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Review Article

Aflatoxin M1 in Milk Worldwide from 1988 to 2020: A Systematic Review and Meta-Analysis

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Background. Aflatoxins are found in various types of food and animal feed. Food contamination with aflatoxin toxin is of particular importance today. Various studies have reported different prevalence of aflatoxin M1 in animal milk. Therefore, due to the importance of this toxin, its role in health, and lack of general statistics about it worldwide, the present study aimed to determine the prevalence of aflatoxin M1 in milk worldwide with a systematic review and meta-analysis study. *Methods*. In this review study, national and international databases were extracted from SID, MagIran, IranMedex, IranDoc, Embase, ScienceDirect, Scopus, PubMed, and Web of Science (ISI) between January 1988 and February 2020. A random effects model was used for analysis, and heterogeneity of studies with an I^2 index was investigated. Data were analyzed using Comprehensive Meta-Analysis (version 2). *Results*. The prevalence of aflatoxin M1 in milk worldwide from January 1988 to February 2020 in 122 articles with a sample size of 18921 was 79.1% (95% CI: 75.5–82.3%). Regarding the heterogeneity based on metaregression, there was a significant difference between the effect of the year of study ($p \leq 0.001$) and sample size ($p \leq 0.001$) with the prevalence of aflatoxin M1 in animal milk. *Conclusion*. The results of this study show that the prevalence of aflatoxin M1 in milk is high worldwide. Therefore, considering the importance of the milk group and its products, special measures should be taken to protect the ration from aflatoxin molds and milk quality.

1. Introduction

Food contamination with aflatoxin toxin is of particular importance today, and global organizations such as the WHO, FAO, and Codex (the Codex Alimentarius Commission) have determined the maximum level of contamination of various foods [1].

Aflatoxin in humans causes acute and chronic poisoning. This toxin has teratogenic and carcinogenic effects [2].

Studies have shown the adverse effects of aflatoxin on the central nervous system, liver and kidney, brain injury, and death. If the human diet contains several mycotoxins, the symptoms of intoxication become more severe depending on the patient's age, gender, and condition [3].

The long-term effects of taking small amounts of mycotoxins are different. The main effect of chronic mycotoxin poisoning, especially aflatoxins, is a variety of cancers, especially liver cancer [4].

Aflatoxins are found in a variety of foods and animal feed. Nowadays, methods of precise analysis have enabled the measurement of its concentration in micrograms of food [5].

Aflatoxin is divided into two major groups: B and G. Food contamination with aflatoxins is generally caused by inappropriate storage of foodstuff which leads to the contamination with *Aspergillus* fungi in various ways. Consumption of contaminated feed by poultry causes aflatoxin M1 to be present in milk, meat, and eggs [6, 7]. The permitted aflatoxin M1 level in dairy products is 0.05 mcg/liter [8].

Studies have shown that consumption of aflatoxin-containing foods is a cause of liver cancer in Qidong people in China [9]. In addition, four years of food inspection and control in Cyprus showed contamination of many foods with this toxin [10].

Studies show that aflatoxin M1 in raw milk can be transferred to dairy products. In one study, adding 1.7 to 2 micrograms of aflatoxin to milk and production of cheese, it was observed that 40% of aflatoxin remained in cheese and 60% in whey [11].

Research on raw milk in Albania has also shown that the amount of aflatoxin M1 in winter milk is higher than in summer milk [12].

Almost all samples of dry matter, baby food, and yogurt in Italy and Kuwait are contaminated with aflatoxin M1, but its content value in dairy products was not considered a serious problem for the Italian people; however, for milk products, the principles of proper maintenance and proper livestock feeding have been suggested [13, 14].

Measurement of aflatoxin M1 by ELISA in Bursa, Turkey, showed that high-fat cheeses contained aflatoxin M1 more than the standard in Turkey [15, 16]. In some parts of the world, aflatoxin M1 contamination is not a serious health problem either, but contamination with this toxin has been reported. For example, studies of raw milk in Spain report contamination in only 33% of the samples [17].

Sampling of milk from supermarkets in Ribeirao, Brazil, showed that about 21% of the samples were contaminated with aflatoxin M1 and its content has been 24–50 ng/l. The results of this study showed that despite the high levels of contamination of pasteurized and sterile milk in Brazil, this is not a serious problem for people. However, more research and investigation is needed in this regard [18].

However, the examination of raw, pasteurized, sterile milk in Mexico shows aflatoxin M1 contamination and in another study, 40% of the samples collected contained more than 0.05 μg/L of aflatoxin M1 [19, 20].

Various studies have reported different prevalence of aflatoxin M1 in animal milk. However, no comprehensive study that shows the results of these studies as a whole globally has been found; therefore, due to the importance of this toxin, its role in health, and lack of general statistics about it worldwide, the present study was conducted to determine the prevalence of aflatoxin M1 in milk worldwide in a systematic review and meta-analysis study.

2. Methods

In this systematic review and meta-analysis study, the prevalence of aflatoxin M1 in animal milk worldwide was assessed based on studies conducted between January 1988 and February 2020. For this purpose, articles published in the databases of SID, MagIran, IranMedex, and IranDoc and international databases of Embase, ScienceDirect, Scopus, PubMed, and Web of Science (ISI) with keywords of Prevalence, Aflatoxin M1, and Milk were searched.

The selection criteria were the availability of full-text cross-sectional studies investigating the prevalence of aflatoxin M1 in animal milk. For more information, the sources of the articles were also reviewed for access to other articles.

2.1. Selection of Studies. Initially, all articles referring to the prevalence of aflatoxin M1 in milk worldwide were collected by researchers and acceptance was performed based on inclusion and exclusion criteria. Exclusion criteria included unrelated cases, case reports, interventional studies, duplication of studies, unclear methodology, and inaccessibility of the full text of the study. In order to reduce bias, articles were searched independently by two researchers and if there is a disagreement about a study, the article was reviewed by the refereeing supervisor. A total of 130 studies entered the third stage, i.e., qualitative evaluation.

2.2. Qualitative Evaluation of Studies. The quality of the articles was evaluated on the basis of the selected and related items of the STROBE 22-item checklist that could be evaluated in this study (study design, background, literature review, place and time of study, consequence, inclusion criteria, sample size, and statistical analysis). Previous studies have also referred to them. Articles referring to 6 to 7 criteria were considered as high-quality articles, and those that did not refer to 2 items and more than 2 items from the seven items were considered as medium and low methodological quality articles, respectively [21]. In the present study, 122 articles were entered into the systematic review and meta-analysis as high-quality and medium-quality studies, and seven articles had poor quality and were excluded.

2.3. Data Extraction. All final articles entered into the meta-analysis process were prepared by a preprepared checklist. Checklists included article title, first author's name, year of publication, study location, sample size, prevalence of aflatoxin M1 in milk, animal species, milk type, and implementation method.

2.4. Statistical Analysis. Since prevalence has binomial distribution, prevalence variance was calculated using a binomial distribution variance formula and weighted mean was used to combine prevalence rate of different studies. To evaluate the heterogeneity of the selected studies, the I^2 index test (heterogeneity was divided into three classes of less than 25% (low heterogeneity), 25–75% (moderate heterogeneity), and more than 75% (high heterogeneity)) was used.

Metaregression analysis was used to investigate the relationship between the prevalence of aflatoxin M1 in animal milk worldwide with the year of study and sample size.

The Begg and Mazumdar test at the significant level of 0.1 and its corresponding funnel plot were used to investigate the propagation error and also considering the high volume of samples. Data were analyzed using Comprehensive Meta-Analysis (version 2) software.

3. Results

In this study, all studies regarding the prevalence of aflatoxin M1 in milk worldwide without a time limit were systematically reviewed according to the PRISMA regulations. In the initial search, 1384 articles were identified, and 122

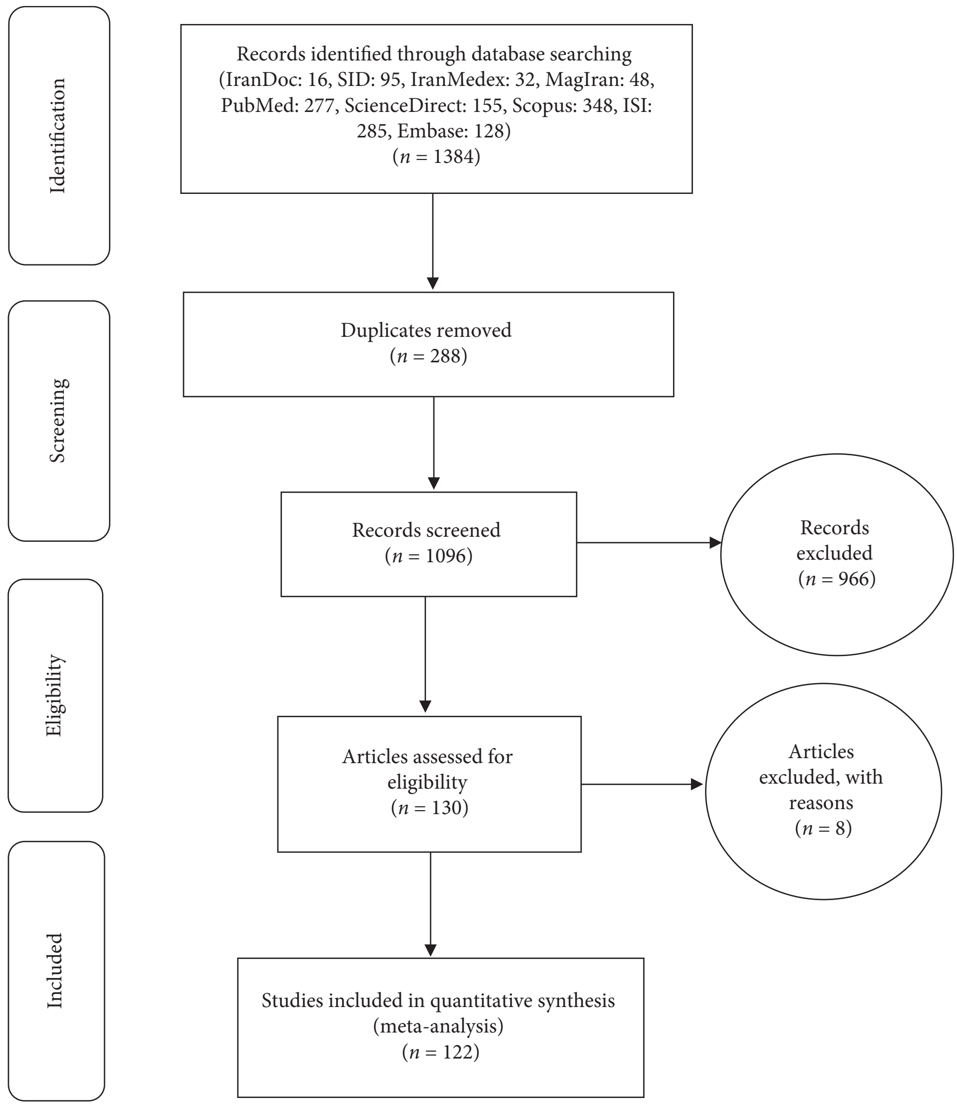


Figure 1: Flow diagram of study selection.

articles eventually published between January 1988 and February 2020 were entered into the final analysis (Figure 1).

