



# Importance of Rigorous and Ongoing Monitoring of Animal Feed Quality and Storage Conditions to Mitigate Aflatoxin M1 Contamination in Dairy Products in Iran: A Health Policy Brief

Kiomars Sharafi <sup>1,2</sup>, Amir Kiani <sup>3,4</sup>, Abdullah Khalid Omer <sup>5</sup>, Kimya Parnoon <sup>6</sup> and Tooraj Massahi <sup>6,\*</sup>

<sup>1</sup>Research Center for Environmental Determinants of Health, Research Institute for Health, Kermanshah University of Medical Sciences, Kermanshah, Iran

<sup>2</sup>Department of Environmental Health Engineering, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran

<sup>3</sup>Regenerative Medicine Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran

<sup>4</sup>Pharmaceutical Sciences Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran

<sup>5</sup>Department of Food Hygiene and Quality Control, Faculty of Veterinary Medicine, Urmia University, Urmia, Iran

<sup>6</sup>Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran

\*Corresponding author: Student Research Committee, Kermanshah University of Medical Sciences, Kermanshah, Iran. Email: toorajmassahi@gmail.com

Received 2024 March 03; Revised 2024 March 06; Accepted 2024 March 09.

## Abstract

**Background:** Milk and dairy products are essential for global nutrition, and ensuring their safety is crucial. Aflatoxin M1 (AFM1), a carcinogen from contaminated animal feed, poses a significant threat to consumers.

**Objectives:** This “health policy brief” highlights the critical need for meticulous and constant monitoring of Iran’s animal feed quality and storage conditions to minimize AFM1 contamination in dairy products.

**Methods:** Comprehensive review papers on AFM1 were reviewed in Iranian dairy products, drawing evidence from various databases.

**Results:** The prevalence of AFM1 contamination in Iranian dairy products, particularly risky for children due to extensive consumption, exceeds safety limits, with livestock feed identified as the primary source. Public health demands rigorous monitoring practices, such as stricter feed quality and storage regulations, regular AFM1 testing, stakeholder collaboration, and public awareness. There are many benefits associated with these measures, including lowering AFM1 levels in dairy products, improving food safety standards, minimizing AFM1 exposure risks, especially for children, and increasing consumer confidence in the integrity of the Iranian dairy industry.

**Conclusions:** Continuous monitoring of animal feed is crucial to safeguard public health and ensure the safety of Iranian dairy products, particularly for children. This comprehensive approach, collaboration, and public awareness are vital to mitigating AFM1 contamination and promoting Iran’s safe and robust dairy industry.

**Keywords:** Aflatoxin M1, Dairy Products, Contamination, Iran

## 1. Background

Milk and dairy products enhance global food and nutrition security by providing essential animal proteins, vitamins, and fatty acids across all age groups. However, ensuring the safety of these indispensable food commodities is of utmost importance, necessitating their freedom from pathogens, toxins, and carcinogens (1). Aflatoxin M1 (AFM1), a potent carcinogen, has emerged as a notable contaminant in milk, originating from aflatoxin B1 (AFB1) in contaminated animal feed. The metabolic conversion of AFB1 to AFM1 in animals’ livers, followed by

its excretion into milk, poses significant health risks to consumers (2).

The occurrence of AFM1 in milk can be attributed to unfavorable fodder storage conditions that facilitate the proliferation of aflatoxin-producing fungi. These toxins resist conventional thermal processing methods employed in the dairy industry, underscoring the critical role of monitoring programs in mitigating exposure risks. The rate of AFB1 conversion to AFM1 is impacted by various factors, including the health status of animals and the quality of their diet. Different international regulatory

guidelines have been established for AFM1 levels in milk, with defined thresholds set by reputable organizations such as the European Commission (EC) at 50 ng/kg and by national organizations such as the Institute of Standards and Industrial Research of Iran (ISIRI) at 100 ng/kg (1).

The high consumption of milk and dairy products, particularly among infants and young children, increases the risk of AFM1 exposure through diet in Iran. Monitoring and controlling fungal growth conditions in animal feed are essential to prevent aflatoxin contamination in dairy products (1-3).

## 2. Objectives

Consequently, the main objective of this paper is to furnish a “health policy brief” tailored for stakeholders and health policymakers in Iran, elucidating the critical significance of meticulous and persistent surveillance of animal feed quality and storage conditions to mitigate AFM1 contamination.

## 3. Methods

This study purposefully reviewed the latest and most comprehensive research on AFM1 contamination in Iranian dairy products. The primary focus was on comprehensive review studies that reported the presence of AFM1 in Iranian dairy products during the last two decades. The research team extensively searched international databases such as Science Direct, Scopus, PubMed, and Google Scholar for relevant literature to conduct this evaluation.

