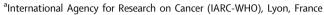
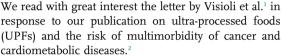
Ultra processed foods and cancer-authors' reply

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Visioli et al. commented on the heterogeneity found in the association between the consumption of different subgroups of UPFs and the risk of multimorbidity. A specific concern expressed by Visioli et al. was that among the nine UPF subgroups investigated, only the consumption of foods of animal origin and sugary or artificially sweetened beverages were associated with such risk. And if we were to adjust for both of these UPF subgroups, the association of total UPF consumption with the risk of multimorbidity would disappear. In a post-hoc analysis as suggested by Visioli et al., the results shifted as expected to the null after adjusting for both of these UPF subgroups (Multimorbidity_{direct} hazard ratio (HR)_{1SD} 0.98; 95% confidence interval (CI): 0.90-1.06), and similarly in a second post-hoc analysis when excluding both animalbased foods and artificially and sugar-sweetened beverages from total UPF (Multimorbidity_{direct} hazard ratio (HR)_{1SD} 1.00; 95% confidence interval (CI):0.97–1.04).

They also state that the data presented do not fully support the conclusions. However, we acknowledged in the article that UPFs of animal origin and sugary or artificially sweetened beverages were associated with higher risk of multimorbidity, whereas other UPFs showed an inverse association, with a borderline certainty, or were not associated with risk. In the conclusion of the discussion, we suggest that more nuanced subgroup analyses of UPFs are warranted.

The points raised by Visioli et al. go beyond our study, and we take this opportunity to provide the reader with our view of the UPF concept, and why we investigated UPF subgroups.

In our analysis, we applied the Nova food processing classification system that differentiates four categories of foods based on the extent and purpose of processing.³ The exposure of interest in our study was Nova group 4; i.e., UPFs. The group of UPFs encompass a broad range of products, which we acknowledged in our article, and necessarily vary considerably in terms of nutrient profile

and processing characteristics; some UPF products may have a better nutrient profile than others.⁴ As correctly pointed out by Visioli et al., these differences across UPF subgroups appear to impact health outcomes differentially, and not all UPF subgroups affect risk. However, UPFs are usually consumed in combination resulting in a dietary pattern characterized by a higher dietary share across all UPF subgroups. Differences among UPF subgroups are then possibly less important than the average quality of the whole UPF group.⁴ Replacing UPFs with less processed foods should

Nevertheless, we and others⁵⁻⁹ think that there is value in understanding which UPFs are driving most associations with health outcomes, and we would therefore welcome additional studies on UPF subtypes. This should facilitate identifying potential mechanisms of the relationship between UPF consumption and health outcomes, and perhaps provide more nuanced guidance for public health.

therefore be encouraged whenever feasible.5

Contributors

All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication. All authors contributed to the article and approved the submitted version. Writing original draft: HF, DA, RC. Writing–review & editing: HF, DA, RC, K-HW.

Disclaimer

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Declaration of interests

The authors declare no conflicts of interest.

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