



Presence and concentration levels of aflatoxin M1 in raw milk: findings from the central Anatolia region of Türkiye

İ. Garip¹, S. Sahin²

¹Department of Pharmacology and Toxicology, Yozgat Bozok University Faculty of Veterinary, ²Department of Medical Pharmacology, Yozgat Bozok University Faculty of Medicine, Yozgat, Turkey

Article information

Article history:

Received February 20, 2026

Accepted June 5, 2026

Published July 5, 2026

Keywords:

Aflatoxin M1

Raw milk

Risk assessment

Food safety

Correspondence:

İ. Garip

imran.garip@bozok.edu.tr

Abstract

In this study, the presence and concentration levels of Aflatoxin M1 (AFM1) in raw milk samples produced in Yozgat province and its districts located in the Central Anatolia Region of Türkiye were determined, and the obtained findings were evaluated in terms of human exposure. Within the scope of the study, a total of 80 raw milk samples were collected from dairy farms in the districts of Sarıkaya, Yozgat Center, Şefaati, Boğazlıyan, and Yenifakılı, and AFM1 analyses were performed using a commercial ELISA kit. Although AFM1 was detected in all samples, the measured concentrations were found to be well below the maximum residue limit of 50 ng/kg established by the European Union for milk and dairy products. The mean AFM1 levels on a district basis ranged between 2.13 and 2.34 ng/kg, and the overall distribution was observed to cluster within a narrow concentration range. As a result of the statistical analyses, a significant difference was detected only between the Şefaati and Boğazlıyan–Yenifakılı districts. In the exposure assessment, the average daily AFM1 intake for adult individuals was calculated to be 0.0044 ng/kg bw/day, indicating a low exposure level. The findings indicate that the current acute risk level in the investigated region is low; however, the detection of the toxin in all samples highlights the importance of maintaining regular monitoring programs from a public health perspective.

DOI: [10.33899/ijvs.2026.169573.4687](https://doi.org/10.33899/ijvs.2026.169573.4687), ©Authors, 2026, College of Veterinary Medicine, University of Mosul.

This is an open access article under the CC BY 4.0 license (<http://creativecommons.org/licenses/by/4.0/>).

Introduction

Aflatoxin M1 (AFM1) in milk is considered one of the major indicators of mycotoxin contamination in milk and dairy products and remains an important food safety concern worldwide. AFM1 is formed when dairy animals consume feed contaminated with aflatoxin B1 (AFB1), which is subsequently metabolized in the liver and excreted into milk, thereby contributing to continuous dietary exposure. Monitoring studies conducted in different countries have demonstrated the widespread occurrence of AFM1 in both raw milk and dairy products, highlighting its relevance for consumer safety (1–4).

The maximum residue limits established by the European Union Commission Regulation No. 1831/2003 and the threshold values recommended by the Codex Alimentarius constitute the principal framework for AFM1 risk management (5,6). AFM1 exposure through milk remains a persistent food safety concern across different geographical regions despite regional differences in contamination levels (3,4).

The health effects of AFM1 are primarily associated with carcinogenicity, hepatotoxicity, and immunotoxicity (7,8). Although AFM1 is considered less potent than AFB1, experimental and epidemiological evidence suggests that AFM1 may exert carcinogenic effects under chronic low-

dose exposure conditions (6,9). However, the magnitude of risk may vary according to factors such as co-exposure to other mycotoxins, individual metabolic characteristics, and dietary habits (10).

Recent studies have also highlighted the effects of AFM1 on intestinal health and immune function. Experimental evidence indicates that AFM1 may impair intestinal barrier integrity, alter mucin expression, and increase intestinal permeability (11,12). In addition, AFM1 may induce immunomodulatory effects and alter gut microbiota composition, particularly under multiple mycotoxin exposure scenarios (13,7).

Infants and young children are considered more vulnerable to mycotoxin exposure because of their developing physiological systems and relatively higher dietary intake per unit body weight (8,14). Therefore, continuous monitoring of AFM1 in milk and dairy products remains important from a public health perspective (15).