## 4. Results

Based on the research on AFM1 contamination in milk in Iran, the mean AFM1 level in Iranian milk was  $77 \pm 159$  ng/kg, surpassing the EC regulation threshold of 50 ng/kg but falling below ISIRI regulations set at 100 ng/kg. The predominant source of AFM1 contamination was livestock farms, with levels reaching 90 ng/kg, particularly in raw milk at 84 ng/kg. In addition, 33.9% of the samples exceeded the EU regulation limit. The study highlighted elevated non-carcinogenic and carcinogenic risk indices associated with AFM1 consumption through milk, especially concerning children and adolescents (1). In another related review focusing on Iranian cheese, the average AFM1 concentration was  $160 \pm 175$  ng/kg, below the EC regulation threshold of 250 ng/kg. However, a significant portion (72.42%) of cheese samples tested positive for AFM1 contamination, with 13% exceeding

regulatory limits. Among the sampling locations, markets and livestock farms had the highest and lowest AFM1 levels, respectively. Health risk assessments underscored substantial health hazards associated with AFM1 in Iranian cheese consumption, particularly concerning children (2). Furthermore, a review study into common dairy products in Iran including yogurt, kashk, ice cream, doogh, butter, and tarrakhine revealed that 67.54% of samples were contaminated with AFM1, with 12.49% surpassing maximum EC and ISIRI limits. Pasteurized kashk exhibited the highest AFM1 concentration at  $73 \pm 110$  ng/kg, while traditional doogh had the lowest at  $5 \pm 7$  ng/kg. Overall risk assessments indicated unacceptable health risks for children due to dairy product consumption in Iran (3).

## 5. Discussion

Aflatoxin M1 contamination in Iranian dairy products presents a significant public health concern, particularly for children, with research pointing to livestock feed as the primary source of this issue. Rigorous and ongoing monitoring of animal feed quality and storage conditions is essential to mitigate AFM1 contamination and address this challenge effectively. The necessity for such monitoring is underscored by the widespread contamination observed in Iranian dairy products, surpassing safety thresholds and emphasizing the need for consistent monitoring to uphold product safety standards. Furthermore, the potential health risks associated with AFM1 consumption, especially for children, highlight the critical role monitoring plays in safeguarding public health by preventing exposure to this harmful toxin (1-4).

Several critical components are essential in executing a comprehensive monitoring strategy. Firstly, enforcing stricter regulations by regulatory bodies plays a crucial role in establishing and upholding elevated standards for feed quality and storage conditions. Regular testing procedures for AFM1 contamination in animal feed are vital to ensure the timely detection and prevention of its transmission to milk and dairy products. Collaboration among governmental entities, dairy farmers, and feed producers is indispensable to implementing best practices throughout the supply chain, fostering a culture of accountability and adherence to safety protocols. Additionally, raising public awareness regarding the risks associated with AFM1 and the significance of consuming safe dairy products is pivotal in empowering informed consumer decisions and propelling industry-wide enhancements (2).

The advantages of rigorous and continuous monitoring extend beyond mitigating AFM1

contamination in Iranian dairy products. The presence of this toxin in dairy products can be minimized by diminishing AFB1 levels in animal feed through sustained monitoring practices, thereby enhancing overall food safety measures within Iran. Furthermore, this approach not only safeguards public health by mitigating exposure to AFM1 but also specifically benefits vulnerable populations such as children who are at heightened risk. Strengthening consumer confidence through consistent monitoring ensures the safety of Iranian dairy products and fosters trust in the industry's dedication to quality and safety standards (1-4).

In conclusion, the indispensable nature of rigorous and continuous monitoring of animal feed quality and storage conditions cannot be overstated in mitigating AFM1 contamination in Iranian dairy products. This holistic strategy, supported by collaboration efforts and public awareness initiatives, serves as a cornerstone for safeguarding public health and ensuring the safety of Iranian dairy products, focusing on protecting vulnerable populations such as children from potential health risks associated with AFM1 exposure.

#### Footnotes

**Authors' Contribution:** K.SH.; Conceptualisation, writing, review & editing. A.K.; Supervision, review & editing. A.K.O; Writing-original draft. K.P.; Writing-original draft. T.M.; Writing-original draft, review & editing.

**Conflict of Interests:** No potential conflict of interest was reported by the authors.

**Ethical Approval:** The study protocol was approved by the Ethics Committee of Kermanshah University of Medical Sciences, Kermanshah, Iran under the ethical code of IR.KUMS.REC.1400.808.

**Funding/Support:** The authors gratefully acknowledge the Research Council of Kermanshah University of Medical Sciences (Grant Number: 4010181) for their financial support.

#### References

1. Massahi T, Kiani A, Sharafi K, Karami Matin B, Omer AK, Ebrahimzadeh G, et al. A systematic literature review for aflatoxin M1 of various milk types in Iran: Human health risk assessment, uncertainty, and sensitivity analysis. *Food Control*. 2023;150:109733. <https://doi.org/10.1016/j.foodcont.2023.109733>.
2. Massahi T, Kiani A, Sharafi K, Omer AK, Ebrahimzadeh G, Jaafari J, et al. A national systematic literature review for aflatoxin M1 in commonly consumed cheese brands in Iran: Human health risk assessment by Monte Carlo simulation. *Heliyon*. 2023;9(9). e19679. [PubMed ID: 37809415]. [PubMed Central ID: PMC10558958]. <https://doi.org/10.1016/j.heliyon.2023.e19679>.
3. Massahi T, Omer AK, Habibollahi MH, Mansouri B, Ebrahimzadeh G, Parnoon K, et al. Human health risk assessment of aflatoxin M1 in various dairy products in Iran: A literature review. *J Food Comp Anal*. 2024;129:106124. <https://doi.org/10.1016/j.jfca.2024.106124>.
4. Sharafi K, Matin BK, Omer AK, Mansouri B, Soleimani H, Fattahi N, et al. A worldwide systematic literature review for aflatoxin M1 in infant formula milk: Human health risk assessment by Monte Carlo simulation. *Food Control*. 2022;134:108681. <https://doi.org/10.1016/j.foodcont.2021.108681>.