RESEARCH ARTICLE (Open Access)

Monitoring of aflatoxin M1 in fresh milk during the winter season in the Pollog region

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Abstract

This study is focused on the monitoring of aflatoxin M1 in fresh milk in the region of Pollog in North Macedonia. The study was carried out from three collection points with a total of 139 farmers (Point 1 = 60 farmers, point 2 = 60 and point 3 = 19 farmers). The study was carried out during the month of February 2023. Two samples were taken per week for four weeks in a row. The samples were analyzed with the fluorometric method (Fluorometer VICAM Series-4EX). The results were characterized according to the EU regulation (µg/kg). It should be noted that in all crops there was the presence of aflatoxin B_1, even though this year was very wet and the farmers' food was less affected by the moisture, resulting in less mold. In this study, a survey was also carried out about the way animals are fed.

Keywords: fresh milk, aflatoxin M_1, Fluorometer, Pollog region, winter season.

1. Introduction

Milk contains necessary nutrients such as high-quality proteins, lipids, minerals, (calcium, magnesium, selenium), and vitamins (riboflavin, vitamin B12, pantothenic acid) for the growth, development, and maintenance of human health [1], [2]. In addition to nutrition, milk provides several biological attributes, such as antimicrobial properties, immune stimulants, enzymes, and antibodies [2]. However, milk safety is a great concern in many developing countries where the production of milk takes place under poor production and management practices along the value chain actors [3], [4]. Milk contamination occurs due to chemical, biological, and/or physical hazards. Chemical hazard contamination mainly includes aflatoxins and heavy metals or residues from veterinary drugs or pesticides. Aflatoxins are metabolic by-products produced mainly by molds, *Aspergillus flavus* and *Aspergillus parasiticus* which results from poor preharvest, postharvest, and storage practices of feed. When ruminants eat feed contaminated with aflatoxin B_1 (AFB_1), it is metabolised and aflatoxin M_1 (AFM_1) is excreted in the milk which poses a threat to human health through consumption [5], [6].

2. Material and Methods

Milk samples were taken during February 2023 and analyzed the same day they were taken from collection points of milk in Pollog Region of North Macedonia with this plan for sampling and analysis, from point 1 (60 farmers)2 samples the 1st week, 3 samples the 2nd week and 1 sample the 3rd week, from point 2 (60 farmers) 2 samples the 1st week, 2 samples the 2nd week and 1 sample the 3rd week and from point 3 (19 farmers) 2 samples the 1st and 2nd week, 6 samples the 3rd week and 11 samples the 4th week.
The samples were analyzed with the fluorometric method with instrument Fluorometer VICAM Series-4EX (According to the manufacturer's instructions, proven method for accreditation). The aflatoxin M_1 was isolated from milk by VICAM's immunoaffinity

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column and measured directly in the fluorimeter. The results of animal feed research show that animals are fed mainly with hay and grains. It was also found that the storage conditions of animal feed were not suitable for all farmers.

3. Results and Discussion

Collection points 1 and 2 showed lower content of aflatoxin M1but based on the average value even the collection point 3 had aflatoxin M1 content within the maximum level set by Commission Regulation (EC) No 1881/2006as presented on Figure 1.

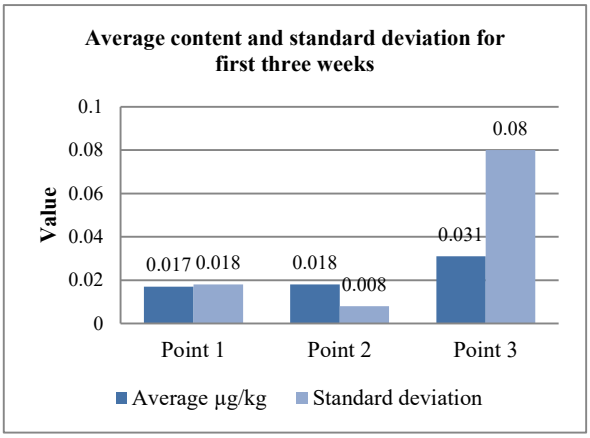

Figure 1. Average content of aflatoxin M1 in milk samples for the first three weeks

3.1. Aflatoxin M1 content in milk samples from collection point 1

In figure 2 are presented the results for aflatoxin M1 content in milk from collection point 1. The sample (06.03) had higher content of Aflatoxin M1 0,053 µg/kg which is at the maximum level set by Commission Regulation (EC) No 1881/2006 (0,050 µg/kg raw milk) the others were within the levels setted by the abovementioned regulation.

