Heterogeneous impacts of dietary transition in China on planetary boundaries

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Population ageing in China is reshaping the food system and associated environmental impacts via global supply chains, yet the expected pressure on the proposed planetary boundaries and the possible environmental consequences of dietary changes are still unknown. Here we adopt a quadratic almost ideal demand system (QUAIDS) model and the EXIOBASE database to estimate Chinaâ€™s food-related environmental footprints (greenhouse gas emissions, eutrophication and cropland use) across age groups from 2020 to 2060, based on population projections aligned with the Shared Socioeconomic Pathway 2 (SSP2). Considering the nationâ€™s ongoing population ageing, we found its total food-related environmental footprints will continue to increase and reach a peak around the year 2050. This temporal trend is primarily driven by the rising purchase power of young adults (20-59 years) and increasing elderly populations (60+ years). Under the business-as-usual scenario, the projected environmental impacts would exceed Chinaâ€™s local safe boundary for phosphorus flows and land-system change by nearly half. Due to environmental spillover effects, the regional-level planetary boundary of Chinaâ€™s trading partners would also be highly occupied, particularly European countries (Netherlands, Ireland, Germany, and Spain) and South American countries (Brazil and the rest of America). Moving Chinaâ€™s current trend-oriented food choices to healthy dietary patterns could alleviate 0%â€“8% possible pressure on the planetary-level safe boundary. Regionally, compared to the reference diet, the dietary transition could ease environmental pressure, especially for South American countries (reduction of 0%â€“7%) due to the reduced red meat consumption, and concurrently put additional pressure, especially for European countries (growth of 2-45%) because of increased dairy consumption. The study reveals that targeted dietary changes in China would not be enough to globally mitigate the expected environmental pressure on the food system sustainability.