foods directly affects the production of other plant varieties. In Brazil, for example, staple food crops such as rice and beans have had their production areas reduced by around 43% and 30%, respectively, between 2008 and 2019. The area for soy production, largely used in livestock feed and as an ingredient in ultra-processed foods, increased by 69.9% in the same period.¹⁷

The effect of ultra-processed diets on agricultural biodiversity urgently warrants further research. Preliminary findings from an ongoing study conducted with data from the Brazilian Household Budget Survey (2017–2018) to investigate the impacts of different patterns of food acquisition on the diversity of plant species used in their production, show that household food baskets with a higher content of ultra-processed foods were associated with significantly poorer agricultural biodiversity (Shannon Entropy, which reflects the diversity of species, decreasing by 13.8% from the first to the fifth quintile) (unpublished data).

THE NEED TO REFOCUS GLOBAL AGENDAS

Food policy dialogue and action must pay greater attention to the agrobiodiversity destruction caused by the global industrial food system. A study based on the Intergovernmental Panel on Climate Change’s Special Emissions Scenarios report shows that even if ecological values become more valued by, and relevant to, citizens and policymakers, production and consumption of food, including animal products, will continue to increase.¹⁸ At present, industrial food systems that drive increased access to, and consumption of, ultra-processed foods will continue using more land, making it increasingly

impossible to use land for crops that enable healthy and sustainable dietary patterns.

The unprecedented rates of biodiversity loss highlight the need for a rapid transition to dietary patterns that are rich in varieties of plant-sourced, fresh and minimally processed foods. Although the Food and Agriculture Organization and World Health Organization have been emphasising the effect of dietary patterns on human health and on ecosystems, little has been done to safeguard the health of people, animals and the environment, all together.

The calamitous effects of ultra-processed foods on human health are well documented.⁴¹⁹ However, awareness of their disastrous impact on human and planetary health remains low, and ultra-processed foods are subsequently missing from international development agendas. In the Zero draft of the United Nations Biodiversity Conference 2021,²⁰ ultra-processed foods are not once mentioned, and there is not even a reference to the impact of the global industrial food system on biodiversity loss. Instead, a focus is on preserving and increasing consumption of wild species, and not on reducing production and consumption of foods that overall damage biodiversity.

Similarly, the UN Food Systems Summit Action Track 2 (Shifting to Sustainable Consumption)²¹ and the subsequent solutions and coalitions (eg, Healthy Diets from Sustainable Food Systems for Children and All)²² identify animal-sourced foods, and foods high in fat, salt, sugar, as issues of concern, but make little reference to food processing, and say nothing about ultra-processed foods or their environmental impact. Although it is important that current global agendas consider the environmental impacts of food/animal production, caution is needed to avoid diverting attention away from the significant environmental effects of other components of food supply chains.²³ In particular, the adverse impacts of ultra-processed foods on agrobiodiversity and broader environmental sustainability are nascent areas of research that need to be nurtured, not inadvertently 'squeezed out' from research and policy agendas.

CONCLUSION

The very rapid rise of ultra-processed foods in human diets will continue to place pressure on the diversity of plant species available for human consumption. Future global food systems fora, biodiversity conventions and climate change conferences need to highlight the destruction of agrobiodiversity caused by ultra-processed foods, and to agree on policies and actions designed to slow and reverse this disaster. Relevant policymakers at all levels, researchers, professional and civil society organisations, and citizen action groups, need to be part of this process.