Figure 2. Aflatoxin M1 content in milk from point 1

3.2. Aflatoxin M1 content in milk samples from collection point 2

All samples taken from collection point 2 had Aflatoxin M1 content within the level set by Commission Regulation (EC) No 1881/2006 (0,050 µg/kg raw milk) as shown on Figure 3.

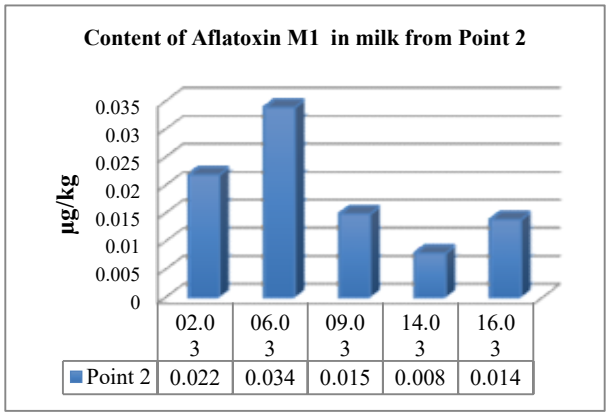

Figure 3. Aflatoxin M1 content in milk from point 2

3.3 Aflatoxin M1 content in milk samples from collection point 3

Highest content of Aflatoxin M1 in milk during the first three weeks of analysis compared to the other points was detected from Point 3 samples (Figure 3) and as a result of this the following weeks were analyzed just the samples from point 3 taken from different farmers. Throughout the month very high values of Aflatoxin M1 were detected in two samples with 0,37 and 0,115 µg/kg content (samples 16.03 and 09.03 respectively).Fluctuations in AFM1 levels in milk occur due to variations in AFB1 contamination levels in crops [7].

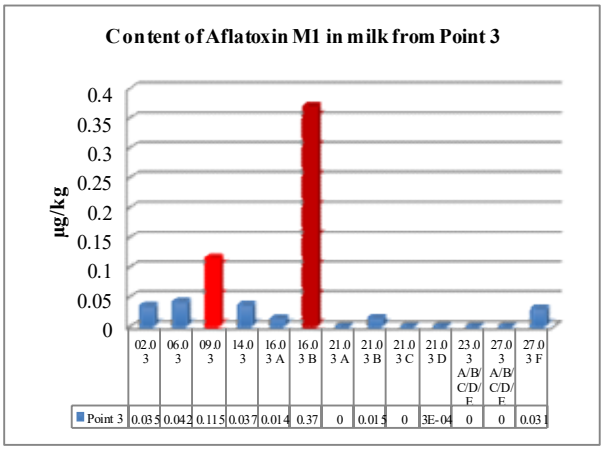

Figure 4. Aflatoxin M1 content in milk from point 3

4. Conclusions

Referring to the results obtained from this study we can conclude:

- In some samples the presence of Aflatoxin M1 has not been detected, in some samples the content of Aflatoxin M1 was within the maximum level set by Commission Regulation (EC) No 1881/2006.
- Samples from collection point 3 had higher values throughout the month compared to the other points.
- After targeting collection point 3 samples and consulting the farmers the situation improved.

Based on the data of this study and the data of various authors on this problematic we recommend:

- Continuous monitoring of animal feed, as it is the first barrier where the problem with Aflatoxin M1 can be eliminated.
- Continuous monitoring of fresh milk to prevent Aflatoxin M1 in dairy products.
- Continuous monitoring of dairy products because it is a thermoresistant toxin and no technological process currently applied to foods can eliminate it.

5. Acknowledgements

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6. References

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