Effects of plastics in the food system on human health, food security, and the environment: a systematic scoping review

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Abstract

Background Due to their characteristics, plastics are ubiquitous across global food systems, which is contributing to environmental pollution. Circular economy policies should account for the myriad effects of plastics across interdependent environmental, human health, and food security and economic domains. However, the available evidence is disparate, and researchers and policymakers do not share a common strategy for addressing this planetary health problem. We aimed to synthesise data from this diverse research landscape to facilitate multidisciplinary collaboration.

Methods In this systematic scoping review, we searched nine databases and 15 grey literature sources, for studies published from the year 2000 onwards (up to January, 2019). We sought to identify quantifiable evidence on major plastic types used in all processes from agricultural production to waste management (so-called farm to flush); and studies presenting quantifiable outcomes (direct or intermediate, beneficial or harmful) in relation to human health, food security, household economics, and the environment. Findings were presented in an evidence gap map. A full study protocol was registered with the Campbell Collaboration.

Findings 3362 studies were included in our review and evidence gap map. Between 2000 and 2019, a 4-times increase in published studies occurred, with China, India, and the USA accounting for 1175 (34·9%) studies, and low-income settings just 54 (1·6%) studies. Plastics used in agricultural production and processing, and storage and transportation were well researched (1869 [55·6%] studies and 1117 [33·2%] studies, respectively), with considerably less research of plastic use in the retail, consumption, and food waste disposal subsectors. Food security outcomes were most frequently captured (2546 [75·7%] studies), with human health (1602 [47·7%] studies) and the environment (282 [8·4%] studies) accounting for substantially less research. Agricultural plastics used to drive productivity or efficiencies were commonly researched (1730 [51·5%] studies), as was plastic packaging and effects on nutritional quality, longevity, or safety of foodstuffs (1090 [32·4%] studies). Little evidence was available regarding on-farm plastic pollution or contamination (34 [1·0%] studies), or regarding the effects of food system plastics on human health (39 [2·4%] studies). Just eight meta-analyses (0·2% studies) were captured, all exploring plastic mulching and row covers.

Interpretation The evidence base regarding the effects of food system plastics on planetary health domains is imbalanced. This review highlights key evidence gaps to fill before circular economy policies can truly account for benefits and harms across different domains.

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Contributors
JY, MD, SoK, and SuK conceived the study. MD, HBR, JY, and SuK curated data. HBR, MD, and JY analysed data. SuK and JY acquired funding. JY, MD, HBR, EJ, SuK, and HW designed the methodology. MD and JY were responsible for project administration. SuK and HW supervised the study. JY, MD, and HBR wrote the original draft. JY, MD, HBR, SuK, and HW reviewed and edited the manuscript.

Declaration of interests
We declare no competing interests.