The probability of bias in the results by the funnel plot and Begg and Mazumdar test at the significant level of 0.1 indicated no bias in the present study ($p = 0.102$) (Figure 2).

Based on the results of the test (I^2: 95.1) and due to the heterogeneity of the selected studies, a random effects model was used to combine the studies and the joint prevalence estimation. There were 122 articles with a sample size of 18921 individuals on the prevalence of aflatoxin M1 in animal milk worldwide with sample size, animal species, milk type, and execution method in each study; the specifications of the selected articles are presented in Table 1.

According to the results of the study, the prevalence of aflatoxin M1 in milk worldwide was 79.1% (95% CI: 75.5–82.3%) (Figure 3).

The middle point of each line represents the prevalence of aflatoxin M1 in milk worldwide in each study, and the rhombic figure shows the prevalence of aflatoxin M1 in milk worldwide for all studies.

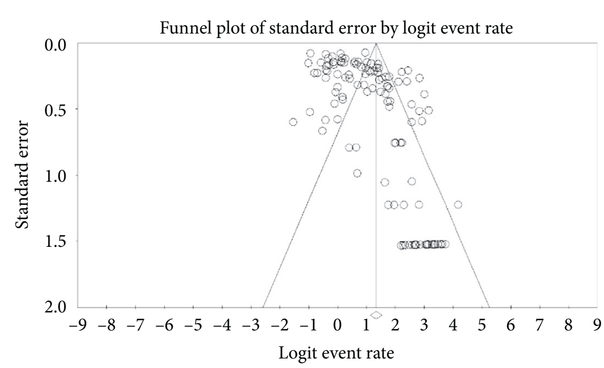


Figure 2: Funnel plot of the results of aflatoxin M1 in milk.

Table 2 presents the results of the analysis of different subgroups by continents.

Table 1: Characteristics of meta-analysis studies on the prevalence aflatoxin M1.

Author, year, reference	Country	Sample size	Prevalence (%)	Species	Type	Detection method	Quality
Kamkar, 2005, [22]	Iran	111	75.7	Cow	Raw	TLC[a]	Medium
Karimi et al., 2007, [23]	Iran	110	99.5	Cow	PTZ[d]	ELISA[b]	High
Ghiasian et al., 2007, [24]	Iran	186	64.0	Cow	Raw	ELISA	High
Oveisi et al., 2007, [25]	Iran	128	99.6	Cow	PTZ	ELISA	High
Tajkarimi et al., 2007, [26]	Iran	98	95.9	Cow	Raw	HPLC[c]	Medium
Tajik et al., 2007, [27]	Iran	144	99.7	Cow	Raw, PTZ	ELISA	High
Tajkarimi et al., 2008, [28]	Iran	319	53.9	Cow	Raw	HPLC	High
Sefidgar et al., 2008, [29]	Iran	120	98.3	Cow	Raw	ELISA	High
Kamkar, 2008, [30]	Iran	52	99.1	Cow	UHT[e]	ELISA	Medium
Ghazani, 2009, [31]	Iran	50	99.0	Cow	PTZ	ELISA	Medium
Sadeghi et al., 2009, [32]	Iran	128	78.1	Cow	PTZ	ELISA	High
Rahimi et al., 2009, [33]	Iran	236	90.3	Cow	Raw, PTZ, UHT	ELISA	High
Riazipour et al., 2010, [34]	Iran	50	84.0	Cow	PTZ	ELISA	High
Nemati et al., 2010, [35]	Iran	90	99.5	Cow	Raw, PTZ, UHT	ELISA	High
Sani et al., 2010, [36]	Iran	196	99.7	Cow	PTZ	ELISA	High
Fallah-1, 2010, [37]	Iran	91	72.5	Cow	PTZ	TLC	Medium
Fallah-2, 2010, [38]	Iran	225	67.1	Cow	PTZ, UHT	ELISA	High
Mohammadian et al., 2010, [39]	Iran	272	94.5	Cow	Raw, PTZ	ELISA	High
Mohamadi and Alizadeh, 2010, [40]	Iran	80	99.4	Cow	PTZ, UHT	ELISA	High
Rahimi et al., 2010, [41]	Iran	311	42.1	Cow, sheep, goat, camel, buffalo	Raw	ELISA	Medium
Heshmati and Milani, 2010, [42]	Iran	210	52.9	Cow	UHT	ELISA	High
Sefidgar et al., 2011, [43]	Iran	72	99.3	Cow	PTZ	ELISA	High
Kamkar et al., 2011, [44]	Iran	122	99.6	Cow	Raw	ELISA	High
Movassagh, 2011, [45]	Iran	49	99.0	Cow	UHT	ELISA	High
Fallah et al., 2011, [46]	Iran	225	64.4	Cow, sheep, goat	Raw	TLC	High
Panahi et al., 2011, [47]	Iran	100	99.5	Cow	Raw	ELISA	High
Rohani et al., 2011, [48]	Iran	72	50.0	Cow	Raw	HPLC	High
Garmakhany et al., 2011, [49]	Iran	74	85.1	Cow	Raw, PTZ	HPLC	High
Rahimi-1 et al., 2011, [50]	Iran	149	95.3	Cow	PTZ, UHT	ELISA	Medium
Rahimi-2 and Ameri, 2011, [51]	Iran	150	46.7	Cow, sheep, goat	Raw	ELISA	High
Rahimi-3 et al., 2011, [52]	Iran	60	40.0	Cow	PTZ	ELISA	High
Behfar et al., 2012, [53]	Iran	100	99.5	Cow	PTZ	HPLC	High
Mohamadi-Sani et al., 2012, [54]	Iran	42	97.6	Cow	PTZ	ELISA	High
Behnamipour et al., 2012, [55]	Iran	75	99.3	Cow	PTZ	ELISA	Medium
Movassagh and Adinehvand, 2013, [56]	Iran	90	99.5	Cow	Raw	ELISA	High
Riahi-Zanjani and Balali-Mood, 2013, [57]	Iran	45	98.9	Cow	PTZ	ELISA	Medium
Khosravi et al., 2013, [58]	Iran	2160	100.0	Cow	Raw	ELISA	High
Sani and Nikpooyan, 2013, [59]	Iran	60	99.2	Cow	PTZ	HPLC	High
Kamkar et al., 2014, [60]	Iran	120	75.0	Cow, buffalo	Raw	ELISA	High
Moeinian et al., 2014, [61]	Iran	311	92.0	Cow	Raw	HPLC	High
Mahmoudiand Zare, 2014, [62]	Iran	30	98.4	Buffalo	Raw	ELISA	High
Rezaei et al., 2014, [63]	Iran	40	98.8	Cow	Raw	HPLC	High
Zanjani et al., 2015, [64]	Iran	45	98.9	Cow	Raw	ELISA	High
Mahmoudi and Norian, 2015, [65]	Iran	288	56.6	Cow	Raw	ELISA	Medium
Fallah et al., 2015, [66]	Iran	254	80.3	Cow	Raw	ELISA	Medium

Table 1: Continued.

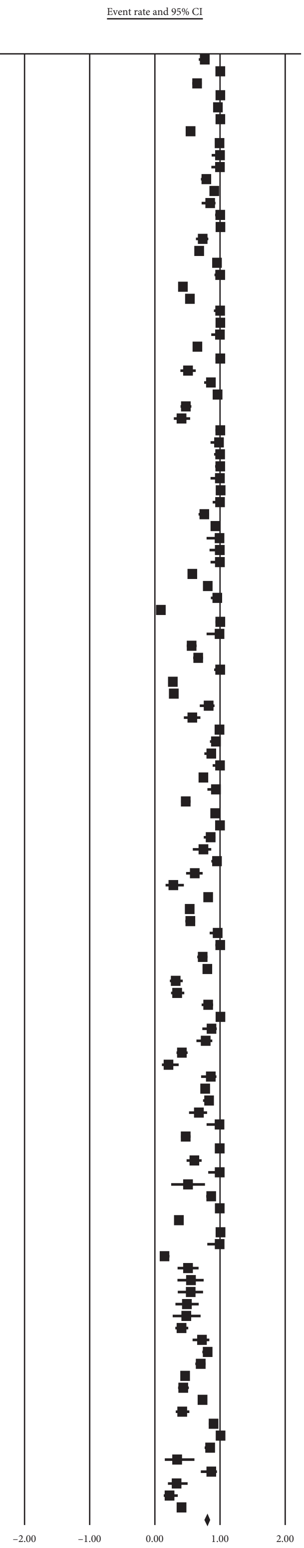
Author, year, reference	Country	Sample size	Prevalence (%)	Species	Type	Detection method	Quality
Barikbin et al., 2015, [67]	Iran	59	94.9	Cow	PTZ	ELISA	High
Rouhi et al., 2015, [68]	Iran	120	8.3	Cow	Raw, PTZ	ELISA	Medium
Najafian and Najafian, 2015, [69]	Iran	100	99.5	Cow	PTZ	ELISA	High
Mashak et al., 2016, [70]	Iran	30	98.4	Cow	UHT	HPLC	High
Hashemi, 2016, [71]	Iran	180	55.6	Cow	Raw, PTZ	ELISA	High
Bahrami et al., 2016, [72]	Iran	172	65.7	Cow, sheep, goat	Raw	ELISA	High
Mohammadi et al., 2016, [73]	Iran	76	99.4	Cow	PTZ	ELISA	High
Bolourchian et al., 2016, [74]	Iran	221	26.7	Cow	Raw	ELISA	High
Fallah et al., 2016, [75]	Iran	808	28.2	Cow, sheep, goat, Camel	Raw	HPLC	High
Sohrabi and Gharahkoli, 2016, [76]	Iran	49	81.6	Cow	PTZ	ELISA	High
Palizban et al., 2016, [77]	Iran	60	56.7	Cow	Raw	ELISA	High
Taherabadi et al., 2016, [78]	Iran	117	98.3	Cow	Raw, PTZ	HPLC	High
Dakhili et al., 2016, [79]	Iran	70	92.9	Cow	Raw	ELISA	High
Shokri and Torabi, 2017, [80]	Iran	70	85.7	Camel	Raw	ELISA	High
Ghariby et al., 2017, [81]	Iran	60	99.2	Buffalo	Raw	ELISA	High
Xiong et al., 2018, [82]	China	242	73.6	Cow	PTZ, UHT	HPLC	High
Sumantri et al., 2019, [83]	Indonesia	42	92.9	Cow	PTZ, raw	ELISA	High
Nile et al., 2016, [84]	India	200	45.5	Cow	Raw	ELISA	High
Asghar et al., 2018, [85]	Pakistan	156	91.7	Cow	Raw	ELISA	High
Turkoglu and Keyvan, 2019, [86]	Turkey	105	99.0	Cow	Raw, PTZ, UHT	ELISA	High
Hassan et al., 2018, [87]	Qatar	72	84.7	Cow	PTZ, UHT	HPLC	High
Assem et al., 2011, [88]	Lebanon	38	73.7	Cow	Raw	ELISA	High
Cano-Sancho et al., 2010, [89]	Spain	72	94.4	Cow	UHT	ELISA	High
Arorini et al., 2016, [90]	Italy	58	60.3	—	Raw, UHT	HPLC	High
Duarte et al., 2013, [91]	Portugal	40	27.5	Cow	PTZ, UHT	ELISA	High
Rama et al., 2016, [92]	Kosovo	178	80.9	Cow	UHT, PTZ	ELISA	High
Santili et al., 2015, [93]	Brazil	635	52.6	Cow	Raw	HPLC	High
Molina et al., 2019, [94]	Costa Rica	183	5.6	—	Raw	HPLC	Medium
Elzupir and Elhussein, 2010, [95]	Sudan	44	95.5	Cow	—	HPLC	Medium
Kuboka et al., 2019, [96]	Kenya	96	99.5	Cow	Raw	ELISA	High
Mwanza et al., 2015, [97]	Egypt	138	72.5	Cow	Raw	ELISA	High
Dashti et al., 2005, [98]	Kuwait	177	79.7	Cow, sheep, goat, camel	Raw, PTZ	ELISA	High
Polovinski-Horvatović et al., 2009, [99]	Serbia	90	31.1	Cow, sheep, goat	UHT, PTZ	TLC	High
Pathirana et al., 2010, [100]	Sri Lanka	87	33.3	Cow	Raw	HPLC	High
Muhammad et al., 2010, [101]	Pakistan	84	81.0	—	Raw	HPLC	Medium
Ruangwises and Ruangwises, 2010, [102]	Thailand	240	99.8	Cow	Raw	HPLC	High
Ertas et al., 2011, [103]	Turkey	43	86.0	—	Raw	ELISA	Medium
Ayoub et al., 2011, [104]	Egypt	48	77.1	—	Raw, PTZ, UHT	ELISA	Medium
El Khoury et al., 2011, [105]	Lebanon	138	40.6	—	PTZ	ELISA	Medium
Kabak and Ozbey, 2012, [106]	Turkey	40	20.0	Cow	UHT	HPLC	High
Al Zuheir and Omar, 2012, [107]	Palestine	40	85.0	Cow, sheep, goat	Raw	ELISA	High
Sadia et al., 2012, [108]	Palestine	232	76.3	—	Raw, PTZ	ELISA	Medium
Abdallah et al., 2012, [109]	Saudi Arabia	96	82.3	Cow	UHT	ELISA	High
Siddappa et al., 2012, [110]	India	45	66.7	Cow	UHT	HPLC	High

