

# Assessment of the Chemical Hazards in Herbs consumed in Europe: Toxins, Heavy Metals, and Pesticide Residues

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## INTRODUCTION

Wild edible plants (WEPs) have been recognized throughout history as part of the human diet, especially in those regions that have experienced food scarcity shortages, crop failure and other adversities such as seasonal variations, diseases, climatic events, and social or political conflicts, participating of the social and cultural heritage. WEPs encompass a diverse array of plant life and botanical features such as herbs, spices, forbs, vines, sedges, rushes, grasses, shrubs, trees, and ferns [4]. Different parts of the plants can be used for food or medicinal purposes. Most traditionally, the term "herbs" refers to plant leaves while flowers, seeds, rhizomes, roots, barks, arils, and pods are encompassed under the term "spices".

The increasing global interest in herbs and spices necessitates a thorough examination of the chemical hazards associated with their consumption. The objective of this work was to provide an understanding of the current state and prevalence of chemical contaminants (toxins, heavy metals, and pesticide residues) in herbs and spices consumed in Europe, facilitating informed decision-making in public health and regulatory frameworks.



Figure 1. WEPs examples.

## MATERIALS AND METHODS

Through an extensive literature search, contamination levels of chemical hazards among different herbs and spices were evaluated. The European Rapid Alert System for Food and Feed (RASFF) has shown 1133 notifications for spices and herbs in the last 10 years (2013-2023).

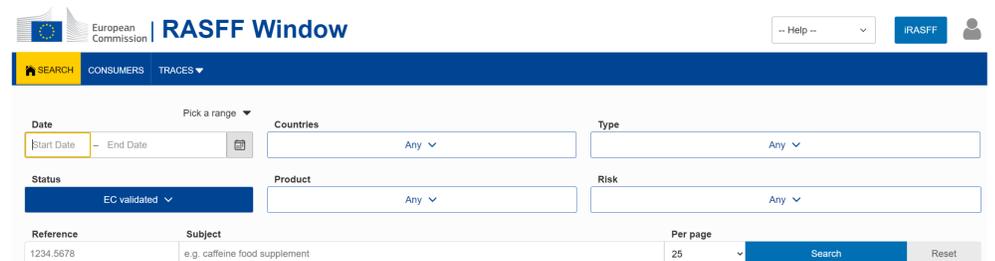
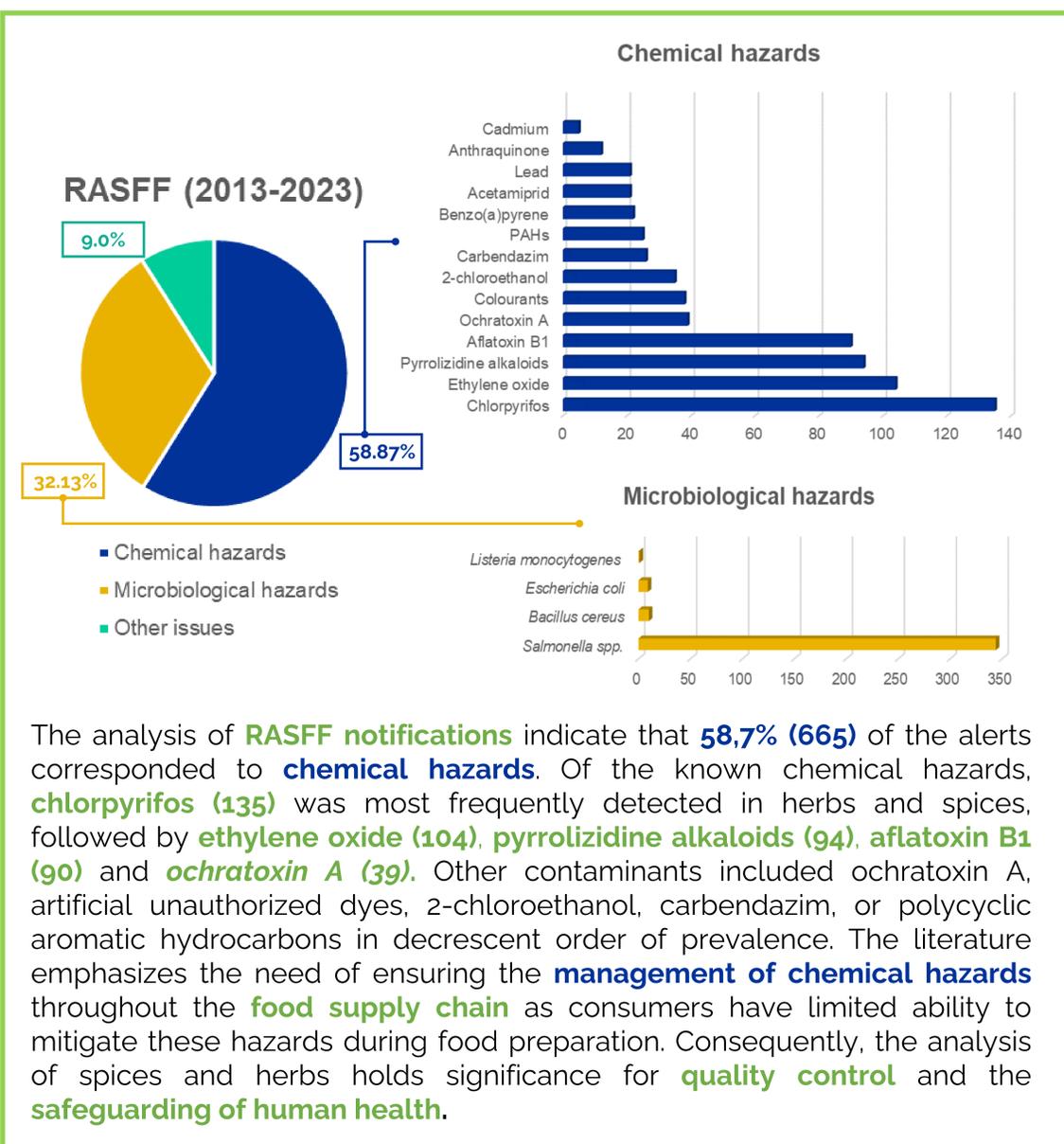
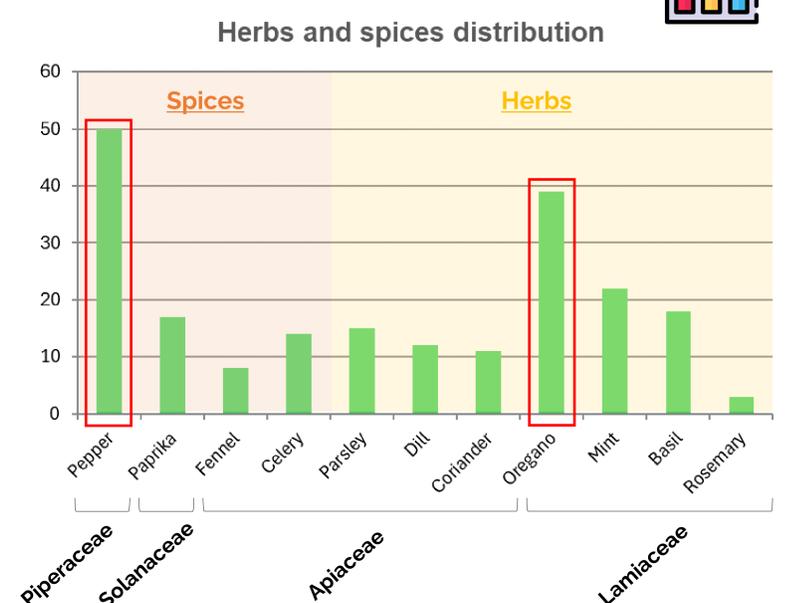


