

Impact of cooking on the fate of elements and species in food: implementation of different analytical approaches

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Trace elements can occur in food because of their presence in the environment, due to human activities or contamination during storage and food processing, including cooking.

There are various ways of cooking (boiling, grilling, frying, etc.) and each of them can affect differently the elements' content. This may lead to a decrease or an increase in element concentration, or even to a transformation of the species. Therefore, to better assess people's exposure to these contaminants and avoid or reduce harmful human effects, it is important to know the fate of the elements and their species in food during cooking.

For this work, we conducted various studies and implemented different approaches to evaluate the impact of cooking on (i) arsenic (As), lead (Pb) and cadmium (Cd) in whelks, (ii) total arsenic and inorganic arsenic (iAs) in rice and (iii) total chromium (Cr), Cr(III) and Cr(VI) in milk and meat.

For the total elements' determination, analyses were carried out by inductively coupled plasma-mass spectrometry (ICP-MS). For the speciation analyses, high performance liquid chromatography (HPLC) coupled to ICP-MS alone or in combination with species-specific isotope dilution (ID) was implemented. This latter technique allows also to assess possible interconversions of Cr species due to foodstuffs cooking.

Results obtained show that boiling was the cooking method with the highest impact on the elements' content, especially for As and iAs with a significant concentration decrease in cooked samples (rice and whelks). On the other hand, the culinary treatments employed for meat and milk samples (heating and frying) did not induce significant differences on total Cr and Cr species levels between raw and cooked samples. Thanks to the ID-ICP-MS approach used, we demonstrated that a total reduction of Cr(VI) to Cr(III) occurred in the samples but that this was due to the sample preparation (extraction) and not to the cooking process.

Keywords: cooking; trace elements; chemical species; ICP-MS; HPLC; isotopic dilution; foodstuffs

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