Table 1: Continued.

Author, year, reference	Country	Sample size	Prevalence (%)	Species	Type	Detection method	Quality
Okeke et al., 2012, [111]	Nigeria	30	98.4	—	PTZ	ELISA	Medium
Tsakiris et al., 2013, [112]	Greece	196	46.4	—	PTZ	ELISA	Medium
Suliman and Abdalla, 2013, [113]	Sudan	143	98.6	Cow	Raw	ELISA	High
Xiong et al., 2013, [114]	China	72	59.7	—	Raw	ELISA	High
Ali-1 et al., 2014, [115]	Sudan	35	98.6	Cow	Raw	ELISA	High
Ali-2 et al., 2014, [115]	Sudan	12	50.0	Cow	PTZ	ELISA	High
Mulunda and Mike, 2014, [116]	South Africa	125	85.6	—	Raw	HPLC	Medium
Kos et al., 2014, [117]	Serbia	150	98.7	Cow	Raw	ELISA	High
Han et al., 2013, [118]	China	200	36	Cow	Raw	ELISA	High
Bilandžić-1 et al., 2014, [119]	Croatia	337	99.9	Cow	Raw	ELISA	High
Bilandžić-2 et al., 2014, [119]	Croatia	32	98.5	Cow	Raw	ELISA	High
Picinin et al., 2010, [120]	Brazil	129	14.0	Cow	Raw	ELISA	High
Asi-1 et al., 2012, [121]	Pakistan	36	50.0	Buffalo	Raw	HPLC	High
Asi-2 et al., 2012, [121]	Pakistan	22	54.5	Cow	Raw	HPLC	High
Asi-3 et al., 2012, [121]	Pakistan	24	54.2	Goat	Raw	HPLC	High
Asi-4 et al., 2012, [121]	Pakistan	29	48.3	Sheep	Raw	HPLC	High
Asi-5 et al., 2012, [121]	Pakistan	19	47.4	Camel	Raw	HPLC	High
Lee et al., 2009, [122]	South Korea	100	40.0	Cow	Raw	ELISA	High
Elgerbi et al., 2004, [123]	Libya	49	71.4	Cow	Raw	HPLC	High
Ghanem and Orfi, 2009, [124]	Syria	126	80.2	Cow, sheep, goat	PTZ	ELISA	High
Peng and Chen, 2009, [125]	Taiwan	144	69.4	—	PTZ	HPLC	High
Kang'ethe et al., 2007, [126]	Kenya	391	45.5	—	—	—	Medium
Sharma et al., 2019, [127]	India	150	42.7	Cow	Raw	HPLC	High
Akbar et al., 2019, [128]	Pakistan	960	72.3	Cow, sheep, goat	Raw	ELISA	High
Zakaria et al., 2019, [129]	Egypt	90	41.1	—	Raw, UHT	HPLC	High
Eker et al., 2019, [130]	Turkey	120	89.2	—	Raw	ELISA	High
Tahira et al., 2019, [131]	Pakistan	570	99.9	—	Raw, UHT, PTZ	ELISA	High
Abbès et al., 2012, [132]	Tunisia	112	83.9	Cow	Raw	ELISA	High
Peña-Rodas et al., 2018, [133]	USA	15	33.3	Cow	Raw	ELISA	High
Venâncio et al., 2019, [134]	Brazil	35	85.7	—	Raw	ELISA	High
Blanco et al., 1988, [17]	Spain	37	32.4	Cow	Raw	—	Medium
Garrido et al., 2003, [18]	Brazil	60	21.7	Cow	Raw, UHT, PTZ	HPLC	High
Carvajal et al., 2003, [19]	Mexico	580	40.0	Cow	Raw	HPLC	High

[a]Thin-layer chromatography. [b]The enzyme-linked immunosorbent assay. [c]High-performance liquid chromatography. [d]Pasteurized. [e]Ultrahigh temperature.

Study name	Statistics for each study				
	Event rate	Lower limit	Upper limit	Z-value	p-value
Kamkar2	0.757	0.668	0.828	5.130	0.000
Karimi	0.995	0.932	1.000	3.808	0.000
Ghiasian	0.640	0.568	0.706	3.761	0.000
Oveisi	0.996	0.941	1.000	3.916	0.000
Tajkarimi	0.959	0.896	0.985	6.184	0.000
Tajik	0.997	0.947	1.000	4.000	0.000
Tajkarimi1	0.539	0.484	0.593	1.398	0.162
Sefidgar1	0.983	0.936	0.996	5.718	0.000
Kamkar3	0.991	0.866	0.999	3.275	0.001
Ghazani	0.990	0.862	0.999	3.247	0.001
Sadeghi	0.781	0.701	0.844	5.954	0.000
Rahimi	0.903	0.858	0.934	10.141	0.000
Riazipour	0.840	0.711	0.918	4.299	0.000
Nemati	0.995	0.918	1.000	3.666	0.000
Sani	0.997	0.961	1.000	4.219	0.000
Fallah-1	0.725	0.625	0.807	4.134	0.000
Fallah-2	0.671	0.607	0.729	5.026	0.000
Mohammadian	0.945	0.911	0.966	10.696	0.000
Mohamadi	0.994	0.909	1.000	3.582	0.000
Rahimi1	0.421	0.368	0.477	−2.767	0.006
Heshmati	0.529	0.461	0.595	0.828	0.408
Sefidgar	0.993	0.900	1.000	3.507	0.000
Kamkar	0.996	0.938	1.000	3.882	0.000
Movassagh	0.990	0.859	0.999	3.233	0.001
Fallah1	0.644	0.580	0.704	4.270	0.000
Panahi	0.995	0.926	1.000	3.741	0.000
Rohani	0.500	0.387	0.613	0.000	1.000
Garmakhany	0.851	0.751	0.916	5.341	0.000
Rahimi-1	0.953	0.905	0.977	7.774	0.000
Rahimi-2	0.467	0.388	0.547	−0.816	0.415
Rahimi-3	0.400	0.285	0.528	−1.539	0.124
Behfar	0.995	0.926	1.000	3.741	0.000
Mohamadi-Sani	0.976	0.849	0.997	3.669	0.000
Behnamipour	0.993	0.903	1.000	3.536	0.000
Movassagh1	0.995	0.918	1.000	3.666	0.000
Zanjani1	0.989	0.849	0.999	3.172	0.002
Khosravi	1.000	0.996	1.000	5.919	0.000
Sani1	0.992	0.882	0.999	3.377	0.001
Kamkar1	0.750	0.665	0.819	5.211	0.000
Moeinian	0.920	0.884	0.945	11.686	0.000
Mahmoudi1	0.984	0.789	0.999	2.883	0.004
Rezaei	0.988	0.833	0.999	3.088	0.002
Zanjani	0.989	0.849	0.999	3.172	0.002
Mahmoudi	0.566	0.508	0.622	2.233	0.026
Fallah	0.803	0.750	0.848	8.910	0.000
Barikbin	0.949	0.854	0.984	4.939	0.000
Rouhi	0.083	0.045	0.148	−7.260	0.000
Najafian	0.995	0.926	1.000	3.741	0.000
Mashak	0.984	0.789	0.999	2.883	0.004
Hashemi	0.556	0.482	0.626	1.488	0.137
Bahrami	0.657	0.583	0.724	4.046	0.000
Mohammadi	0.994	0.905	1.000	3.545	0.000
Bolourchian	0.267	0.213	0.329	−6.643	0.000
Fallah2	0.282	0.252	0.314	−11.945	0.000
Sohrabi	0.816	0.683	0.902	4.043	0.000
Palizban	0.567	0.440	0.685	1.030	0.303
Taherabadi	0.983	0.934	0.996	5.681	0.000
Dakhili	0.929	0.840	0.970	5.527	0.000
Shokri	0.857	0.754	0.921	5.246	0.000
Ghariby	0.992	0.882	0.999	3.377	0.001
Xiong	0.736	0.676	0.787	7.018	0.000
Sumantri	0.929	0.801	0.977	4.281	0.000
Nile	0.465	0.397	0.534	−0.989	0.323
Asghar	0.917	0.862	0.951	8.278	0.000
Turkoglu	0.990	0.936	0.999	4.622	0.000
Hassan	0.847	0.745	0.913	5.229	0.000
Assem	0.737	0.576	0.852	2.795	0.005
Cano-Sancho	0.944	0.861	0.979	5.507	0.000
Arorini	0.603	0.473	0.720	1.564	0.118
Duarte	0.275	0.159	0.432	−2.738	0.006
Rama	0.809	0.745	0.860	7.570	0.000
Santili	0.526	0.487	0.565	1.309	0.191
Molina	0.536	0.463	0.607	0.960	0.337
Elzupir	0.955	0.836	0.989	4.207	0.000
Kuboka	0.995	0.923	1.000	3.712	0.000
Mwanza	0.725	0.644	0.793	5.077	0.000
Dashti	0.797	0.731	0.850	7.311	0.000
Polovinski-Horvatovi?	0.311	0.224	0.414	−3.491	0.000
Pathirana	0.333	0.243	0.438	−3.048	0.002
Muhammad	0.810	0.711	0.880	5.207	0.000
Ruangwises	0.998	0.968	1.000	4.362	0.000
Ertas	0.860	0.722	0.936	4.133	0.000
Ayoub	0.771	0.632	0.868	3.532	0.000
El Khoury	0.406	0.327	0.490	−2.200	0.028
Kabak	0.200	0.103	0.352	−3.507	0.000
Al Zuheir	0.850	0.704	0.931	3.917	0.000
Sadia	0.763	0.704	0.813	7.571	0.000
Abdallah	0.823	0.733	0.887	5.746	0.000
Siddappa	0.667	0.518	0.788	2.192	0.028
Okeke	0.984	0.789	0.999	2.883	0.004
Tsakiris	0.464	0.396	0.534	−0.999	0.318
Suliman	0.986	0.946	0.996	5.976	0.000
Xiong	0.597	0.481	0.704	1.639	0.101
Ali -1	0.986	0.813	0.999	2.993	0.003
Ali -2	0.500	0.244	0.756	0.000	1.000
Mulunda	0.856	0.783	0.907	6.997	0.000
Kos	0.987	0.948	0.997	6.046	0.000
Han	0.360	0.296	0.429	−3.906	0.000
Biland -1	0.999	0.977	1.000	4.603	0.000
Biland -2	0.985	0.799	0.999	2.929	0.003
Picinin	0.140	0.090	0.211	−7.159	0.000
Asi -1	0.500	0.342	0.658	0.000	1.000
Asi -2	0.545	0.341	0.735	0.426	0.670
Asi -3	0.542	0.346	0.725	0.408	0.683
Asi -4	0.483	0.311	0.659	−0.186	0.853
Asi -5	0.474	0.268	0.689	−0.229	0.819
Lee	0.400	0.309	0.499	−1.986	0.047
Elgerbi	0.714	0.574	0.823	2.898	0.004
Ghanem	0.802	0.723	0.862	6.250	0.000
Peng	0.694	0.615	0.764	4.538	0.000
Kang'ethe	0.455	0.406	0.505	−1.768	0.077
Sharma	0.427	0.350	0.507	−1.790	0.073
Akbar	0.723	0.694	0.750	13.298	0.000
Zakaria	0.411	0.314	0.515	−1.678	0.093
Eker	0.892	0.822	0.936	7.177	0.000
Tahira	0.999	0.986	1.000	4.976	0.000
Abbès	0.839	0.759	0.896	6.425	0.000
Rodas	0.333	0.146	0.594	−1.266	0.206
Venâncio	0.857	0.700	0.939	3.709	0.000
Blanco	0.324	0.194	0.489	−2.090	0.037
Garrido	0.217	0.130	0.338	−4.101	0.000
Carvajal	0.400	0.361	0.440	−4.784	0.000
	0.791	0.755	0.823	12.800	0.000



