Monitoring of tropane alkaloids in food

Maes o ddiddordeb ymchwil: Chemical hazards in food and feed
Hyd yr astudiaeth: 2015-01-01
Cod prosiect: FS102116
Cynhaliwyd gan: Fera Science Ltd

Background

Tropane alkaloids (TAs) are plant toxins that are naturally produced in several families including Brassicaceae, Solanaceae (e.g. mandrake, henbane, deadly nightshade, Jimson weed) and Erythroxylaceae (including coca).Tropane alkaloids can occur in cereal-based foods through the contamination of cereals with seeds from deadly nightshade and henbane.

In 2013, EFSA's Panel on Contaminants in the Food Chain (CONTAM Panel) delivered a scientific opinion on the risks to human and animal health related to the presence of tropane alkaloids in food and feed. Although over 200 tropane alkaloids are known, data on their toxicity and occurrence in food and feed are limited, with the exception of (-)-hyoscyamine (an isomer of atropine) and (-)-scopolamine. More recently, it has been found that a group of tropane alkaloids, the calystegines are found in various edible plants of the Solanum genus and in the weed Convolvulus.

Due to limited occurrence and toxicity data, the CONTAM Panel could only characterise risk to human health for two TAs: ((-)-hyoscyamine and (-)-scopolamine). The panel recommended more analytical data on the occurrence of TAs should be collected to better characterise the risks to human health from TAs occurring in food and feed. Consequently, EFSA commissioned research to obtain representative occurrence data for tropane alkaloids in foods. This project is the UK contribution to the study. The data obtained will serve as supporting information for future exposure assessments.

Objective and Approach

This project is the UK's contribution to a European Union wide study on tropane alkaloids in food commissioned by EFSA to gather data on the occurrence of tropane alkaloids in food for human consumption from different geographic regions in Europe. Three organisations including Fera Science Ltd from the UK were involved in the study. The UK element of the project was co-funded by the Food Standards Agency.

The main objective of this study was to obtain occurrence data on the levels of TAs in food. To achieve this, a literature review was carried out to identify TAs that are likely to occur as contaminants in food and the relevant food commodities in which these substances are likely to occur in order to inform the sampling strategy.

A total of 286 UK retail samples (cereal based products: 30 breakfast cereals, 13 maize products, 33 bread and pasta, 32 biscuits and baked goods, 22 single grain flours, 46 cereal based infant foods), 10 green beans and stir fry vegetables, 20 dry herbal teas, 44 potatoes and 15 aubergines) were analysed for tropane alkaloids as part of the EFSA survey. An additional 52 UK

retail samples (20 cereal based infant foods, 11 single grain flours, 6 maize products, 12 oilseeds and 9 black and green teas) and 17 single grain flours sampled directly at mills were analysed for TAs on behalf of the FSA.

Samples were analysed using a validated analytical method, liquid-chromatography with tandem mass spectrometry (LC-MS/MS) for the presence of tropane alkaloids.

In addition to scopolamine and atropine, the following 23 alkaloids were covered in the survey: 6-hydroxytropinone, O-acetylscopolamine, nortropinone, anisodamine, pseudotropine, anisodine, scopine, apoatropine, scopoline, aposcopolamine, tropine, tropinone, homatropine, 2?-hydroxymethyl, littorine, convolamine, noratropine, convolidine, norscopolamine, convolvine, phenylacetoxytropane, fillalbine, and calystegines (for potatoes and aubergine only).

Results

Levels of TAs found in the samples were generally very low and the levels found in UK products were comparable with those tested in other countries as part of the EFSA study.

EFSA samples

Tropane alkaloids were detected at low levels in 51 samples. 6.6% of breakfast cereal, 15.4% maize products, 15.6% of biscuits and baked goods, 22.7% of bread,1.2% of single component flours, 30.4% of infant foods, 80% of dry (herbal) tea, 60% stir-fry mixes, 100% of potatoes and 100% of aubergines. The patterns of tropane alkaloids detected differed between the various groups of food products. Tropane alkaloids were not detected in pasta and green beans samples.

Atropine and scopolamine were the main tropane alkaloids detected in most food groups, with levels ranging from 0.05 - 9.8 µg/kg for atropine and from 0.05 - 12.9 µg/kg for scopolamine in cereal based products. 3 cereal-based infant food samples were found to exceed the EU maximum permitted levels of 1 µg/kg each for atropine and scopolamine set out in Commission Regulation (EC) No 1881/2006 (as amended). The highest level found was 3.73 µg/kg for atropine. Higher levels were found in samples of dry herbal teas, with levels ranging from 0.38 - 129 µg/kg for atropine and 0.33 - 34.1 µg/kg for scopolamine.

This study was carried out for purposes of gathering data on the occurrence of tropane alkaloids in various foods on the market and not for compliance testing. Nevertheless, the manufacturers of the foods found to be slightly over the maximum levels for atropine and scopolamine were informed of their results.

Additional UK samples

The levels of TAs detected in the additional UK samples were also low. Atropine and scopolamine were detected in samples of maize products, infant food, oilseeds and black tea with levels ranging from 0.06 – 1.14 µg/kg. The highest level was detected in a sample of cereal based infant baby food, for scopolamine.
This survey captures a first look at the occurrence of tropane alkaloids in foods. The data generated from this survey have been submitted to EFSA to contribute to their ongoing risk assessments.

England, Northern Ireland and Wales

PDF
Gweld Research Report: Monitoring of tropane alkaloids in foods as PDF(Open in a new window)
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