

Peer Review

Review of: "Polycyclic Aromatic Hydrocarbons in Brazilian Food: A Critical Review of Levels, Human Health Risk Assessment, and Potential Gaps in the Recent Literature"

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This article presents a crucial and timely systematic review of Polycyclic Aromatic Hydrocarbon (PAH) contamination in Brazilian food, coupled with a comprehensive health risk assessment. Given the well-established carcinogenic, mutagenic, and teratogenic properties of PAHs and the potential for inadequate regulatory frameworks in developing countries like Brazil, this research addresses a critical public health concern. The explicit aim to review recent literature, assess health risks, and identify gaps in research and regulatory practices is highly relevant and provides a strong foundation for informing future actions. A significant strength of this work lies in its systematic approach to reviewing the literature. The authors conducted a predefined search across multiple reputable databases (Scopus, ScienceDirect, PubMed, and Web of Science), enhancing the comprehensiveness and reliability of the review. The identification of 16 distinct food matrices from 36 eligible studies highlights the breadth of the investigation and the diverse sources of PAH contamination in the Brazilian food supply. This systematic methodology is essential for providing a clear overview of the current state of research in this critical area. The health risk characterization performed using established risk assessment methodologies, including Estimated Daily Intake, Hazard Quotient (HQ), and Cancer Risk (CR) calculations, is another strong point. The inclusion of both median and maximum exposure scenarios, utilizing consumption data from the Brazilian Family Budget Research, adds a layer of realism and robustness to the risk assessment. This detailed approach allows for a more accurate estimation of the potential health impacts of PAH exposure through food consumption. The analysis revealing that several food categories exceeded European Union regulatory

limits for benzo[a]pyrene and PAH₄ is a particularly alarming and significant finding. This direct comparison to established international standards provides a clear benchmark and underscores the severity of PAH contamination in certain Brazilian food items. The identification of alarming CR values in tea, cheese, and vegetable oils, all exceeding the acceptable threshold, serves as a stark warning and emphasizes the urgent need for intervention. However, the article also highlights several opportunities for improvement and critical gaps. A notable regional disparity in research efforts, with a significant concentration of studies in Southeast Brazil, is a key limitation. This uneven geographical coverage hinders the ability to conduct comprehensive national risk assessments and may leave other regions with potentially high contamination levels under-monitored. Addressing this disparity is crucial for obtaining a more complete picture of PAH contamination across the entire country. The identification of critical gaps in PAH monitoring and the contribution of research funding disparities to uneven geographical coverage point to systemic challenges. The current limitation of Brazilian standards mainly to olive oils further emphasizes the inadequacy of the existing regulatory framework. There is an urgent need for enhanced regulatory oversight, including the establishment of comprehensive standards for a wider range of food matrices, and increased investment in research to support standardized monitoring protocols across all regions. While the article effectively identifies the problem and quantifies the risks, a more detailed discussion of the potential sources of PAH contamination in the identified food matrices would be beneficial. For example, exploring the specific processing methods, environmental factors, or agricultural practices that contribute to high PAH levels in tea, cheese, and vegetable oils could provide valuable insights for developing targeted mitigation strategies. Furthermore, while the article calls for increased investment in research, a more explicit discussion of the specific research areas that require attention would be valuable. This could include recommendations for studies on the effectiveness of different mitigation techniques, the development of cost-effective monitoring methods suitable for developing countries, or investigations into the long-term health consequences of low-level chronic PAH exposure in the Brazilian population. The article's humanized tone, particularly in its acknowledgment of the challenges faced by developing countries like Brazil, resonates with the broader public health implications of this issue. Maintaining this approach throughout the discussion, perhaps by relating the potential health impacts to the lived realities of affected communities, could further enhance the article's impact and encourage greater support for regulatory and research initiatives. In conclusion, this article makes a valuable contribution by systematically reviewing PAH contamination in Brazilian food, assessing the associated health risks, and identifying critical gaps. Its strengths lie in its systematic methodology, robust risk assessment, and the alarming findings regarding exceedance of regulatory

limits and high cancer risk values. By addressing the identified opportunities for improvement, including the regional disparity in research, the inadequacy of regulatory frameworks, and the need for more detailed source identification and targeted research investments, the article can enhance its impact and provide even more comprehensive guidance for safeguarding the Brazilian food supply and protecting public health.

Declarations

Potential competing interests: No potential competing interests to declare.