Meta analysis

Figure 3: Prevalence of aflatoxin M1 in milk worldwide and 95% confidence interval.

3.1. Meta-Analysis of Results in Studies in Iran. Due to the high number of studies conducted in Iran, it was reported separately. Based on the results of the test (I^2: 95.7) and due to the heterogeneity of the selected studies, a random effects model was used to combine the studies. The probability of bias in the results by the Begg and Mazumdar test at the significant level of 0.1 indicated no bias in the present study ($p = 0.788$). There were 60 articles with a sample size of 10132 individuals on the results of the study in Iran, and the prevalence of aflatoxin M1 in milk in Iran was 88.5% (95% CI: 84.4–91.6%) (Figure 4).

Using metaregression, the relationship between the year of study and sample size with the prevalence of aflatoxin M1 in milk worldwide was investigated. The prevalence of aflatoxin M1 in milk increased worldwide as the year increased, and the prevalence decreased with increasing sample size; there was a significant difference between the prevalence of aflatoxin M1 and the sample size ($p \leq 0.001$) and year of study ($p \leq 0.001$) (Figures 5 and 6).

The results of metaregression, based on the year of study on each continent, showed that in the three continents of America, Africa, and Europe, with increasing year of study, the prevalence of aflatoxin M1 increases ($p \leq 0.001$) and decreases in Asia ($p \leq 0.001$) (Figure 7).

4. Discussion

Mycotoxins are biological substances that affect the health, quality, and production of toxic fungi in foods due to the growth of toxinogenic fungi. Therefore, the prevalence and amount of different mycotoxins in foods need to be constantly measured and planned in the food chain to minimize them in order to provide the health of consumers [34].

The potential risks of aflatoxin M1 in human health are particularly important in the development of liver cancer through milk and dairy products [74]. There have been various reports of the prevalence of aflatoxin M1 in milk samples [35]. In the present study, the prevalence of aflatoxin M1 in animal milk worldwide was 79.1%.

In a study by Ghaffarian Bahraman et al., the prevalence of aflatoxin M1 in buffaloes (86%), cows (86%), sheep (42%), goats (42%), and camels was reported (30%) [135].

The overall prevalence of raw milk aflatoxin in Iran, Turkey, Lebanon, Palestine, Egypt, and Syria was 76, 12, 67, 85, 38, and 14%, respectively, in a systematic review and meta-analysis conducted by Rahmani et al. [136], and these two studies are in line with the present study.

The milk free of aflatoxin is considered desirable, but it is not easy to achieve this ideal. Therefore, all countries (depending on their particular circumstances) accept milk contamination with some amounts of this toxin [35].

The most effective way to prevent aflatoxin M1 contamination of milk is to reduce aflatoxin B1 in food and supplements used in dairy cattle. Therefore, it is recommended that the feed available in be monitored permanently for the amount of aflatoxin contamination. Storage and harvesting of forage and other feedstuffs should be technically and hygienically performed, and feeds susceptible to molding, especially flour, bread, pulverized sugar beet pulp, and wet and moldy fodder should be removed from the diet of lactating animals [81].

Table 2: Analysis of subgroups by continents.

Continent	N	Sample size	I^2	Begg and Mazumdar	Prevalence (95% CI)
Asia	92	14651	95.1	0.110	82.6 (95 % CI: 78.8–85.9)
Europe	14	1498	94.9	0.381	79.1 (95 % CI: 63.4–89.2)
Africa	9	1079	94	0.465	76.4 (95 % CI: 61.7–86.7)
America	7	1637	93.7	0.763	41.3 (95 % CI: 30.1–53.5)

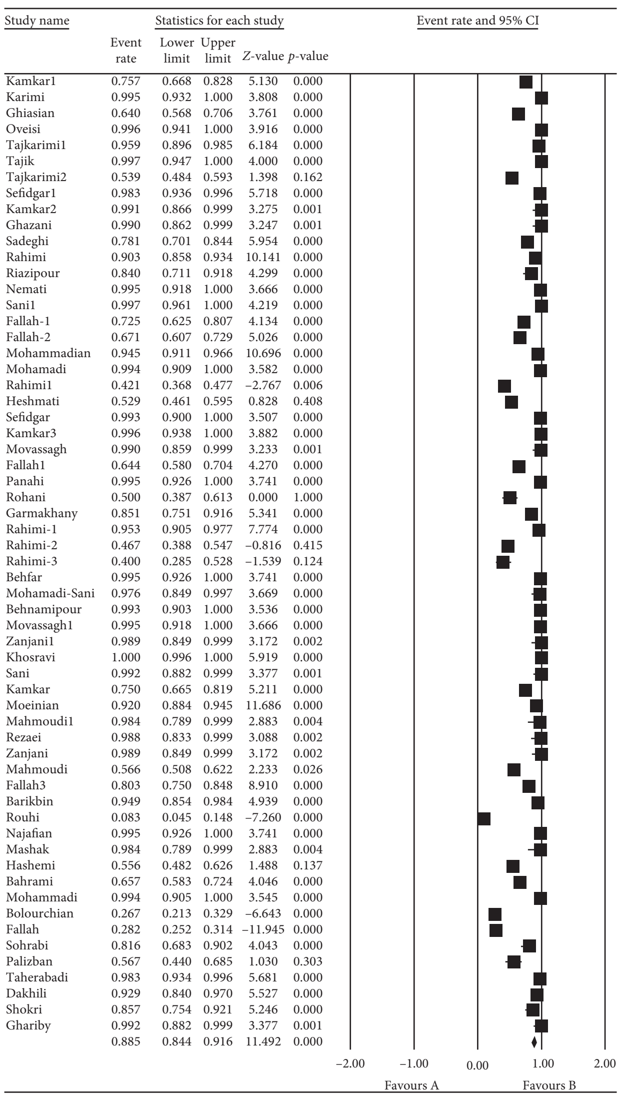


Figure 4: Prevalence of aflatoxin M1 in milk in Iran and 95% confidence interval.

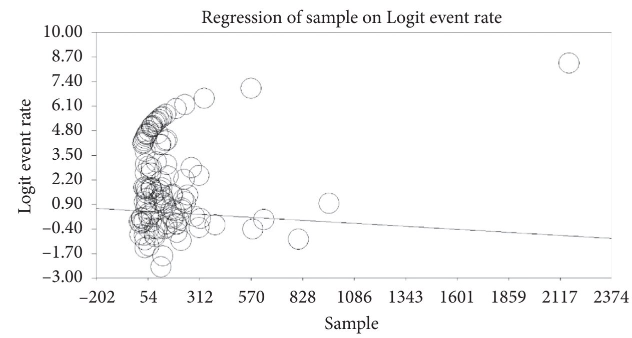


Figure 5: Metaregression of the relationship between sample size and prevalence of aflatoxin M1 in milk.

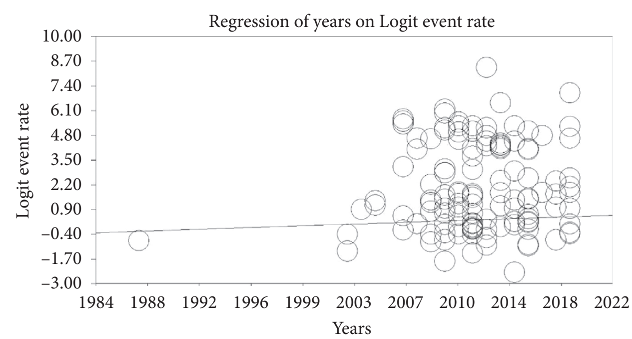


Figure 6: Metaregression of the relationship between the study year and the prevalence of aflatoxin M1 in milk.