Figure 2. RASFF Window system from European Commission.

## RESULTS AND DISCUSSION



The analysis of RASFF notifications indicate that 58,7% (665) of the alerts corresponded to chemical hazards. Of the known chemical hazards, chlorpyrifos (135) was most frequently detected in herbs and spices, followed by ethylene oxide (104), pyrrolizidine alkaloids (94), aflatoxin B1 (90) and ochratoxin A (39). Other contaminants included ochratoxin A, artificial unauthorized dyes, 2-chloroethanol, carbendazim, or polycyclic aromatic hydrocarbons in decrescent order of prevalence. The literature emphasizes the need of ensuring the management of chemical hazards throughout the food supply chain as consumers have limited ability to mitigate these hazards during food preparation. Consequently, the analysis of spices and herbs holds significance for quality control and the safeguarding of human health.



Out of the total alerts in herbs and spices, 89 species correspond to spices and 120 to herbs. The notified alerts were distributed in 4 families: Lamiaceae (82), Apiaceae (60), Solanaceae (17) and Piperaceae (50). Both literature data and RASFF showed that pepper (50) and oregano (39) were the products most contaminated.

## CONCLUSIONS

This work contributed to identifying gaps and challenges in regulatory practices and to the dialogue on the safety and quality of herbs and spices, offering a holistic perspective on toxins, heavy metals, and pesticide residues and fostering collaboration between all stakeholders to advance in public health protection in Europe.

**Acknowledgments:** The research leading to these results was supported by MICINN supporting the Ramón y Cajal grant for M.A. Prieto (RYC-2017-22891) and by Xunta de Galicia for supporting the pre-doctoral grant of M. Carpena (ED481A 2021/313). This work has been carried out in the frame of the European Food Risk Assessment (EU-FORA) Fellowship Program cycle 2023–2024 funded by EFSA.