

## Abstract

# The Role of Ultra-Processed Foods in Plant-Based Diets: Associations with Human Health and Environmental Sustainability <sup>†</sup>

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**Abstract:** Background: The growing consumption of ultra-processed foods (UPFs) among vegetarians and vegans may occur at the expense of the health and environmental benefits of plant-based diets. Objectives: This study aimed to investigate the associations of UPFs in plant-based diets with all-cause mortality and environmental impact. Methods: Analyses were based on 35,030 participants (20–70 years; 74% females) from the EPIC-NL cohort who were followed up from 1993 to 1997 through 2014. The Plant-Based Diet Index (PDI) and UPF consumption (g/2000 kcal) were calculated using a validated FFQ. Based on a median split of the PDI and UPF consumption, four dietary categories were created (e.g., high PDI score/low UPF consumption). Cox proportional hazard and multiple linear regression models were used to estimate associations with all-cause mortality risk, greenhouse gas (GHG) emissions, and blue water consumption. Results: Among diets high in plant-based foods, higher UPF consumption tended to be associated with a 5% (HR: 1.05, CI: 0.95, 1.16) increased all-cause mortality risk and was statistically significantly associated with 1.3% (95% CI: 0.7, 1.9) higher GHG emissions and a 2.5% (95% CI: −3.1, −1.3) lower blue water consumption compared to lower UPF consumption. Diets lower in plant-based foods were associated with a 15% (HR: 1.15, CI: 1.05, 1.26) and 24% (HR: 1.24, CI: 1.13, 1.36) increased mortality risk, 11.7% (95% CI: 11.4, 12.3) and 12.5% (95% CI: 11.9, 13.0) higher GHG emissions, and 8.8% (95% CI: −9.4, −8.2) and 11.3% (95% CI: −12.6, −10.7) lower blue water consumption for low and high UPF consumers, respectively, compared with diets high in plant-based foods and low in UPF. Discussion: UPF consumption did not counteract the health and (reduced) environmental impacts of adhering to a more plant-based diet, although special concern needs to be given to the high blue water consumption of specific plant foods. Future research should clarify whether this also holds for current settings in which populations consume higher amounts and different types of (plant-based) UPFs.

**Keywords:** plant-based diet; ultra-processed foods; NOVA classification; all-cause mortality; environmental impact; cohort study



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**Informed Consent Statement:** Informed consent was obtained from all participants involved in the study.

**Data Availability Statement:** Internal rules apply to the use of EPIC-NL data. Requests to work with the data are dependent on approval and should be sent to the cohort staff.

**Conflicts of Interest:** The authors declare no conflict of interest.

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