

Communication 025/2026

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How much mould toxin from cattle feed ends up in milk?

New BfR model provides reliable predictions

Dairy cows with high milk yields release significantly more aflatoxin M1 (AFM1), a mould toxin, into their milk than cows with lower milk yields. This is something we've known for some time, but until now it has not been possible to calculate and predict it accurately. Researchers at the Feed Centre of the German Federal Institute for Risk Assessment (BfR) have now developed a mathematical model that can be used to determine the relationship between milk yield and the transfer of aflatoxin into milk.

The new model is primarily a tool for risk management and for industry stakeholders. It helps to assess whether the existing Maximum Level for AFM1 in milk can be adhered to given a known Aflatoxin B1 (AFB1) concentration in the animal feed. This is all the more important given that aflatoxin occurrence on forage crops may occur in regions where it has previously been less of a concern in the wake of climate change. The mathematical model has already been integrated into the BfR's publicly accessible computer tool [ConTrans](#).

Mould toxins (mycotoxins) are natural toxins whose prevalence in food and feed is undesirable but cannot be completely avoided. For AFM1 in raw milk, heat-treated milk and milk for the manufacture of milk-based products, a Maximum Level of 0.05 micrograms per kilogram ($\mu\text{g}/\text{kg}$) applies in accordance with Regulation (EU) 2023/915. The results of food monitoring authorities in Germany show that the vast majority of cow's milk samples on the market are in compliance with the Maximum Level.

The study was published as a fast-track article in the journal 'Archives of Toxicology' to make the results quickly available to researchers, health authorities and other stakeholders.

Aflatoxins are produced by certain moulds (*Aspergillus* species) that infect plants such as maize and other grains, particularly when hot and dry growing conditions are followed by

damp storage. If dairy cows consume contaminated feed, they take up aflatoxin B1 (AFB1) that is contained in it, which is then converted into aflatoxin M1 (AFM1) in the liver and a fraction of it passes into the milk. As AFM1 is classified by the International Agency for Research on Cancer (IARC) as possibly carcinogenic to humans, strict Maximum Levels apply in the EU: compound feed for dairy cattle may contain a maximum of 5 micrograms (μg) of AFB1 per kilogram, and one kilogram of milk may contain a maximum of 0.05 μg of AFM1.

It is known that the proportion of AFM1 that enters the milk – the transfer rate – depends on the cow's daily milk yield. For example, a cow that produces 50 litres of milk a day releases about seven times more AFM1 into the milk than a cow that produces only 5 litres a day. It is known that AFM1 is primarily excreted from the cow's body not via milk, but via bile and urine. As milk yield increases, release via milk appears to become more significant.

To describe the link between milk yield and transfer rate mathematically, the BfR used data from 19 controlled feeding trials published over several decades, covering a wide range of milk yields (6 to 46 litres per day) and AFB1 dosages in the feed. Using a statistical method known as hierarchical Bayesian inference, which allows information and uncertainties from numerous studies to be combined, the scientists created a so-called two-compartment toxicokinetic model. It describes how AFB1 is taken up, converted into AFM1 and finally released via milk and other routes such as urine.

The model predicts that the mean transfer rate is 0.41% at a milk yield of 5 litres per day and rises to 3.05% at 50 litres per day. Crucially, the model also provides 95% credible intervals, thereby accounting for statistical uncertainty. Realistically, the transfer rate could therefore lie between 0.13% and 1.40% at 5 litres per day, and between 1.07% and 8.19% at 50 litres per day. These wide intervals reflect the actual biological variability between cows and studies, and realistically represent the uncertainty that must be taken into account when using the computer tool.

The model is available as open-source code and as an interactive online calculator within [the ConTrans tool](#). Users can use it to ask specific questions: for example, what is the highest compatible level of AFB1 in feed required to ensure compliance with the EU Maximum Limit in milk, taking uncertainty into account. You can register for ConTrans via the following link: <https://akademie.bfr.berlin/427925>

Publication:

Jan-Louis Moenning, Jorge Numata: Quantifying milk yield-dependent aflatoxin B1-to-M1 transfer in dairy cows: A Bayesian consensus toxicokinetic model. Archives of Toxicology 2026, <https://doi.org/10.1007/s00204-026-04366-3>

Further information on the BfR website on the topic of feed safety and mycotoxins

FAQ Mould in foods – health risks and how to avoid them

<https://www.bfr.bund.de/en/service/frequently-asked-questions/topic/mould-in-foods-health-risks-and-how-to-avoid-them/>

Topic page: Feed Centre - Feed Safety, Substance Transfer in the Food Chain

<https://www.bfr.bund.de/en/about-us/bfr-structure/department-food-and-feed-safety-in-the-food-chain/feed-centre-feed-safety-substance-transfer-in-the-food-chain/>

Press Release: From the trough to the plate – digitally calculated

<https://www.bfr.bund.de/en/press-release/from-the-trough-to-the-plate-digitally-calculated/>

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