

Feed storage practices and aflatoxin contamination of dairy feeds in the Greater Addis Ababa milk shed, Ethiopia

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Aflatoxins

- Toxic secondary metabolites produced by *Aspergillus* fungi.
- Contaminates variety of foods such as corn, oil seed and animal feed.
- One of the most toxic forms of aflatoxin (AFB1) is converted to AFM1 and excreted in milk by lactating animals that consume contaminated feed.
- Highly carcinogenic, cause liver cancer, stunting and immunosuppression.



Aspergillus flavus (Maize breeding program at Texas A&M University)

Aflatoxin Regulatory Guidance

FDA Mycotoxin Regulatory Guidance

**A Guide for Grain Elevators,
Feed Manufacturers,
Grain Processors and Exporters**



National Grain and Feed Association
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Phone: (202) 289-0873 Fax: (202) 289-5388
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August 2011

FDA's Action Levels for Aflatoxin

FDA has established the following action levels for aflatoxins present in human food, animal feed and animal feed ingredients as indicated in Chart 1.

Chart 1: FDA Action Levels for Aflatoxin in Human Food, Animal Feed and Animal Feed Ingredients		
Intended Use	Grain, Grain By-Product, Feed or other Products	Aflatoxin Level [parts per billion (p.p.b.)]
Human consumption	Milk	0.5 p.p.b. (aflatoxin M1)
Human consumption	Foods, peanuts and peanut products, brazil and pistachio nuts	20 p.p.b.
Immature animals	Corn, peanut products, and other animal feeds and ingredients, excluding cottonseed meal	20 p.p.b.
Dairy animals, animals not listed above, or unknown use	Corn, peanut products, cottonseed, and other animal feeds and ingredients	20 p.p.b.
Breeding cattle, breeding swine and mature poultry	Corn and peanut products	100 p.p.b.
Finishing swine 100 pounds or greater in weight	Corn and peanut products	200 p.p.b.
Finishing (i.e., feedlot) beef cattle	Corn and peanut products	300 p.p.b.
Beef, cattle, swine or poultry, regardless of age or breeding status	Cottonseed meal	300 p.p.b.

The following additional policies and legal provisions concerning aflatoxin also are important:

- **FDA Blending Policy:** Importantly, with respect to aflatoxin, FDA currently generally does **not** permit corn containing aflatoxin to be blended with uncontaminated corn to reduce the aflatoxin content of the resulting mixture to levels acceptable for use as human food or animal feed. However, on occasion FDA has relaxed its "no-blending" policy in

EU

0.05 p.p.b.

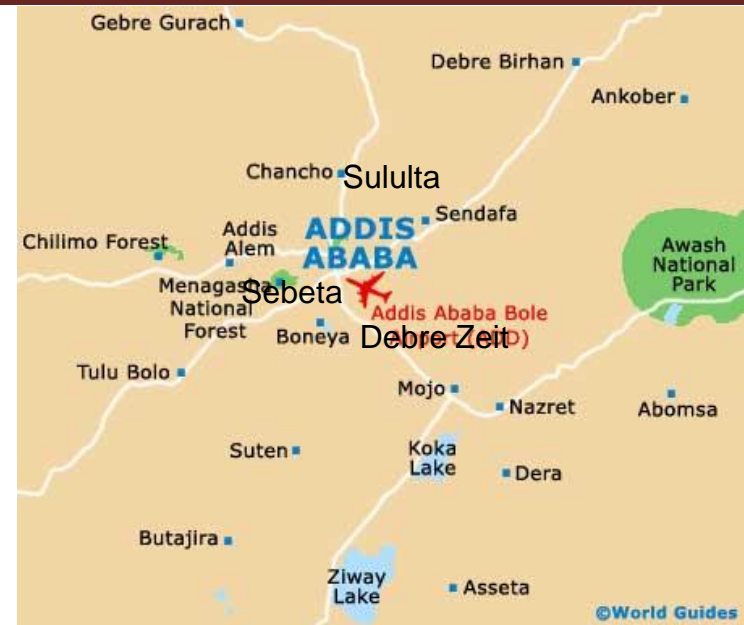
5 p.p.b.