In European Union legislation, the maximum permitted level of AFM1 is 50 ng/kg for milk and dairy products and 25 ng/kg for infant formula products intended for sensitive consumer groups (5). In contrast, the United States Food and Drug Administration (FDA) applies an action level of 500 ng/kg for AFM1 in milk, reflecting a different regulatory approach to risk management (6).

Overall, chronic AFM1 exposure remains a relevant public health concern, particularly for vulnerable populations. Reliable regional monitoring data are therefore essential for evaluating contamination patterns and supporting risk assessment efforts.

Accordingly, the present study aimed to determine AFM1 levels in raw milk samples collected from Yozgat province and its districts in the Central Anatolia Region of Türkiye and to evaluate potential human exposure based on the detected contamination levels.

Materials and methods

Sample collection

Within the scope of this study, raw milk samples were collected from a total of 80 dairy farms located in Yozgat province and its districts to evaluate AFM1 contamination and potential consumer exposure. Sampling was performed in the districts of Sarıkaya (n=20), Yozgat Center (n=22), Şefaati (n=20), and Boğazlıyan–Yenifakılı (n=18), which represent major dairy-producing areas of the region. Farms were selected using a simple random sampling approach from available dairy farm records provided by local agricultural authorities. Only active dairy farms producing marketable raw milk during the sampling period were included in the study, and only one milk sample was collected from each farm to avoid repeated measurements from the same source.

The sample size was determined based on the regional distribution of dairy farms and sampling feasibility while ensuring representative coverage of the main milk-producing districts. Sampling was conducted between October and November 2022. Collected milk samples were transported to the laboratory under refrigerated conditions and stored at -80°C in the dark until analysis.

Chemical analysis and sample preparation

A commercial ELISA kit (Elabscience®, USA) was used for the determination of AFM1 in milk samples, and all analyses were performed in accordance with the manufacturer's protocol. Prior to analysis, all kit components and samples were brought to room temperature. According to the manufacturer's data, the limit of detection (LOD) and limit of quantification (LOQ) for the milk matrix were 0.005 µg/kg and 0.015 µg/kg, respectively. Fatty milk samples were centrifuged at 4000 rpm for 5 minutes to remove the upper fat layer. The obtained lower phase was diluted with 35% methanol (MeOH) at a ratio of 1:9, and 50 µL of the diluted sample was transferred into the ELISA plate wells. The optical density (OD) values were measured at 450 nm using a microplate reader (BMG Labtech CLARIOstar®).

Quantitative determination of aflatoxin M1 and method validation

The analytical performance of the ELISA method was evaluated in terms of calibration linearity, recovery, repeatability, and certified reference material (CRM) verification. Recovery experiments were performed by spiking blank milk samples with known concentrations of AFM1 standard solution at three different levels (low, medium, and high). Each spiking level was analyzed in triplicate, and recovery percentages were calculated by comparing measured concentrations with the nominal spiked concentrations. Repeatability was assessed by analyzing selected samples in duplicate within the same analytical run, and results were expressed as relative standard deviation (RSD). Certified reference material (Sigma-Aldrich® CRM) with a known AFM1 concentration was analyzed alongside the samples to verify method accuracy and ensure traceability of the results. Quality control procedures included duplicate sample analysis, routine calibration verification, and continuous monitoring of assay performance throughout the analytical process. Acceptability of analytical performance was evaluated based on recovery rates within 80–120%, RSD values below acceptable limits, agreement between duplicate measurements, and consistency of calibration curve parameters. Measurements showing deviations beyond acceptable limits were reanalyzed to minimize analytical error (Table 1).

Table 1: Method validation parameters for AFM1 determination by ELISA

AFM1 (µg/kg)	Recovery (%)	Repeatability (RSDR, %)
0.10	87	4.7
0.20	95	5.5
0.40	98	4.6

Exposure assessment

The Average Daily Dose (ADD) of AFM1 was estimated using the following equation:

$$ADD = (C \times IR) / BW$$

where C is the mean AFM1 concentration in milk (ng/kg), IR is the daily milk intake (kg/day), and BW is the body weight (kg).

