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The Incidence, Geographical Distribution and Levels of Aflatoxin B1 on Stored Hay Batches in Kars Province of Turkey

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Abstract: Aflatoksin B1 (AFB1) in animal feed is one of the major toxic substances for animal and thus for human health. Therefore, the incidence, geographical distribution and levels of AFB1 in hay batches were investigated. Hay samples from new and old ones were collected from different geographical locations in the Kars province. In the region, the incidence of AFB1 in new and old hay samples were 33.08% and 59.26%, respectively. Homogenous geographical distribution of AFB1 was observed among the villages. The amounts of AFB1 in new and old batches were 16.93±1.24 and 30.13±1.45 ppb, respectively. No significant differences were detected among the mean value of towns.

Key Words: Aflatoxin B1, hay, Turkey.

Türkiye'nin Kars İlinde Stoklanan Kuru Ot Yığınlarında Aflatoksin B1'in İnsidensi, Coğrafik Dağılımı ve Düzeyleri

Özet: Hayvan yemleri içinde Aflatoksin B1 (AFB1), hayvanlar ve böylelikle insanlar için önemli toksik oluşumlardan birisidir. Bu sebepten dolayı, ot yığınlarında AFB1'in insidensi, coğrafi dağılım ve düzeyleri araştırıldı. Yeni ve eski ot örnekleri Kars ilinin farklı yörelerinden toplandı. Bölgede AFB1 insidensi yeni ve eski otlarda sırasıyla % 33.08 ve % 59.26 idi. Köyler arasında AFB1'in homojen coğrafi dağılımı gözlendi. Yeni ve eski ot yığınlarında AFB1 miktarları sırasıyla 16.93±1.24 ve 30.13±1.45 ppb idi. İlçelerin ortalama değerleri arasında istatistiksel önemli farklılıklar bulunamadı.

Anahtar Sözcükler: Aflatoksin B1, ot, Türkiye.

Introduction

The presence of fungi and their growth in feed are one of the major causes of toxicosis threatening animal and human health. More than 100.000 fungal species are considered as natural contaminant of agricultural products[1,2]. Moulds and their mycotoxins can be a problem in feed when they grow under favourable conditions, such as high moisture, temperature and aeration[2-4].

Generally, moulds can grow between zero and 60°C. However, the ideal temperature for their growth ranges from zero to 10°C[5].

AFB1 is one of the most toxic mycotoxin and belongs to a group of secondary metabolites produced by *Aspergillus flavus* and *Aspergillus parasiticus*, and is highly toxic and potent carcinogen[1,3,6,7]. Aflatoxins may have also adverse effects on immune responses to infectious agents and some of them are potent carcinogen, hepatotoxic, nephrotoxic and

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genotoxic[2,4]. When acute aflatoxicosis occurs dramatic signs of illness become apparent or it results in death of affected individuals. Chronic intake may not result in obvious clinical abnormalities. But depressed body condition or production rate, impaired resistance to infectious agents are the general signs of chronic aflatoxicosis[3,8,9]. Animal products, such as meat, milk and eggs may contain the toxin. Consumption of these animal products can be hazardous for human health[6]. Therefore, aflatoxicosis has an important economic impact on marketing and utilisation of agricultural products[6,7].

Normally, there should be no trace of AFB1 in feed. However, in the vast majority of storage types of hay batches, mould growth and thus production of AFB1 is one of the unavoidable consequences. In this respect, the amount of AFB1 and other mycotoxins must be limited for animal feed. The Turkish Government limits AFB1 level allowing maximum 50 ppb in animal feed (The Official Gazette Date: 02.05.1990, No: 20506). But, Waldner and Lalman[5] reported that this should be 20 ppb at maximum.

Kars province is located in a large plateau with the altitude of 1775 meters and climate is harsh and terrestrial. It is divided into 8 sub-regions. Winter is long and cold while summer is short and drought. It has heavy rain and hard air stream in autumn and spring seasons. Sometimes, summer is rainy. Winter in the district is always snowy with low temperatures (between -25 and 0°C).

Hay and pasture feeding is common practice in a high proportion of the Eastern Turkey. Pasture is harvested, dried and piled up on a field as batches by farmers in the summer. These batches, exposed to environmental effects such as rain, snow, wind, bacterial and fungal contamination etc., are consumed for winter feeding of cattle and sheep. At the end of winter, the remaining hay is allocated for next year winter feeding. Favourable climate conditions of the regions may predispose fungal growth and its further AFB1 production in hay. Low production rate, reduced weight gains, impaired resistance to infections and abortion in cows have been important problems of cattle breeding in Kars province. But, there is no report describing AFB1 levels in animal feed in this region.

Therefore, the present study was designated to determine the incidence, geographical distribution and levels of AFB1 in hay batches in the region.

Materials and Methods

Sample collection:

A total of 133 town and village centres were selected for sample collection based on their location on the map homogeneously (Figure 1). Samples were collected from two different groups as; one-year-old (New) and two-year-old (Old). Samples were collected during winter season (between 15th December, 2000 and 15th January, 2001). Towns and villages, the origin of samples, were illustrated in Table I and Figure 1.

Detection of AFB1 levels:

Samples were analysed according to Stahr[10] for the presence of AFB1 using Thin-Layer Chromatography (TLC) method.

Statistics:

Main AFB1main levels of new and old samples were analysed by paired two-sample t-test[11], One-way Analyses of Variance[11] was used for detection of significances among the main AFB1 levels of towns. Differences were considered significant when $P<0.05$.

Numbers and letters in tables and figures:

Numbers in tables and figures indicate town centres; 1: Kars (Central town), 2: Akyaka, 3: Arpaçay, 4: Digor, 5: Kağızman, 6: Sarıkamış, 7: Selim, 8: Susuz. Each letter with number represents villages.