Given that the quality of milk received is the most important factor affecting the level of contamination of dairy products with aflatoxin M1 and the processes that take place at the plant (even if it is accompanied by the growth of fungi) have no role in producing this mycotoxin, factories must therefore avoid accepting contaminated milk to improve the quality of their products [28].

This is not possible in some cases due to the geographical location of the plant. Because the climatic conditions of dairy cattle affect their milk contamination, as the Tajkarimi study in Iran also showed, milk contamination varies significantly across geographical regions [28].

The papers in this study used three methods of ELISA, HPLC, and TLC to measure aflatoxin M1, and the results of the three methods were not significantly different. All three methods have been introduced as valid methods in this regard [137].

Most of the papers used the ELISA method because it is an easy and inexpensive method for screening tests. It is said to be that one of the disadvantages of this method is that it shows the contamination higher than the actual amount [34].

The results of our systematic review and meta-analysis show that milk contamination rates are on the rise in most countries, and this could be a matter for policy makers to take seriously the quality of animal nutrition. However, this increase was not statistically significant, and in some countries, there was a declining trend, indicating that the health quality of animal nutrition in some countries increased.

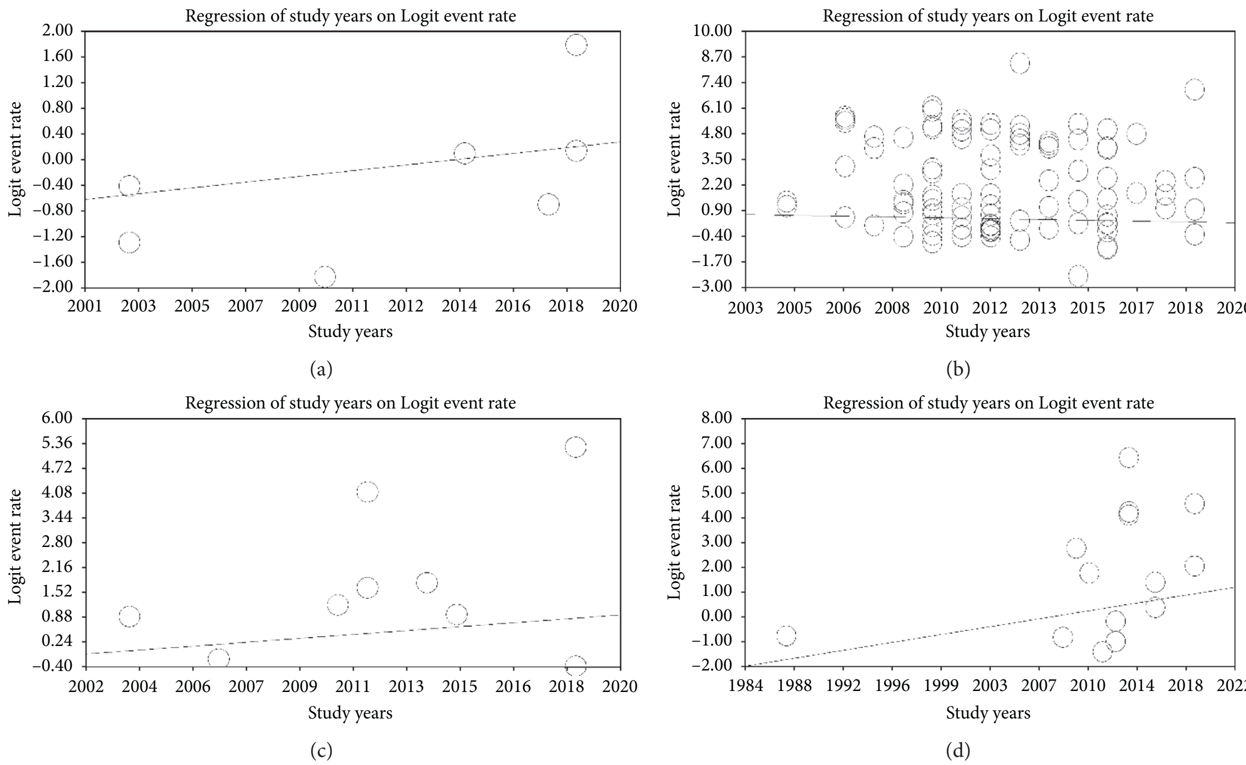


Figure 7: Metaregression of the relationship between the study year and the prevalence of aflatoxin M1 in milk according to the continents studied.

According to thermal process sources, it does not have much effect on aflatoxin contamination [138].

Therefore, no specific reason was found to justify the difference between industrial and traditional farming as well as between different factories located in different regions. There is even some uncertainty about the effect of milk pasteurization process on aflatoxin M1 levels [139].

This lack of information and uncertainties makes it difficult to decide on the desired methods for decontamination and to determine acceptable levels of contamination in each area and factory, making it difficult to predict the extent of contamination. Although factors such as forage, climatic conditions, forage storage, and a number of other factors are considered important and effective in the rate of this contamination, but the extent and effect of any of the factors is not well clear. Therefore, a precise answer to this question needs special study in this field.

Considering the international public demand for food hygiene, contamination of mycotoxins by various foods has received much attention. This led to the development and evaluation of aflatoxin milk contamination by the GECFA Committee for Expert Evaluation of Toxicology in this field. The Codex, as an international organization, is responsible for providing food regulation facilities to facilitate trade and has established the aflatoxin M1 standard in milk at 0.05 ppb.

Which was higher than the standard value in most of the articles reviewed in different parts of the world. Therefore, by adopting appropriate measures to reach the standard level, it can reduce aflatoxin M1 levels in foods by training and changing nutritional culture.

4.1. Limitations. The fact that some samples were not randomly selected is one of the limitations of this study. Lack of identical reporting of articles, nonsimilarity of the implementation method, and lack of consistency and lack of full text of the papers presented at the conference can be mentioned.

5. Conclusion

The results of this study show that the prevalence of aflatoxin M1 in milk is high worldwide. The highest prevalence was also reported in Asia with 82.6, and the results of metaregression, based on the year of study on each continent, showed that in the three continents of America, Africa, and Europe, with increasing year of study, the prevalence of aflatoxin M1 increases and decreases in Asia. Therefore, due to the importance of the milk group and its products, special measures should be taken to protect the ration from aflatoxin molds and milk quality.

Data Availability

Datasets are available through the corresponding author upon reasonable request.

Ethical Approval

Ethical approval was received from the Ethics Committee of the Deputy of Research and Technology, Kermanshah University of Medical Sciences (3009778).

Disclosure

The funder has no role in the study process.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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References

[1] World Health Organ Technical Report Series, *Evaluation of Certain Mycotoxins in Food. Fifty-Sixth Report of the Joint FAO/WHO Expert Committee on Food Additives*, Vol. 906, World Health Organ, Geneva, Switzerland, 2002.

[2] G. Sabbioni and O. Sepai, "Determination of human exposure to aflatoxins," in *Mycotoxins in Agriculture and Food Safety*, K. K. Sinha and D. Bhatnagar, Eds., pp. 183–226, Marcel Dekker Inc., New York, NY, USA, 1998.

[3] J. W. Bennett and M. Klich, "Mycotoxins," *Clinical Microbiology Reviews*, vol. 16, no. 3, pp. 497–516, 2003.

[4] M. L. Rodríguez Velasco, M. M. Calonge Delso, and D. Ordónez Escudero, "ELISA and HPLC determination of the occurrence of aflatoxin M1 in raw cow's milk," *Food Additives and Contaminants*, vol. 20, no. 3, pp. 276–280, 2003.

[5] F. Caloni, A. Stammati, G. Friggè, and I. De Angelis, "Aflatoxin M1 absorption and cytotoxicity on human intestinal in vitro model," *Toxicon*, vol. 47, no. 4, pp. 409–415, 2006.

[6] Y. M. Abdulrazzaq, N. Osman, Z. M. Yousif, and S. Al-Falahi, "Aflatoxin M1in breast-milk of UAE women," *Annals of Tropical Paediatrics*, vol. 23, no. 3, pp. 173–179, 2003.

[7] G. Battacone, A. Nudda, A. Cannas, A. C. Borlino, G. Bomboi, and G. Pulina, "Excretion of aflatoxin M1 in milk of dairy ewes treated with different doses of aflatoxin B1," *Journal of Dairy Science*, vol. 86, no. 8, pp. 2667–2675, 2003.

[8] A. Gürbay, S. Aydın, G. girgin, A. B. Engin, and G. Şahin, "Assessment of aflatoxin M1 levels in milk in Ankara, Turkey," *Food Control*, vol. 17, no. 1, pp. 1–4, 2006.

[9] J.-S. Wang, X. Shen, X. He et al., "Protective alterations in phase 1 and 2 metabolism of aflatoxin B1 by oltipraz in residents of Qidong, People's Republic of China," *JNCI Journal of the National Cancer Institute*, vol. 91, no. 4, pp. 347–354, 1999.

[10] E. Ioannou-Kakouri, M. Aletrari, E. Christou, A. Hadjioannou-Ralli, A. Koliou, and D. Akkelidou, "Surveillance and control of aflatoxins B1, B2, G1, G2, and M1 in foodstuffs in the Republic of Cyprus: 1992–1996," *Journal of AOAC International*, vol. 82, no. 4, pp. 883–892, 1999.

[11] C. López, L. Ramos, S. Ramadán, L. Bulacio, and J. Perez, "Distribution of aflatoxin M1 in cheese obtained from milk artificially contaminated," *International Journal of Food Microbiology*, vol. 64, no. 1-2, pp. 211–215, 2001.

[12] E. Panariti, "Seasonal variations of aflatoxin M1 in the farm milk in Albania," *Arhiv Za Higijenu Rada I Toksikologiju*, vol. 52, no. 1, pp. 37–41, 2001.

[13] V. P. ivastava, A. Bu-Abbas, W. Al-Johar, S. Al-Mufti, M. K. J. Siddiqui, and M. K. Siddiqui, "Aflatoxin M1 contamination in commercial samples of milk and dairy products in Kuwait," *Food Additives and Contaminants*, vol. 18, no. 11, pp. 993–997, 2001.

[14] F. Galvano, V. Galofaro, A. Ritieni, M. Bognanno, A. De Angelis, and G. Galvano, "Survey of the occurrence of aflatoxin M1 in dairy products marketed in Italy: second year of observation," *Food Additives and Contaminants*, vol. 18, no. 7, pp. 644–646, 2001.

[15] H. H. Oruc and S. Sonal, "Determination of aflatoxin M1levels in cheese and milk consumed in Bursa, Turkey," *Veterinary and human toxicology*, vol. 43, pp. 292-293, 2001.

[16] U. Gunsen and I. Buyukyoruk, "Aflatoxins in retail food products in Bursa, Turkey," *Veterinary and human toxicology*, vol. 44, pp. 289-290, 2002.

[17] J. L. Blanco, L. Domínguez, E. Gómez-Lucía, J. F. Garayzabal, J. A. García, and G. Suárez, "Presence of aflatoxin M1 in commercial ultra-high-temperature-treated milk," *Applied and Environmental Microbiology*, vol. 54, no. 6, pp. 1622-1623, 1988.