Milk consumption data were obtained from the GEMS/Food Consumption Database developed by the World Health Organization (WHO) and FAO. For exposure estimation, a daily milk intake of 0.2 kg/day and an average adult body weight of 70 kg were assumed. Based on these parameters, the estimated Average Daily Dose (ADD) of AFM1 was calculated as 0.0044 ng/kg bw/day. It should be noted that this estimation represents a scenario-based exposure assessment derived from single-time-point sampling and does not account for seasonal variation or long-term temporal fluctuations in AFM1 levels.

Statistical analysis

Statistical analyses were performed using SPSS software. One-Way Analysis of Variance (ANOVA) was used to

compare mean AFM1 concentrations among districts. Tukey HSD post-hoc analysis was applied to identify the source of significant differences between groups. In addition, the non-parametric Kruskal–Wallis test was performed to verify the consistency of the results and to account for potential deviations from parametric assumptions. A P-value of < 0.05 was considered statistically significant. Results are presented as mean ± standard deviation.

Results

In this study, AFM1 levels were analyzed in a total of 80 raw milk samples obtained from Yozgat province and its districts. When evaluated on a district basis, the number of samples ranged from 18 to 22.

When the distribution of AFM1 levels was examined on a district basis, the measurement values were observed to cluster within similar ranges across all regions. For the entire province, the 25th–75th percentile range (2.111–2.433 ng/kg) suggests that the majority of the samples are concentrated within a narrow concentration band. One-way analysis of variance (ANOVA) conducted to determine whether there were statistical differences in mean AFM1 levels among districts revealed a significant difference between groups ($P < 0.05$). Tukey HSD post-hoc analysis, performed to identify the source of the differences, indicated that the mean AFM1 levels between Şefaati and Boğazlıyan–Yenifakılı districts differed significantly, whereas no significant differences were observed in other district comparisons. Extended descriptive statistics at the district level and the results of post-hoc comparisons are presented in Table 2.

Table 2: Extended Descriptive Statistics of AFM1 Levels (ng/kg) by District and for the Entire Province

Region	n	Mean	SD	Min	Max	Median	%25	%75	Post-Hoc Result*
Boğazlıyan–Yenifakılı	18	2.135	0.294	1.185	2.641	2.121	2.064	2.249	Significant with Şefaati ($P=0.031$)
Şefaati	20	2.340	0.234	1.816	2.808	2.394	2.257	2.467	Significant with Boğazlıyan ($P=0.031$)
Sarıkaya	20	2.249	0.171	1.849	2.484	2.287	2.157	2.384	Not significant
Yozgat Center	22	2.341	0.232	1.731	2.805	2.400	2.228	2.456	Not significant
Yozgat Province Overall	80	2.271	0.245	1.185	2.808	2.297	2.111	2.433	–

* Following one-way ANOVA, Tukey HSD post-hoc test was performed. A significance level of $P < 0.05$ was considered.

The highest mean value was observed in Yozgat Center at 2.341 ng/kg, followed by the districts of Şefaati and Sarıkaya, respectively. The lowest mean value was detected in the Boğazlıyan–Yenifakılı region. When all samples across the province were evaluated collectively, the average AFM1 concentration was calculated as 2.271 ng/kg. The standard deviation values ranged from 0.167 to 0.293, indicating limited variation between regions. Examination of the sample-based distribution revealed that measurement values were generally concentrated within the 2.0–2.6 ng/kg

range. The lowest individual value was 1.185 ng/kg in the Boğazlıyan–Yenifakılı region, while the highest individual value was 2.805 ng/kg in Yozgat Center (Table 3).

Discussion

In this study, AFM1 was detected in all raw milk samples collected from Yozgat province and its districts, representing the Central Anatolia region. However, the measured concentrations were well below the maximum residue limit

of 50 ng/kg established by the European Union for milk and dairy products. The observed mean AFM1 levels, ranging approximately between 2 and 2.3 ng/kg, indicate a low-level but persistent contamination profile at the regional scale. This suggests that while AFM1 is not completely absent, it does not reach levels that would pose an acute risk under the current production and storage conditions (16).