5 p.p.b.

5 p.p.b.

Study locations-the greater Addis Ababa milk shed

- Includes Addis Ababa, Debre Zeit, Sebeta, Sendafa and Sululta
- It serves as a major milk supplier to urban markets in and around Addis Ababa.
- The sector is commercial and uses concentrate feeding.



Study Methods

- Study participants:
 - 100 dairy farmers
 - 27 from Addis Ababa, 23 from Debre Zeit, 9 from Sebeta, 31 from Sendafa and 10 from Sululta
 - 5 feed producers
 - 5 feed processors
 - 9 feed traders
- A semi-structured questionnaire was administered to all study participants
- 100 grams of each feed samples were collected

Results – feed storage practices

Storage conditions conducive to accumulation of moulds and aflatoxins

- In general, feed kept indoors in plastic bags
- Preventive measures such as raised platforms uncommon
- Quality assessment limited to visual inspection
- Feed often stored for up to 6 months



All dairy farmers used concentrates every day to feed cattle of all ages

- Ingredients in concentrates feed include:
 - Wheat barn (100%)
 - Noug seed cake (73%)
 - Pea hulls (37%)
 - Maize grain (12%)

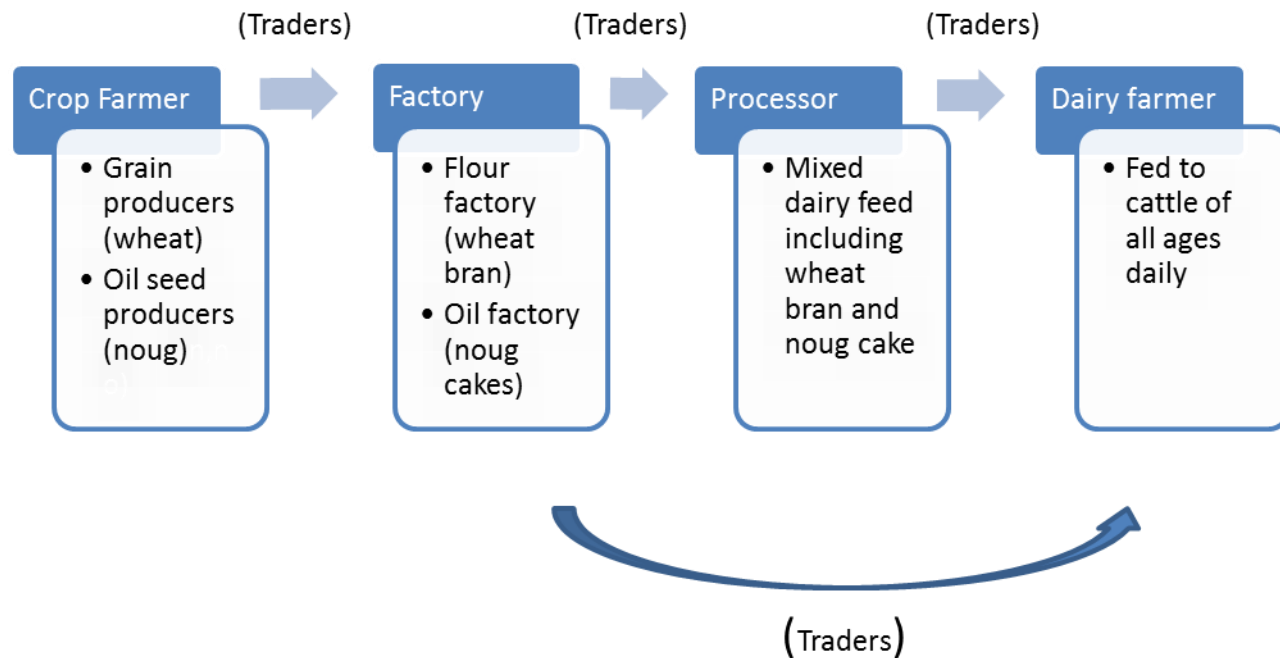


Noug cake



Pea hulls and wheat bran

The fate of wheat bran and noug cake in the peri-urban dairy value chain



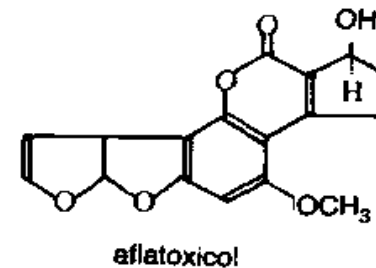
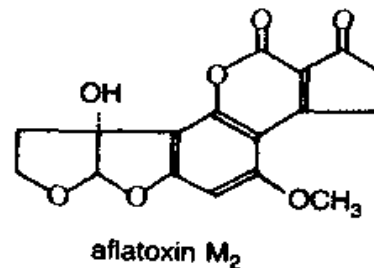
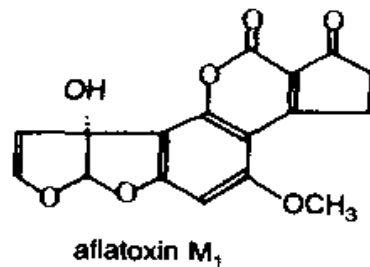
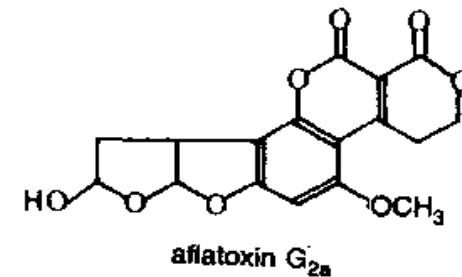
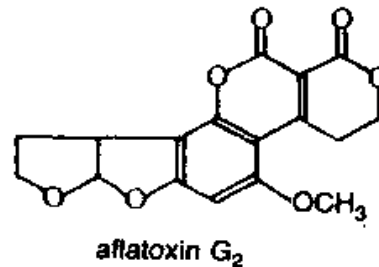
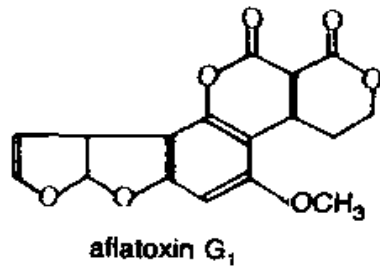
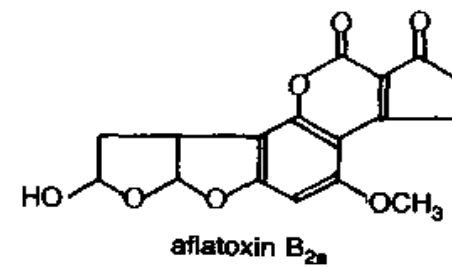
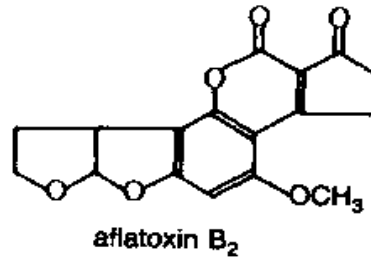
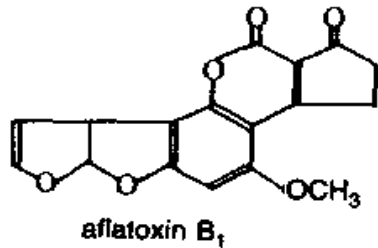
Noug Seed (*Guizotia abyssinica*)



Beside its use as oil seed and animal feed, noug is sold in the local market for consumption.

Feed analysis of aflatoxin B1 (AFB1) using enzyme-linked immunosorbent assay (ELISA)

Aflatoxins are difuranocoumarin compounds and vary depending on their chemical structures



Results of feed analysis

AFB1 distribution and percentage of feed samples collected from milk producers in Addis Ababa and its surrounding area

