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Occurrence of tropane alkaloids in foodstuffs and risks for the Belgian consumer

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Tropane alkaloids (TAs) are secondary metabolites produced by a variety of plants from the families of Brassicaceae, Convolvulaceae, Moraceae and Solanaceae. It is generally believed that plants produce these phytotoxins to defend themselves against damage by herbivorous animals or other invasive organisms. TAs affect heart rate, respiration and functions in the central nervous system. TAs are considered as a food safety issue, as food crops and herbs can be contaminated with TA-containing weeds during harvest or processing. TA levels in food are regulated under Commission Regulation (EU) 2021/1408.

The aim of this study was to design, develop and validate a simple and sensitive analytical method in support of the collection of occurrence data, human exposure estimation and health risk assessment associated with the intake of the most prominent TAs, atropine and scopolamine, via the dietary route. The analytical technique of choice was ultra-high performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS). The sample preparation of cereal-based food, oilseeds, honey and pulses consisted of a solid-liquid extraction with an acidified mixture of methanol and water, while an additional step of solid-phase extraction on a cation-exchange sorbent was introduced in the treatment of teas and herbal infusions, aromatic herbs, spices and food supplements. The limits of quantification of the method varied from 0.5 ug kg-1 to 2.5 ug kg-1.

The method was applied to assess the presence of TAs in a set of commercial food products from the Belgian market. Of the total of 538 products, 26% contained atropine and/or scopolamine. Atropine was more frequently detected (24% of samples) compared to scopolamine (13%). The highest TA levels (up to 655 ug kg-1 for TA sum) were detected in herbal infusions and spices. The highest mean acute exposure to the sum of atropine and scopolamine was found for children via legumes, meat and dairy imitates and grains.

Keywords: tropane alkaloids, LC-MS/MS, analysis, food control, food safety

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