[18] N. S. Garrido, M. H. Iha, M. R. Santos Ortolani, and R. M. Duarte Fávaro, "Occurrence of aflatoxins M1 and M2 in milk commercialized in Ribeirão Preto-SP, Brazil," *Food Additives and Contaminants*, vol. 20, no. 1, pp. 70–73, 2003.

[19] M. Carvajal, A. Bolaños, F. Rojo, and I. Méndez, "Aflatoxin M1 in pasteurized and ultrapasteurized milk with different fat content in Mexico," *Journal of Food Protection*, vol. 66, no. 10, pp. 1885–1892, 2003.

[20] M. Carvajal, F. Rojo, I. Méndez, and A. Bolaños, "Aflatoxin B1 and its interconverting metabolite aflatoxicol in milk: the situation in Mexico," *Food Additives and Contaminants*, vol. 20, no. 11, pp. 1077–1086, 2003.

[21] J. P. Vandenbroucke, E. Von Elm, D. G. Altman et al., "Strengthening the reporting of observational studies in epidemiology (STROBE): explantion and elaboration," *Epidemiology*, vol. 18, no. 6, pp. 805–835, 2007.

[22] A. Kamkar, "A study on the occurrence of aflatoxin M1 in raw milk produced in Sarab city of Iran," *Food Control*, vol. 16, no. 7, pp. 593–599, 2005.

[23] G. Karimi, M. Hassanzadeh, M. Teimuri, F. Nazari, and A. Nili, "Aflatoxin M1 contamination in pasteurized milk in Mashhad, Iran," *Journal of Pharmaceutical Sciences*, vol. 3, no. 3, pp. 153–156, 2007.

[24] S. A. Ghiasian, A. H. Maghsood, T. R. Neyestani, and S. H. Mirhendi, "Occurrence of aflatoxin M1 in raw milk during the summer and winter seasons in Hamedan, Iran," *Journal of Food Safety*, vol. 27, no. 2, pp. 188–198, 2007.

[25] M.-R. Oveisi, B. Jannat, N. Sadeghi, M. Hajimahmoodi, and A. Nikzad, "Presence of aflatoxin M1 in milk and infant milk products in Tehran, Iran," *Food Control*, vol. 18, no. 10, pp. 1216–1218, 2007.

[26] M. Tajkarimi, F. Shojaee Aliabadi, M. Salah Nejad, H. Pursoltani, A. A. Motallebi, and H. Mahdavi, "Seasonal study of aflatoxin M1 contamination in milk in five regions in Iran," *International Journal of Food Microbiology*, vol. 116, no. 3, pp. 346–349, 2007.

[27] H. Tajik, M. Rohani, and M. Moradi, "Detection of anatoxin Ml in raw and commercial pasteurized milk in Urmia, Iran,"

Pakistan Journal of Biological Sciences, vol. 10, no. 22, pp. 4103–4107, 2007.

[28] M. Tajkarimi, F. Aliabadi-Sh, A. Salah Nejad, H. Poursoltani, A. A. Motallebi, and H. Mahdavi, "Aflatoxin M1 contamination in winter and summer milk in 14 states in Iran," *Food Control*, vol. 19, no. 11, pp. 1033–1036, 2008.

[29] S. A. A. Sefidgar, G. Azizi, A. R. Khosravi, and S. Roudbar-Mohammadi, "Presence of aflatoxin M1 in raw milk at cattle farms in Babol, Iran," *Pakistan Journal of Biological Sciences*, vol. 11, no. 3, pp. 484–486, 2008.

[30] A. Kamkar, "Detection of aflatoxin M1 in powdered milk samples by ELISA," *Animal Sciences Journal (Pajouhesh & Sazandegi)*, vol. 79, pp. 174–180, 2008.

[31] M. H. M. Ghazani, "Aflatoxin M1 contamination in pasteurized milk in Tabriz (Northwest of Iran)," *Food and Chemical Toxicology*, vol. 47, no. 7, pp. 1624-1625, 2009.

[32] N. Sadeghi, M. R. Oveisi, B. Jannat, M. Hajimahmoodi, H. Bonyani, and F. Jannat, "Incidence of aflatoxin M1 in human breast milk in Tehran, Iran," *Food Control*, vol. 20, no. 1, pp. 75–78, 2009.

[33] E. Rahimi, A. Shakerian, M. Jafariyan, M. Ebrahimi, and M. Riahi, "Occurrence of aflatoxin M1 in raw, pasteurized and UHT milk commercialized in Esfahan and Shahr-e Kord, Iran," *Food Security*, vol. 1, no. 3, pp. 317–320, 2009.

[34] M. Riazipour, H. Tavakkoli, M. Razzaghi Abyane, H. Rafati, and S. Sadr Momtaz, "Measuring the amount of M1 aflatoxin in pasteurized milks," *Kowsar Medical Journal*, vol. 15, no. 2, pp. 89–93, 2010.

[35] M. Nemati, M. A. Mehran, P. K. Hamed, and A. Masoud, "A survey on the occurrence of aflatoxin M1 in milk samples in Ardabil, Iran," *Food Control*, vol. 21, no. 7, pp. 1022–1024, 2010.

[36] A. M. Sani, H. Nikpooyan, and R. Moshiri, "Aflatoxin M1 contamination and Antibiotic residue in milk in Khorasan province, Iran," *Food and Chemical Toxicology*, vol. 48, no. 8-9, pp. 2130–2132, 2010.

[37] A. A. Fallah, "Aflatoxin M1 contamination in dairy products marketed in Iran during winter and summer," *Food Control*, vol. 21, no. 11, pp. 1478–1481, 2010.

[38] A. A. Fallah, "Assessment of aflatoxin M1 contamination in pasteurized and UHT milk marketed in central part of Iran," *Food and Chemical Toxicology*, vol. 48, no. 3, pp. 988–991, 2010.

[39] B. Mohammadian, M. Khezri, N. Ghasemipour, S. Mafakheri, and P. P. Langroudi, "Aflatoxin M1 contamination of raw and pasteurized milk produced in Sanandaj, Iran," *Archives of Razi Institute*, vol. 65, no. 2, pp. 99–104, 2010.

[40] H. Mohamadi and M. Alizadeh, "A Study of the occurrence of aflatoxin M1 in dairy products marketed in Urmia, Iran," *Journal of Agricultural Science and Technology (JAST)*, vol. 12, 2010.

[41] E. Rahimi, M. Bonyadian, M. Rafei, and H. R. Kazemeini, "Occurrence of aflatoxin M1 in raw milk of five dairy species in Ahvaz, Iran," *Food and Chemical Toxicology*, vol. 48, no. 1, pp. 129–131, 2010.

[42] A. Heshmati and J. M. Milani, "Contamination of UHT milk by aflatoxin M1 in Iran," *Food Control*, vol. 21, no. 1, pp. 19–22, 2010.

[43] S. Sefidgar, M. Mirzae, M. Assmar, and S. Naddaf, "Aflatoxin M1 in pasteurized milk in Babol city, Mazandaran province, Iran," *Journal of Public Health*, vol. 40, no. 1, p. 115, 2011.

[44] A. Kamkar, G. J. Khaniki, and S. Alavi, "Occurrence of aflatoxin M1 in raw milk produced in Ardebil of Iran," *Journal of Environmental Health Science and Engineering*, vol. 8, no. 2, pp. 133–140, 2011.

[45] M. H. Movassagh, "Presence of aflatoxin M1 in Uht milk in Tabriz (Northwest of Iran)," *Journal of Food Safety*, vol. 31, no. 2, pp. 238–241, 2011.

[46] A. A. Fallah, M. Rahnama, T. Jafari, and S. S. Saei-Dehkordi, "Seasonal variation of aflatoxin M1 contamination in industrial and traditional Iranian dairy products," *Food Control*, vol. 22, no. 10, pp. 1653–1656, 2011.

[47] P. Panahi, S. Kasaee, A. Mokhtari, A. Sharifi, and A. Jangjou, "Assessment of aflatoxin M1 contamination in raw milk by ELISA in Urmia, Iran," *American-Eurasian Journal of Toxicological Sciences*, vol. 3, no. 4, pp. 231–233, 2011.

[48] F. G. Rohani, M. M. Aminaee, and M. Kianfar, "Survey of aflatoxin M1in cow's milk for human consumption in Kerman Province of Iran," *Food Additives and Contaminants: Part B*, vol. 4, no. 3, pp. 191–194, 2011.

[49] A. D. Garmakhany, H. Zighamian, R. Sarhangpour, M. Rasti, and N. Aghajani, "Occurrence of aflatoxin M1 in raw and pasteurized milk in Esfahan province of Iran," *Minerva Biotecnologica*, vol. 23, no. 2-3, pp. 53–57, 2011.

[50] E. Rahimi, Z. Nilchian, and A. Behzadnia, "Presence of aflatoxin M1 in pasteurized and UHT milk commercialized in shiraz, Khuzestan and Yazd, Iran," *Journal of Chemical Health Risks*, vol. 1, no. 1, pp. 7–10, 2012.

[51] E. Rahimi and M. Ameri, "A survey of aflatoxin M1 contamination in bulk milk samples from dairy bovine, ovine, and Caprine Herds in Iran," *Bulletin of Environmental Contamination and Toxicology*, vol. 89, no. 1, pp. 158–160, 2012.

[52] E. Rahimi, M. Mohammadhosseini Anari, M. Alimoradi, P. Rezaei, M. Arab, and M. Goudarzi, "Aflatoxin M1 in pasteurized milk and white cheese in Ahvaz, Iran," *Global Veterinaria*, vol. 9, no. 4, pp. 384–387, 2012.

[53] A. Behfar, Z. Nazari Khorasgani, Z. Alemzadeh, M. Goudarzi, R. Ebrahimi, and N. Tarhani, "Determination of aflatoxin M1 levels in produced pasteurized milk in Ahvaz city by using HPLC," *Jundishapur Journal of Natural Pharmaceutical Products*, vol. 7, no. 2, pp. 80–84, 2012.

[54] A. Mohamadi Sani, M. Khezri, and H. Moradnia, "Determination of aflatoxin in milk by ELISA technique in Mashad (Northeast of Iran)," *ISRN Toxicol*, vol. 2012, Article ID 121926, 4 pages, 2012.

[55] Y. Arast, M. Mohammadian, and S. Behnamipour, "Occurance of aflatoxin M1 in two dairy products by ELISA in central part of Iran," *Life Science Journal*, vol. 9, no. 3, pp. 1831–1833, 2012.

[56] M. Movassagh and S. Adinehvand, "Study of aflatoxin M1 level in the collected raw cow milk from milk collection centers in Tabriz," *Journal of Food Hygiene*, vol. 3, no. 10, pp. 63–70, 2013.

[57] B. Riahi-Zanjani and M. Balali-Mood, "Aflatoxin M1 contamination in commercial pasteurized milk from local markets in Fariman, Iran," *Mycotoxin Research*, vol. 29, no. 4, pp. 271–274, 2013.

[58] A. R. Khosravi, H. Shokri, S. Eshghi, and S. Darvishi, "Global occurrence of aflatoxin M1 in milk with particular reference to Iran," *Food Security*, vol. 5, no. 4, pp. 533–539, 2013.

