Aflatoxin M₁

In 2004, the European Union installed new limits for aflatoxin M₁ in infant formulae and follow-on formulae, including infant milk and follow-on milk and in dietary foods for special medical purposes intended specifically for infants (1). The limits have been set at 0.025 µg/kg for both categories of food, and apply for all 25 EU member states since November 2004. It is not known whether these limits are easily enforceable in the EU, as no publications on the occurrence of aflatoxin M₁ in these products have appeared yet.

Papers about analytical methodology for aflatoxin M₁ showed that liquid chromatography in combination with tandem mass spectrometry is increasingly used now (2-5), but it remains unclear at this moment whether this sophisticated technique has real advantages above the more conventional approaches, such as liquid chromatography with fluorescence detection. Interlaboratory validation studies of LC/MS/MS methods have not yet been carried out, and do not seem to be planned. In one of the papers on LC/MS/MS (2) the authors also studied the effectiveness and cleanup efficacy of immunoaffinity columns as compared to that of Mycosep multifunctional cleanup columns. Average recovery and detection limits of whole milk and low-fat milk cleaned up by immunoaffinity columns were found to be significantly superior to those obtained with the multifunctional cleanup columns.

A newer approach to determine aflatoxin M₁ in milk is with an electrochemical immunoanalytical sensor using screen-printed electrodes (6). This technique, which is currently also being explored for the determination of trichothecenes in cereals within the European BioCop project (see www.BioCop.org) combines the high selectivity of immunoanalysis with the ease and low price of electrochemical probes. In the development of the technique, antibodies were immobilized directly on the surface of the screen-printed electrodes, allowing competition to occur between free aflatoxin M₁ and that conjugated with horse radish peroxidase. The electrochemical technique chosen was chronoamperometry. The authors claim a detection limit of 0.025 µg/kg and a working range of 0.030 to 0.160 µg/kg. This would make the technique suitable to detect in the area of current legal limits for aflatoxin M₁.

As is usually the case, also in 2005/2006 some articles were published about the transfer of aflatoxin B₁ from feed to aflatoxin M₁ in milk and on the effects of processing of naturally contaminated milk (7-8). The results found do not differ much from earlier published observations, i.e. up to a few % of aflatoxin B₁ in the feed appears as aflatoxin M₁ in the milk, and further processing and storage does not significantly reduce the content of aflatoxin M₁ in dairy products.

An interesting study on human exposure to some principal food mycotoxins, including aflatoxin M₁, was done in France (9). This total diet study showed that the estimated average intake of aflatoxin M₁ in the French population is 0.09 ng/kg body weight/day for adults and
0.22 ng/kg body weight/day for children, with 95\textsuperscript{th} percentile values of 0.21 ng/kg body weight/day for adults and 0.55 ng/kg body weight/day for children respectively. These results were of the same order of magnitude as those estimated during a previous French evaluation in 1999, when the average aflatoxin M\textsubscript{1} contamination levels were close to the detection limits, which was also the case during the present study.

Recently published surveys on the occurrence of aflatoxin M\textsubscript{1} in milk and milk products involved countries as Brazil (10), Italy (11), Iran (12-13) and Turkey (14-17). The levels found were usually low, often fulfilled national legal requirements, and were not of health concern.

References