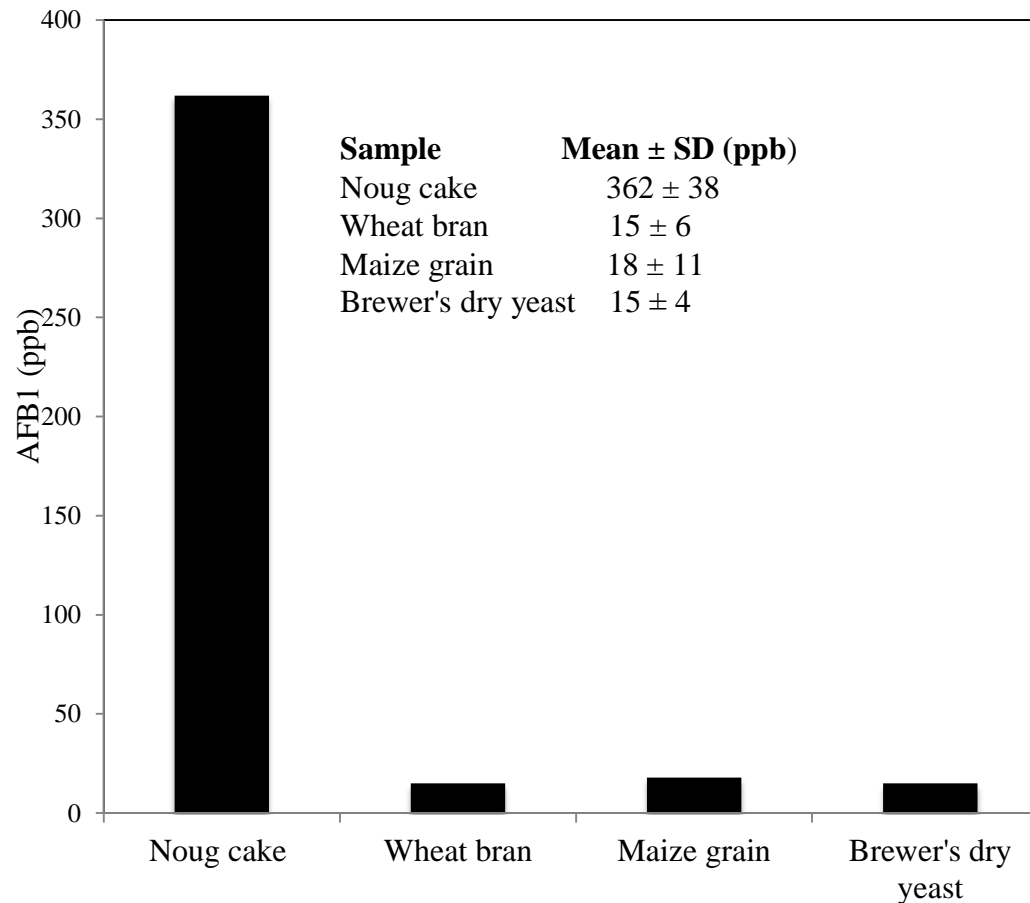
	AFB1 levels (ppb) in feed samples			
	<5	5-20	20-100	>100 ^c
N ^a	0	61	24	29
% ^b	0	54	21	25

^aNumber of contaminated samples

^bPercentage of AFB1 contaminated feed samples

^cThe highest AFB1 concentration was 419 ppb.

Results of feed analysis



Concentration of AFB1 (ppb) in individual dairy feed ingredients

Results of feed analysis

Regions	^a No. of samples	AFB1 levels (ppb) in feed samples			Percentage of 100>
		^b <20	^b 20-100	^b 100>	
Addis Ababa	27	9	8	10	37
Debre Zeit	23	5	7	11	48
Sebeta	9	6	1	2	22
Sendafa	31	26	4	1	3
Sululta	10	5	3	4	40

^aTotal number of concentrate feed samples from producers per region

^bNumber of contaminated samples

AFB1 distribution levels and concentrations of AFB1 in feed samples from milk producers per region.

Source: Gizachew et al. Food Control 59 (2016) 773-779

Conclusion

- High level contamination of aflatoxin (AFB1) in feed.
- Noug (*Guizotia abyssinica*) cakes are widely used in the greater Addis Ababa milk shed as cattle feed and have been found to be highly contaminated with AFB1.

Future activities

- Chemical detoxification of aflatoxin (AFB1).
- Investigate the moisture and temperature conditions that are conducive for *Aspergillus* fungi to grow on noug cake.
- Intervention studies that involve improving feed storage conditions.

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