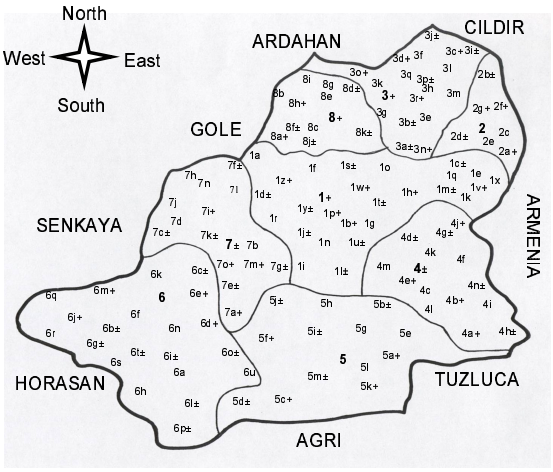
Results

The level of AFB1 in hay batches were investigated in 133 towns and villages of Kars province. Forty-four new and eighty old hay batch samples out of 133 were AFB1 positive (33.08% and 60.15%, respectively) in general. Geographically, AFB1 positive towns and villages indicated a homogenous distribution (Figure 1).

There was no statistically significant difference among the towns based on the mean values of AFB1 in each of new and old hay batches (Table I).

However, there were significant differences between new and old samples of some towns at

different degrees (P<0.05 and P<0.001). But in general, the difference of the mean AFB1 levels between the new and old hay batches was significant (P<0.001) (Table I).



+ : AFB1 positive centres in old hay stocked batch, ± : AFB1 positive centres in new and old hay stocked batch.

Figure 1:
The incidence and distribution of AFB1 contamination in new and old hay stocked batches in the towns and villages of the Kars.

The results according to the towns demonstrated a similar tend (Figure 2).

incidence and distribution of Aflotoxin B1 (AFB1) in this region.

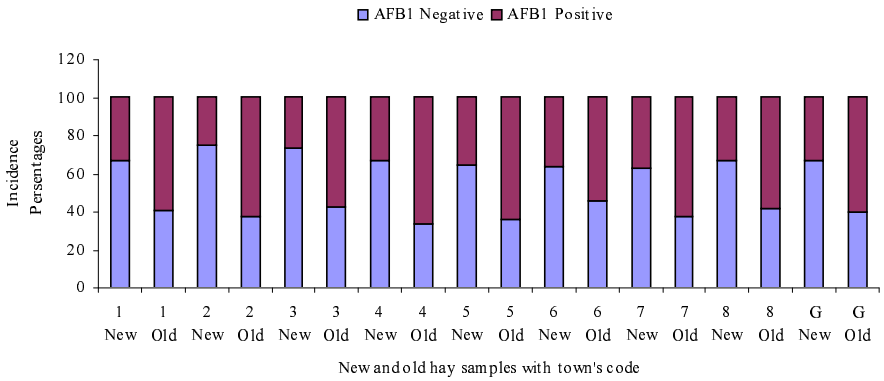
It is well known that AFB1 is toxic substance for animals and human health and it originates from animal products (such as meat, milk, egg, cheese, etc.)[6,7].

In the present study, the rates of AFB1 contamination both in the new and old hay stocks were significantly high, particularly in old ones. Contamination of the new hay with the toxin was also significant (Figure 1, 2 and Table I).

Geographically, homogenous incidental results of AFB1 contamination may reflect of the entire east of Turkey. Therefore, we may consider the present contamination status as an important threat for feeding programmes in the Eastern Turkey (Figure 1).

The study showed that the average values of the new hays were below the allowed limits (Table I). Old hays' averagevalues were just above the maximum limits of Waldner and Lalman[5], however, these results were below the same limit allowed by Turkish Government. Present findings indicate that some farms are under the threat of low or high level of AFB1 contamination.

Distributions of AFB1 levels were homogenous in Kars province like AFB1 contaminated hay batch incidences (Table I).



G: General result of Kars province

Figure 2:
Incidence and distribution of AFB1 in towns and overall the region.

Discussion

Kars province represents the whole eastern Turkey in respect of animal breeding and feeding practices. This article is the first describing the

Conclusion

Continuous intake of small amounts of aflatoxin B1 may cause cancer. Therefore, all the

AFB1 contaminated hay batches may be threatening for animal and thus human health.

All AFB1 contaminated feed must be considered toxinogenic and precautions must be taken by government officials.

Table I. Statistical evaluation of AFB1 contaminated hay samples in the villages and towns of Kars province.

	New		Old		t-test results (Significancy)
	n	X±Sx (ppb)	n	X±Sx (ppb)	
Central (1)	9	17.22±3.02	16	28.44±3.61	P<0.05
Akyaka (2)	2	22.5±2.50	5	25±7.91	NS
Arpacay (3)	5	17±4.06	11	27.72±4.01	NS
Digor (4)	5	18±3.39	10	28.5±3.95	NS
Kagızman (5)	5	17±4.64	9	33.33±3.54	P<0.05
Sarikamis (6)	8	18.13±3.26	12	31.25±4.31	P<0.05
Selim (7)	6	12.5±2.81	10	37±3.35	P<0.001
Susuz (8)	4	16.25±4.27	7	27.86±3.25	NS
General	44	16.93±1.24	80	30.13±1.45	P<0.001

Recommended precautions are;

1. The farmer should be trained for aflatoxicosis, its importance and precautive measures

2. Hay batches and animal products (meat, milk, cheese, etc) should be controlled periodically for the presence of AFB1.

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