[59] A. M. Sani and H. Nikpooyan, "Determination of aflatoxin M1 in milk by high-performance liquid chromatography in Mashhad (Northeast of Iran)," *Toxicology and Industrial Health*, vol. 29, no. 4, pp. 334–338, 2013.

[60] A. Kamkar, S. Yazdankhah, A. Mohammadi Nafchi, and A. S. Mozaffari Nejad, "Aflatoxin M1in raw cow and buffalo

milk in Shush city of Iran," *Food Additives & Contaminants: Part B*, vol. 7, no. 1, pp. 21–24, 2014.

[61] K. Moeinian, K. Yaghmaeian, and R. Ghorbani, "Aflatoxin M1 concentration in raw milk produced in the cities of Semnan province-Iran," *Koomesh*, vol. 10, pp. 176–181, 2014.

[62] R. Mahmoudi and P. Zare, "Total and M1 aflatoxins contamination in meat and milk buffalo were slaughtered in the Northwest of Iran," *Journal of Food Research (University of Tabriz)*, vol. 24, no. 1, pp. 11–18, 2014.

[63] M. Rezaei, M. Parviz, M. Es'haghi Gorji, N. Shariatifar, M. Hosseini, and S. Habibi, "Occurrence of aflatoxin M1 in milk in QOM, Iran," *Italian Journal of Food Science*, vol. 26, no. 3, pp. 325–328, 2014.

[64] B. R. Zanjani, R. Rahmani, S. M. R. Sorkhabadi et al., "A survey on aflatoxin M1 in raw milk of Fariman city, Khorasan province, Iran," *Jundishapur Journal of Natural Pharmaceutical Products*, vol. 10, no. 2, pp. 1–4, 2015.

[65] R. Mahmoudi and R. Norian, "Aflatoxin B1 and M1 contamination in cow feeds and milk from Iran," *Food and Agricultural Immunology*, vol. 26, no. 1, pp. 131–137, 2015.

[66] A. A. Fallah, A. Barani, and Z. Nasiri, "Aflatoxin M1 in raw milk in Qazvin province, Iran: a seasonal study," *Food Additives & Contaminants: Part B*, vol. 8, no. 3, pp. 195–198, 2015.

[67] B. Barikbin, A. Allahresani, R. Khosravi, and M. Khodadadi, "Detection of aflatoxin in dairy products marketed in Iran," *Health Scope*, vol. 4, no. 1, 2015.

[68] R. Rouhi, A. Kazemi, A. S. Jahromi et al., "Levels of aflatoxin M1 in different types of milk collected in Jahrom, Iran, winter-spring 2013," *American Journal of Animal and Veterinary Sciences*, vol. 10, no. 3, pp. 193–196, 2015.

[69] M. Najafian and B. Najafian, "Investigation of the Level of Aflatoxin M1 in Milk Sampl of Gilan Dairy Factories Using ELISA," *Journal Of Microbial World*, vol. 8, no. 3, pp. 248–253, 2015.

[70] Z. Mashak, H. J. Sohi, A. Heshmati, and A. S. M. Nejad, "Assessment of Aflatoxin M1 contamination in UHT Flavored milk samples in Karaj, Iran," *Journal of Pharmacy Research*, vol. 15, no. 3, pp. 407–411, 2016.

[71] M. Hashemi, "A survey of aflatoxin M1 in cow milk in southern Iran," *Journal of Food and Drug Analysis*, vol. 24, no. 4, pp. 888–893, 2016.

[72] R. Bahrami, Y. Shahbazi, and Z. Nikousefat, "Aflatoxin M1 in milk and traditional dairy products from west part of Iran: occurrence and seasonal variation with an emphasis on risk assessment of human exposure," *Food Control*, vol. 62, pp. 250–256, 2016.

[73] H. Mohammadi, M. Shokrzadeh, Z. Aliabadi, and B. Riahi-Zanjani, "Occurrence of aflatoxin M1 in commercial pasteurized milk samples in Sari, Mazandaran province, Iran," *Mycotoxin Research*, vol. 32, no. 2, pp. 85–87, 2016.

[74] M. Bolourchian, S. Safi, and S. H. S. Beheshtiha, "On the occurrence of aflatoxin M-1 in dairy cattle milk in Varamin region, Tehran," *International Journal of Medical Research & Health Sciences*, vol. 5, no. 7, pp. 68–72, 2016.

[75] A. A. Fallah, R. Fazlollahi, and A. Emami, "Seasonal study of aflatoxin M1 contamination in milk of four dairy species in Yazd, Iran," *Food Control*, vol. 68, pp. 77–82, 2016.

[76] N. Sohrabi and H. Gharahkoli, "A seasonal study for determination of aflatoxin M1 level in dairy products in Iranshahr, Iran," *Current Medical Mycology*, vol. 2, no. 3, pp. 27–31, 2016.

[77] P. Ghajarbeygi, M. Palizban, R. Mahmoudi, G. Jahed Khaniki, and B. Pakbin, "Aflatoxin M1 contamination of Cow's raw milk in different seasons from Qazvin province, Iran," *Journal of Biology and Today's World*, vol. 5, no. 10, pp. 173–176, 2016.

[78] M. S. Taherabadi, M. J. Gharavi, I. Javadi et al., "The level of aflatoxin M1 in raw and pasteurized milk produced in Alborz province, Iran," *Jundishapur Journal of Natural Pharmaceutical Products*, vol. 11, no. 4, Article ID e31708, 2016.

[79] M. Dakhili, S. Shalibeik, and I. Ahmadi, "Detection of aflatoxin M1 in milk from Qom (aried and semiaried) province of Iran," *International Journal of Advanced Biotechnology and Research*, vol. 7, pp. 1461–1465, 2016.

[80] H. Shokri and S. Torabi, "The effect of milk composition, yeast-mould numbers and seasons on aflatoxin M1 amounts in camel milk," *Journal of Food Safety*, vol. 37, no. 2, Article ID e12300, 2017.

[81] H. Ghariby, A. Takdastan, A. K. Neisi, H. Rezazadeh, and H. Kuhpaee, "Investigating aflatoxin M1 contamination in buffalos milk using immunoassay," *Journal of Mazandaran University of Medical Sciences*, vol. 26, no. 145, pp. 248–256, 2017.

[82] J. Xiong, L. Xiong, H. Zhou, Y. Liu, and L. Wu, "Occurrence of aflatoxin B1 in dairy cow feedstuff and aflatoxin M1 in UHT and pasteurized milk in central China," *Food Control*, vol. 92, pp. 386–390, 2018.

[83] I. Sumantri, F. Purwanti, N. Nuryono, and A. Agus, "Estimation of aflatoxin M1 exposure through consumption of various dairy milk products in Yogyakarta, Indonesia (estimasi paparan aflatoksin m1 melalui konsumsi berbagai produk susu di yogyakarta, Indonesia)," *Jurnal Veteriner*, vol. 20, no. 1, pp. 58–64, 2019.

[84] S. H. Nile, S. W. Park, and C. N. Khobragade, "Occurrence and analysis of aflatoxin M1 in milk produced by Indian dairy species," *Food and Agricultural Immunology*, vol. 27, no. 3, pp. 358–366, 2016.

[85] M. A. Asghar, A. Ahmed, and M. A. Asghar, "Aflatoxin M1 in fresh milk collected from local markets of Karachi, Pakistan," *Food Additives & Contaminants: Part B*, vol. 11, no. 3, pp. 167–174, 2018.

[86] C. Turkoglu and E. Keyvan, "Determination of aflatoxin M1 and ochratoxin A in raw, pasteurized and UHT milk in Turkey," *Acta Scientiae Veterinariae*, vol. 47, no. 1, 2019.

[87] Z. U. Hassan, R. Al-Thani, F. A. Atia et al., "Evidence of low levels of aflatoxin M1 in milk and dairy products marketed in Qatar," *Food Control*, vol. 92, pp. 25–29, 2018.

[88] E. Assem, A. Mohamad, and E. A. Oula, "A survey on the occurrence of aflatoxin M1 in raw and processed milk samples marketed in Lebanon," *Food Control*, vol. 22, no. 12, pp. 1856–1858, 2011.

[89] G. Cano-Sancho, S. Marin, A. J. Ramos, J. Peris-Vicente, and V. Sanchis, "Occurrence of aflatoxin M1 and exposure assessment in Catalonia (Spain)," *Revista Iberoamericana de Micología*, vol. 27, no. 3, pp. 130–135, 2010.

[90] S. Armorini, A. Altafini, A. Zaghini, and P. Roncada, "Occurrence of aflatoxin M1 in conventional and organic milk offered for sale in Italy," *Mycotoxin Research*, vol. 32, no. 4, pp. 237–246, 2016.

[91] S. C. Duarte, A. M. Almeida, A. S. Teixeira et al., "Aflatoxin M1 in marketed milk in Portugal: assessment of human and animal exposure," *Food Control*, vol. 30, no. 2, pp. 411–417, 2013.

[92] A. Rama, F. Latifi, D. Bajraktari, and N. Ramadani, "Assessment of aflatoxin M1 levels in pasteurized and UHT milk consumed in Prishtina, Kosovo," *Food Control*, vol. 57, pp. 351–354, 2015.

[93] A. B. N. Santili, A. C. de Camargo, R. D. S. R. Nunes et al., "Aflatoxin M1in raw milk from different regions of São Paulo state-Brazil," *Food Additives & Contaminants: Part B*, vol. 8, no. 3, pp. 207–214, 2015.

[94] A. Molina, G. Chavarría, M. Alfaro-Cascante, A. Leiva, and F. Granados-Chinchilla, "Mycotoxins at the start of the food chain in Costa Rica: analysis of six *Fusarium* toxins and ochratoxin A between 2013 and 2017 in animal feed and aflatoxin M1 in dairy products," *Toxins*, vol. 11, no. 6, p. 312, 2019.

[95] A. O. Elzupir and A. M. Elhussein, "Determination of aflatoxin M1 in dairy cattle milk in Khartoum State, Sudan," *Food Control*, vol. 21, no. 6, pp. 945-946, 2010.

[96] M. M. Kuboka, J. K. Imungi, L. Njue, F. Mutua, D. Grace, and J. F. Lindahl, "Occurrence of aflatoxin M1 in raw milk traded in Peri-urban Nairobi, and the effect of Boiling and Fermentation," *Infection Ecology & Epidemiology*, vol. 9, no. 1, Article ID 1625703, 2019.

[97] M. Mwanza, A. Abdel-Hadi, A. M. Ali, and M. Egbuta, "Evaluation of analytical assays efficiency to detect aflatoxin M1 in milk from selected areas in Egypt and South Africa," *Journal of Dairy Science*, vol. 98, no. 10, pp. 6660–6667, 2015.

[98] B. Dashti, S. Al-Hamli, H. Alomirah, S. Al-Zenki, A. B. Abbas, and W. Sawaya, "Levels of aflatoxin M1 in milk, cheese consumed in Kuwait and occurrence of total aflatoxin in local and imported animal feed," *Food Control*, vol. 20, no. 7, pp. 686–690, 2009.