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REFERENCES

- Leite FHM, de Carvalho Cremm E, de Abreu DSC, et al. Association of neighbourhood food availability with the consumption of processed and ultra-processed food products by children in a city of Brazil: a multilevel analysis. *Public Health Nutr* 2018;21:189-200.
- Borges CA, Gabe KT, Jaime PC. Consumer food environment healthiness score: development, validation, and testing between different types of food Retailers. *Int J Environ Res Public Health* 2021;18. doi:10.3390/ijerph18073690. [Epub ahead of print: 01 Apr 2021].
- Fardet A, Rock E. Ultra-processed foods and food system sustainability: what are the links? *Sustainability* 2020;12:6280-26.
- Monteiro CA, Lawrence M, Millett C, et al. The need to reshape global food processing: a call to the United Nations Food Systems Summit. *BMJ Glob Health* 2021;6:e006885.
- Baker P, Machado P, Santos T, et al. Ultra-processed foods and the nutrition transition: global, regional and national trends, food systems transformations and political economy drivers. *Obes Rev* 2020;21:e13126.
- Food and Agriculture Organization of the United Nations (FAO). What is agrobiodiversity? 1999. Available: <http://www.fao.org/3/y5609e/y5609e01.htm>
- Antonelli A, Fry C, Smith RJ. *State of the World's Plants and Fungi* 2020, 2020. <https://www.kew.org/sites/default/files/2020-10/State%20of%20the%20Worlds%20Plants%20and%20Fungi%202020.pdf>
- Food and Agriculture Organization. The state of the world's biodiversity for food and agriculture. In: Pilling JBD, ed. *FAO Commission on genetic resources for food and agriculture assessments Rome*. 572. Rome: FAO, 2019.
- Food and Agriculture Organization of the United Nations (FAO). *The Commission on Genetic Resources for Food and Agriculture (CGRFA) Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture (PGRFA)*. Rome, Italy: FAO, 2012.
- Rist S, Bonanomi EB, Giger M. *Variety is the source of life: agrobiodiversity benefits, challenges, and needs*. Swiss: Swiss Academy of Sciences (SCNAT), 2020.
- Monteiro CA, Cannon G, Levy RB, et al. Ultra-processed foods: what they are and how to identify them. *Public Health Nutr* 2019;22:936-41.
- Gaines A, Shahid M, Huang L, et al. Deconstructing the supermarket: systematic ingredient disaggregation and the association between ingredient usage and product health indicators for 24,229 Australian foods and beverages. *Nutrients* 2021;13. doi:10.3390/nu13061882. [Epub ahead of print: 31 May 2021].
- Moberg E, Karlsson Potter H, Wood A, et al. Benchmarking the Swedish diet relative to global and national environmental targets—Identification of indicator limitations and data gaps. *Sustainability* 2020;12:1407.

- 14 Anastasiou K, Baker P, Hadjikakou M. A review of the environmental impacts of ultra-processed foods: what are the implications for sustainable food systems? under review.
- 15 Fortes MF, Leite FHM, Garzillo JMF. Analysis of the impact of the meat supply chain on the Brazilian agri-food system. *SSRN* 2021.
- 16 Eshel G, Shepon A, Makov T, *et al*. Partitioning United States' feed consumption among livestock categories for improved environmental cost assessments. *J Agric Sci* 2015;153:432–45.
- 17 CONAB. *Portal de informações agropecuárias (agricultural information)*. Companhia Nacional de Abastecimento (national supply company). Brasília: CONAB, 2020.
- 18 Bodirsky BL, Rolinski S, Biewald A, *et al*. Global food demand scenarios for the 21st century. *PLoS One* 2015;10:e0139201.
- 19 Monteiro CA, Cannon G, Lawrence M. *Ultra-processed foods, diet quality, and health using the nova classification system*. Rome: Food and Agriculture Organization, 2019.
- 20 Convention on Biological Diversity. *Recommendation adopted by the open-ended working group on the post 2020 global biodiversity framework*. Rome, 2020.
- 21 United Nations. Action Track 2 – Shift to healthy and sustainable consumption patterns, United Nations Food Systems Summit 2021. In: *Action track discussion starter: United nations*, 2021.
- 22 United Nations Food Systems Summit. *The Coalition of Action for Healthy Diets from Sustainable Food Systems for Children & All*, 2021. <https://foodsystems.community/coalitions/the-coalition-of-action-for-healthy-diets-from-sustainable-food-systems-for-children-all/>
- 23 Crippa M, Solazzo E, Guizzardi D, *et al*. Food systems are responsible for a third of global anthropogenic GHG emissions. *Nat Food* 2021;2:198–209.