Table 3: Comparative Distribution of AFM1 Measurement Values by District (ng/kg)

Sample Number	Boğazlıyan–Yenifakılı (ng/kg)	Şefaati (ng/kg)	Sarıkaya (ng/kg)	Yozgat Center (ng/kg)
1	2.000	2.477	2.306	2.257
2	1.974	2.167	2.458	2.381
3	1.185	2.025	2.221	2.090
4	2.054	2.092	2.353	2.435
5	1.985	2.399	2.386	2.520
6	2.095	2.562	2.082	2.623
7	2.373	2.603	1.989	2.428
8	2.330	2.463	2.383	2.009
9	2.115	2.309	2.108	2.436
10	2.252	2.434	2.286	2.247
11	2.126	1.956	2.320	1.731
12	2.209	2.339	2.173	2.463
13	2.111	2.442	1.987	2.805
14	2.200	2.808	2.287	2.111
15	2.093	2.412	1.849	2.346
16	2.641	2.314	2.229	2.259
17	2.238	2.501	2.281	2.221
18	2.451	2.388	2.484	2.187
19	–	1.816	2.402	2.418
20	–	2.287	2.399	2.490
21	–	–	–	2.604
22	–	–	–	2.432

Reported AFM1 levels in the international literature vary widely depending on the country and seasonal conditions. Studies conducted in different regions, such as Greece, Brazil, and Armenia, have mostly reported mean AFM1 concentrations in the range of 5–30 ng/kg, while in some areas, the exceedance rates have been reported to reach 5–20% (1,3,4). In this context, the fact that the values obtained in the present study are below many regional averages reported in the literature suggests that feed-derived AFB1 contamination may be relatively low in the region studied (16-18). However, the detection of AFM1 in all samples indicates that contamination is chronic and widespread in nature and cannot be completely disregarded (16,19).

When district-based distributions were examined, it was observed that AFM1 levels generally clustered within a narrow concentration band and that the median values were quite close to the averages. This situation suggests that the

distribution does not show a significant skewness and that similar risk factors may be effective in the regional production chain (18,7). The lower standard deviation values observed in the Sarıkaya district reveal that AFM1 levels exhibit a more homogeneous distribution, while the relatively high variation in the Boğazlıyan–Yenifakılı region indicates that micro-scale heterogeneity may be due to differences in feed storage conditions, moisture content, or farm-based practices. However, statistical analyses revealed a significant difference only between the districts of Şefaati and Boğazlıyan–Yenifakılı, indicating that the overall contamination profile is largely similar at the regional level. This result suggests that AFM1 formation may be influenced by local environmental factors but may also share common determinants throughout the supply chain.

From an analytical perspective, the high correlation coefficient ($r \approx 0.999$) and coefficient of determination ($R^2 \approx 0.998$) exhibited by the calibration curve of the ELISA method used in the study are important indicators of the accuracy and reliability of the measurements. The fact that the recovery rates obtained in the method validation parameters are in the range of 87–98% and that the repeatability values are within acceptable limits supports the analytical validity of the results obtained. This finding supports the reliability of the analytical results and indicates that the measured AFM1 levels likely reflect the actual contamination profile.

The limitations of the study include the fact that sampling was conducted within a specific time frame and seasonal variability could not be evaluated. AFM1 levels are known to be closely related to feed storage conditions, temperature, and environmental humidity. In addition, only one milk sample was collected per farm, which may limit the ability to capture within-farm variability and may reduce the representativeness of individual farm-level contamination patterns. The literature reports that AFM1 may be associated with immunosuppression, hepatocellular damage, and impaired gastrointestinal barrier integrity, particularly with long-term low-dose exposure (7,11,12). Therefore, even if the measured values are below regulatory limits, caution is required for sensitive populations when continuous consumption is involved.

Studies conducted in Turkey also reveal that AFM1 contamination can exhibit regional variations. In particular, monitoring studies conducted in different provinces report that average AFM1 levels generally remain below regulatory limits but are detectable in all samples (17,20). These findings are consistent with the results obtained in the present study and suggest that AFM1 may have a low-level but persistent contamination profile throughout Turkey.

When considering infants and children, risk assessment must be conducted more cautiously. The lower limit values specified for infant formulas in European Union legislation reflect the increased sensitivity of early age groups to

mycotoxins (20,21). Although the values measured in the current study are below these lower limits, it should be noted that relative exposure may be higher in children compared to adults, given their higher milk consumption relative to body weight. This situation particularly highlights the importance of continuity in regional monitoring studies.