[99] M. Polovinski-Horvatović, V. Jurić, and D. Glamočić, "Two year study of incidence of aflatoxin M1 in milk in the region of Serbia," *Biotechnology in Animal Husbandry*, vol. 25, no. 5-6, pp. 713–718, 2009.

[100] U. Pathirana, K. Wimalasiri, K. Silva, and S. Gunarathne, "Investigation of farm gate cow milk for aflatoxin M_1," *Tropical Agricultural Research*, vol. 21, no. 2, 2010.

[101] K. Muhammad, M. Y. Tipu, M. Abbas, A. M. Khan, and A. A. Anjum, "Monitoring of aflatoxin M1 in market raw milk in Lahore city, Pakistan," *Pakistan Journal of Zoology*, vol. 42, no. 6, 2010.

[102] N. Ruangwises and S. Ruangwises, "Aflatoxin M1 contamination in raw milk within the central region of Thailand," *Bulletin of Environmental Contamination and Toxicology*, vol. 85, no. 2, pp. 195–198, 2010.

[103] N. Ertas, Z. Gonulalan, Y. Yildirim, and F. Karadal, "A survey of concentration of aflatoxin M1 in dairy products marketed in Turkey," *Food Control*, vol. 22, no. 12, pp. 1956–1959, 2011.

[104] M. Ayoub, A. Sobeih, and A. A. Raslan, "Evaluation of aflatoxin M1 in raw, processed milk and some milk products in Cairo with special reference to its recovery," *Researcher*, vol. 3, pp. 5–11, 2011.

[105] A. El Khoury, A. Atoui, and J. Yaghi, "Analysis of aflatoxin M1 in milk and yogurt and AFM1 reduction by lactic acid bacteria used in Lebanese industry," *Food Control*, vol. 22, no. 10, pp. 1695–1699, 2011.

[106] B. Kabak and F. Ozbey, "Aflatoxin M1 in UHT milk consumed in Turkey and first assessment of its bioaccessibility using an in vitro digestion model," *Food Control*, vol. 28, no. 2, pp. 338–344, 2012.

[107] I. M. Al Zuheir and J. A. Omar, "Presence of aflatoxin M1 in raw milk for human consumption in palestinian," *Walailak Journal of Science and Technology (WJST)*, vol. 9, no. 3, pp. 201–205, 2012.

[108] A. Sadia, M. A. Jabbar, Y. Deng et al., "A survey of aflatoxin M1 in milk and sweets of Punjab, Pakistan," *Food Control*, vol. 26, no. 2, pp. 235–240, 2012.

[109] M. I. Abdallah, M. S. Bazalou, and M. Z. Al-Julaifi, "Determination of aflatoxin M1 concentrations in full-fat cow's UHT milk sold for consumption in Najran-Saudi regarding its public health significance," *Egyptian Journal of Applied Sciences*, vol. 27, no. 3, pp. 40–54, 2012.

[110] V. Siddappa, D. K. Nanjegowda, and P. Viswanath, "Occurrence of aflatoxin M1 in some samples of UHT, raw & pasteurized milk from Indian states of Karnataka and Tamilnadu," *Food and Chemical Toxicology*, vol. 50, no. 11, pp. 4158–4162, 2012.

[111] K. Okeke, I. Abdullahi, H. Makun, and S. Mailafiya, "A preliminary survey of aflatoxin M1 in dairy cattle products in Bida, Niger State, Nigeria," *African Journal of Food Science and Technology*, vol. 3, no. 10, pp. 273–276, 2012.

[112] I. N. Tsakiris, M. N. Tzatzarakis, A. K. Alegakis, M. I. Vlachou, E. A. Renieri, and A. M. Tsatsakis, "Risk assessment scenarios of children's exposure to aflatoxin M1 residues in different milk types from the Greek market," *Food and Chemical Toxicology*, vol. 56, pp. 261–265, 2013.

[113] S. Suliman and M. Abdalla, "Presence of aflatoxin M1 in dairy cattle milk in Khartoum State-Sudan," *Poljoprivreda I Sumarstvo*, vol. 59, no. 2, p. 199, 2013.

[114] J. L. Xiong, Y. M. Wang, M. R. Ma, and J. X. Liu, "Seasonal variation of aflatoxin M1 in raw milk from the Yangtze River Delta region of China," *Food Control*, vol. 34, no. 2, pp. 703–706, 2013.

[115] M. A. I. Ali, I. E. M. El Zubeir, and A. M. A. Fadel Elseed, "Aflatoxin M1in raw and imported powdered milk sold in Khartoum state, Sudan," *Food Additives & Contaminants: Part B*, vol. 7, no. 3, pp. 208–212, 2014.

[116] M. Mulunda and D. Mike, "Occurrence of aflatoxin M1 from rural subsistence and commercial farms from selected areas of South Africa," *Food Control*, vol. 39, pp. 92–96, 2014.

[117] J. Kos, J. Lević, O. Đuragić, B. Kokić, and I. Miladinović, "Occurrence and estimation of aflatoxin M1 exposure in milk in Serbia," *Food Control*, vol. 38, pp. 41–46, 2014.

[118] R. W. Han, N. Zheng, J. Q. Wang, Y. P. Zhen, X. M. Xu, and S. L. Li, "Survey of aflatoxin in dairy cow feed and raw milk in China," *Food Control*, vol. 34, no. 1, pp. 35–39, 2013.

[119] N. Bilandžić, Đ. Božić, M. Đokić et al., "Assessment of aflatoxin M1 contamination in the milk of four dairy species in Croatia," *Food Control*, vol. 43, pp. 18–21, 2014.

[120] L. C. A. Picinin, M. M. O. P. Cerqueira, E. A. Vargas, Â. M. Q. Lana, I. M. Toaldo, and M. T. Bordignon-Luiz, "Influence of climate conditions on aflatoxin M1 contamination in raw milk from Minas Gerais State, Brazil," *Food Control*, vol. 31, no. 2, pp. 419–424, 2013.

[121] M. R. Asi, S. Z. Iqbal, A. Ariño, and A. Hussain, "Effect of seasonal variations and lactation times on aflatoxin M1 contamination in milk of different species from Punjab, Pakistan," *Food Control*, vol. 25, no. 1, pp. 34–38, 2012.

[122] J. E. Lee, B.-M. Kwak, J.-H. Ahn, and T.-H. Jeon, "Occurrence of aflatoxin M1 in raw milk in South Korea using an immunoaffinity column and liquid chromatography," *Food Control*, vol. 20, no. 2, pp. 136–138, 2009.

[123] A. M. Elgerbi, K. E. Aidoo, A. A. G. Candlish, and R. F. Tester, "Occurrence of aflatoxin M1 in randomly selected North African milk and cheese samples," *Food Additives and Contaminants*, vol. 21, no. 6, pp. 592–597, 2004.

[124] I. Ghanem and M. Orfi, "Aflatoxin M1 in raw, pasteurized and powdered milk available in the Syrian market," *Food Control*, vol. 20, no. 6, pp. 603–605, 2009.

[125] K.-Y. Peng and C.-Y. Chen, "Prevalence of aflatoxin M1 in milk and its potential liver cancer risk in Taiwan," *Journal of Food Protection*, vol. 72, no. 5, pp. 1025–1029, 2009.

[126] E. K. Kang'ethe, G. M. M'ibui, T. F. Randolph, and A. K. Lang'at, "Prevalence of aflatoxin M1 and B1 in milk and animal feeds from urban smallholder dairy production in Dagoretti division, Nairobi, Kenya," *East African Medical Journal*, vol. 84, no. 11, pp. S83–S86, 2007.

[127] H. Sharma, V. J. Jadhav, and S. R. Garg, "Aflatoxin M1 in milk in Hisar city, Haryana, India and risk assessment," *Food Additives & Contaminants: Part B*, vol. 13, no. 1, pp. 1–5, 2019.

[128] N. Akbar, M. Nasir, N. Naeem et al., "Occurrence and seasonal variations of aflatoxin M1 in milk from Punjab, Pakistan," *Toxins*, vol. 11, no. 10, p. 574, 2019.

[129] A. Zakaria, Y. Amin, O. Khalil, E. Abdelhiee, and M. Elkamshishi, "Rapid detection of aflatoxin M1 residues in market milk in Aswan Province, Egypt and effect of probiotics on its residues concentration," *Journal of Advanced Veterinary and Animal Research*, vol. 6, no. 2, p. 197, 2019.

[130] F. Y. Eker, K. Muratoglu, and A. G. Eser, "Detection of aflatoxin M1 in milk and milk products in Turkey," *Environmental Monitoring and Assessment*, vol. 191, no. 8, p. 523, 2019.

[131] I. Tahira, N. Sultana, A. Munir, S. M. Hasan, and N. Q. Hanif, "Occurrence of aflatoxin M1 in raw and processed milk consumed in Pakistan," *Pakistan Journal of Pharmaceutical Sciences*, vol. 32, no. 3, 2019.

[132] S. Abbès, J. B. Salah-Abbès, Y. Bouraoui, S. Oueslati, and R. Oueslati, "Natural occurrence of aflatoxins (B1 and M1) in feed, plasma and raw milk of lactating dairy cows in Beja, Tunisia, using ELISA," *Food Additives and Contaminants: Part B*, vol. 5, no. 1, pp. 11–15, 2012.

[133] O. Peña-Rodas, R. Martinez-Lopez, and R. Hernandez-Rauda, "Occurrence of aflatoxin M1 in cow milk in El salvador: results from a two-year survey," *Toxicology Reports*, vol. 5, pp. 671–678, 2018.

[134] R. L. Venâncio, A. Ludovico, E. H. W. de Santana, E. A. de Toledo, F. C. de Almeida Rego, and J. S. dos Santos, "Occurrence and seasonality of aflatoxin M1 in milk in two different climate zones," *Journal of the Science of Food and Agriculture*, vol. 99, no. 6, pp. 3203–3206, 2019.

[135] A. Ghaffarian Bahraman, S. Mohammadi, A. Jafari et al., "Occurrence of aflatoxin M1 in milks of five animal species in Iran: a systematic review and meta-analysis," *Food Reviews International*, vol. 35, no. 2, pp. 1–21, 2019.

[136] J. Rahmani, S. Alipour, A. Miri et al., "The prevalence of aflatoxin M1 in milk of Middle East region: a systematic review, meta-analysis and probabilistic health risk assessment," *Food and Chemical Toxicology*, vol. 118, pp. 653–666, 2018.

[137] V. M. Scussel, "Comparison of methods by TLC and HPTLC for determination of aflatoxin M1 in milk and B1 in eggs," *Food Science and Technology*, vol. 23, pp. 46–52, 2003.

[138] World Health Organization Publication, Aflatoxins, "International Agency for Research on Cancer (IARC) Summaries & Evaluations," 2002, http://www.inchem.org/documents/iarc/vol73/73-17.html.

[139] B. V. Clell, "Aflatoxins," Extension veterinarian Utah State University, Logan, UT, USA, Bulletim Ticnico No. 11, 1999.