The limitations of the study include the fact that sampling was conducted within a specific time frame and seasonal variability could not be evaluated. AFM1 levels are known to be closely related to feed storage conditions, temperature, and environmental humidity. The literature reports that AFB1 formation and, consequently, milk AFM1 levels may increase due to rising temperature and humidity conditions in summer and autumn months (3,1). Therefore, it is believed that long-term monitoring studies covering different seasons will contribute to a more comprehensive understanding of the regional risk profile. Furthermore, the use of a single analytical method in the study can be considered a methodological limitation; in the future, supporting ELISA results with confirmatory techniques such as LC-MS/MS will increase the comparability of measurements. Another limitation of the present study is that the exposure assessment was conducted only for adult individuals. Children and infants were not included in the calculation due to differences in body weight and variability in consumption patterns. Considering their lower body weight and relatively higher milk consumption per kilogram of body weight, the relative AFM1 exposure in children may be proportionally higher than that estimated for adults. Therefore, future studies including age-specific exposure scenarios would provide a more comprehensive risk characterization.

Conclusion

Within the scope of this study, aflatoxin M1 (AFM1) levels were determined in raw milk samples obtained from Yozgat province and its districts using the ELISA method, and the results were evaluated in terms of human exposure. AFM1 was detected in all samples analyzed, but the measured concentrations were found to be well below the maximum residue limits set by the European Union. Comparisons made at the district level revealed that AFM1 levels generally distributed within a narrow concentration range and that interregional variation was limited.

Exposure calculations have shown that the daily intake of AFM1 for adults is low. However, the detection of toxins in all samples indicates that contamination has not been eliminated and highlights the importance of continuous monitoring studies. Considering sensitive groups such as infants and children, the continuation of regular regional screening programs and the strengthening of control strategies to prevent feed-related contamination are critical for public health.

The findings indicate that the current risk level in the area under investigation is low; however, considering the long-term effects of AFM1 exposure, it is necessary to ensure the continuity of monitoring and risk assessment studies.

In addition, the findings of this study may provide valuable policy implications for regional food safety authorities, emphasizing the importance of strengthening feed control strategies and preventive monitoring systems to minimize AFM1 contamination at the primary production stage.

Acknowledgements

This study was supported by the Scientific Research Projects Coordination Unit of Yozgat Bozok University (Yozgat BAP) under project number 6602b-VET/19-347. The authors gratefully acknowledge the financial support provided by the institution.

Conflict of interest

The authors declare that they have no conflict of interest.

References

1. Maggira M, Ioannidou M, Sakaridis I, Samouris G. Determination of aflatoxin M1 in raw milk using an HPLC-FL method in comparison with commercial ELISA kits—application in raw milk samples from various regions of Greece. *Vet Sci*. 2021;8(3):46. DOI: [10.3390/vetsci8030046](https://doi.org/10.3390/vetsci8030046)
2. Sumantri C, Purwanti E, Nuryono N, Agus A. Estimation of aflatoxin M1 exposure through consumption of various dairy milk products in Yogyakarta, Indonesia. *J Vet*. 2019;20(1):58. DOI: [10.19087/jveteriner.2019.20.1.58](https://doi.org/10.19087/jveteriner.2019.20.1.58)
3. Oliveira GG, VM, Aronovich M, Rodrigues R, LA. Evaluation of aflatoxin M1 contamination and physicochemical adulteration in raw milk from Southeast Brazil. *Anim Husb Dairy Vet Sci*. 2020;4(1). DOI: [10.15761/ahdvs.1000173](https://doi.org/10.15761/ahdvs.1000173)
4. Pipoyan D, Hovhannisyan A, Beglaryan M, Mantovani A. Risk assessment of AFM1 in raw milk and dairy products produced in Armenia, a Caucasus region country: A pilot study. *Foods*. 2024;13(10):1518. DOI: [10.3390/foods13101518](https://doi.org/10.3390/foods13101518)
5. Panara A, Katsa M, Kostakis M, Bizani E, Thomaidis N. Monitoring of aflatoxin M1 in various origins Greek milk samples using liquid chromatography tandem mass spectrometry. *Separations*. 2022;9(3):58. DOI: [10.3390/separations9030058](https://doi.org/10.3390/separations9030058)
6. Barajas-Ramírez A, Moncada-Abaunza D, Gómez-Espinoza A. Mycotoxins in foods, from the field to the plate: A review. *Int Food Res J*. 2021;28(2):230-247. DOI: [10.47836/ifrj.28.2.02](https://doi.org/10.47836/ifrj.28.2.02)
7. Yao Y, Ye Y, Wang X, Zou Z, Zhang Y, Chai Y, Yu X, Zhang L, Wang J. Mycotoxin contamination: Occurrence, biotransformation, pathogenic mechanisms, and strategies for nutritional intervention. *Molecules*. 2025;30(19):3860. DOI: [10.3390/molecules30193860](https://doi.org/10.3390/molecules30193860)
8. Mielech A, Puścion-Jakubik A, Socha K. Assessment of the risk of contamination of food for infants and toddlers. *Nutrients*. 2021;13(7):2358. DOI: [10.3390/nu13072358](https://doi.org/10.3390/nu13072358)
9. Dai C, Tian Y, Hao L, Tang X, Wang Y, Sharma A, Jiang H, Shen X. Aflatoxin B1 toxicity and protective effects of curcumin: Molecular mechanisms and clinical implications. *Antioxidants*. 2022;11(10):2031. DOI: [10.3390/antiox11102031](https://doi.org/10.3390/antiox11102031)

10. Tang Y, He X, Yuan J, Li Y, Luo H, You L. Simultaneous detection of multiple mycotoxins in agricultural products: Recent advances in optical and electrochemical sensing methods. *Compr Rev Food Sci Food Saf.* 2024;23(6). DOI: [10.1111/1541-4337.70062](https://doi.org/10.1111/1541-4337.70062)
11. Huang X, Gao Y, Li S, Wu C, Wang J, Zheng N. Modulation of mucin (MUC2, MUC5AC and MUC5B) mRNA expression and protein production and secretion in Caco-2/HT29-MTX co-cultures following exposure to individual and combined aflatoxin M1 and ochratoxin A. *Toxins.* 2019;11(2):132. DOI: [10.3390/toxins11020132](https://doi.org/10.3390/toxins11020132)
12. Gao Y, Li S, Yang D, Wang J, Zheng N. The protective effects of lactoferrin on aflatoxin M1-induced compromised intestinal integrity. *Int J Mol Sci.* 2021;23(1):289. DOI: [10.3390/ijms23010289](https://doi.org/10.3390/ijms23010289)
13. Lázaro Á, Vila-Donat P, Manyes L. Emerging mycotoxins and preventive strategies related to gut microbiota changes: Probiotics, prebiotics, and postbiotics: A systematic review. *Food Funct.* 2024;15(18):8998-9023. DOI: [10.1039/d4fo01705f](https://doi.org/10.1039/d4fo01705f)
14. Bastos-Moreira Y, Argaw A, Dailey-Chwalibóg T, El-Hafi J, Olivier Ouédraogo L, Celine Toe L, De Saeger S, Lachat C, De Boevre M. Prenatal ochratoxin A exposure, birth outcomes and infant growth in rural Burkina Faso: A human biomonitoring sub-study from the MISAME-III trial. *Emerg Contam.* 2024;10(4):100355. DOI: [10.1016/j.emcon.2024.100355](https://doi.org/10.1016/j.emcon.2024.100355)
15. Akbari P, Braber S, Varasteh S, Alizadeh A, Garssen J, Fink-Gremmels J. The intestinal barrier as an emerging target in the toxicological assessment of mycotoxins. *Arch Toxicol.* 2017;91(3):1007-1029. DOI: [10.1007/s00204-016-1794-8](https://doi.org/10.1007/s00204-016-1794-8)
16. Schrenk D, Bignami M, Bodin L, Chipman JK, del Mazo J, Grasl-Kraupp B, Hogstrand C, Hoogenboom L, Leblanc JC, Nebbia CS, Nielsen E, Ntzani E, Petersen A, Sand S, Schwerdtle T, Vleminckx C, Marko D, Oswald IP, Piersma A, Routledge M, Schlatter J, Baert K, Gergelova P, Wallace H. Risk assessment of aflatoxins in food. *EFSA J.* 2020;18(3):e06040. DOI: [10.2903/j.efsa.2020.6040](https://doi.org/10.2903/j.efsa.2020.6040)
17. Gürbay A, Aydın S, Girgin G, Engin AB, Şahin G. Assessment of aflatoxin M1 levels in milk in Ankara, Turkey. *Food Control.* 2006;17(1):1-4. DOI: [10.1016/j.foodcont.2004.07.008](https://doi.org/10.1016/j.foodcont.2004.07.008)
18. Seid A, Mama A. Aflatoxicosis and occurrence of aflatoxin M1 (AFM1) in milk and dairy products: A review. *Austin J Vet Sci Anim Husb.* 2019;6(1):1054. [\[available at\]](#)
19. Min L, Fink-Gremmels J, Li D, Tong X, Tang J, Nan X, Yu Z, Chen W, Wang G. An overview of aflatoxin B1 biotransformation and aflatoxin M1 secretion in lactating dairy cows. *Anim Nutr.* 2021;7(1):42-48. DOI: [10.1016/j.aninu.2020.11.002](https://doi.org/10.1016/j.aninu.2020.11.002)
20. Demir T, Ağaoğlu S. Exposure assessment of aflatoxin M1 through ingestion of infant formula in Türkiye. *Turk J Agric Food Sci Technol.* 2023;11(2):396-402. DOI: [10.24925/turjaf.v11i2.396-402.5805](https://doi.org/10.24925/turjaf.v11i2.396-402.5805)
21. Jafarian-Dehkordi A, Pourradi N. Aflatoxin M1 contamination of human breast milk in Isfahan, Iran. *Adv Biomed Res.* 2013;2:86. DOI: [0.4103/2277-9175.122503](https://doi.org/0.4103/2277-9175.122503)

مستويات وجود وتركيز الأفلاتوكسين M1 في الحليب الخام: نتائج من منطقة وسط الأناضول في ترشقية

عمران غاريب¹، سرکان شاهين²

¹قسم الصيدلة والسموم، كلية الطب البيطري، ²قسم الصيدلة الطبية، كلية الطب، جامعة يوزغات بوزوك، يوزغات، تركيا

في هذه الدراسة، تم تحديد مستويات وجود وتركيز الأفلاتوكسين M1 (AFM1) في عينات الحليب الخام المنتجة في مقاطعة يوزغات ومقاطعاتها الواقعة في منطقة وسط الأناضول في ترشقية، وتم تقييم النتائج التي تم الحصول عليها من حيث التعرض البشري. ضمن نطاق الدراسة تم جمع ما مجموعه ٨٠ عينة حليب خام من مزارع الألبان في مناطق ساريكايه، مركز يوزغات، سفاتلي، بوكازيان، نينفاكالي، أجريت التحاليل لتقييم الـ AFM1 باستخدام عدة ELISA التجارية. وعلى الرغم من الكشف عن وجود AFM1 في جميع العينات، تبين أن التركيزات المقاسة كانت أقل بكثير من الحد الأقصى للرواسب البالغ ٥٠ نانوغرام/كغ الذي حدده الاتحاد الأوروبي للحليب ومنتجات الألبان. تراوحت مستويات AFM1 على أساس المقاطعة بين ٢,١٣ و ٢,٣٤ نانوغرام/كجم، ولوحظ أن التوزيع العام يتجمع ضمن نطاق تركيز ضيق. ونتيجة للتحليلات الإحصائية، لم يكشف إلا عن اختلاف كبير بين مقاطعتي سفاتلي وبوكازيان-نينفاكالي. وفي تقييم التعرض، قدر متوسط المتناول اليومي من الـ AFM1 للأفراد البالغين بأنه ٠,٠٠٤٤ نانوغرام/كيلوغرام من وزن الجسم في اليوم، مما يشير إلى انخفاض مستوى التعرض. تشير النتائج إلى أن مستوى الخطر الحاد الحالي في المنطقة التي تم فحصها منخفض؛ ومع ذلك، فإن اكتشاف الذيفان في جميع العينات يسلط الضوء على أهمية الحفاظ على برامج المراقبة المنتظمة من منظور الصحة العامة.