



# ❏ Mycotoxins in Dairy Cattle and Potential for Carry-Over into Dairy Products

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# Mycotoxins in Feed

- Contamination of feedstuffs with mycotoxins is increasing in Canada and worldwide



## CONSEQUENCES

1. Significant economic losses in animal husbandry
2. Trade barriers for raw materials and food products

# Mycotoxins in Dairy Feed

- Ruminant diet is unique from monogastrics
  - diverse components that opens the animal to possible co-exposure to mycotoxins

<b>Diet Component</b>	<b>Mycotoxins</b>
Concentrates	Aflatoxins, fumonisins, zearalenone, DON, ergot alkaloids
Pasture grasses	Ergot alkaloids, trichothecenes
Silage	Storage (post-harvest) mycotoxins

# Mycotoxicosis in Dairy Cows

- Reduced milk production
- Temperature intolerance
- Peripheral gangrene
- Reduced feed intake
- Altered nutrient absorption in the intestine
- Diarrhea
- Mastitis and laminitis
- Reproductive issues

# Mycotoxin Absorption in Dairy Cows

- Ruminants have greater tolerance to feed contaminated with mycotoxins
- Largely due to the ability of the ruminal microflora to degrade mycotoxins to less toxic forms



...this does not apply,  
to all mycotoxins that  
contaminate feed  
materials



**TRANSFORMATION  
IN RUMEN**



converted to  
more toxic  
forms

degraded/  
converted to  
less toxic form

**EXCRETION**

excreted in  
feces and urine

**MYCOTOXIN  
INGESTED**

DEOXYNIVALENOL  
(DON)

FUMONISINS

AFLATOXIN (AF-B1)

ERGOT

ZERALANONE

**CARRY OVER  
INTO MILK?**

# Concern for mycotoxin carry-over

- Began in the 1960s, with the 1st reported cases aflatoxin contamination
- Feed contamination high, milk production low, analytical method poorly developed
- Cow milk is the main milk type used for human consumption = **83 % of world milk production**
  - buffalo milk = 13%
  - goat milk = 2%
  - sheep milk = 1%
  - camel milk = 0.3%

# Tolerable daily intake (TDI) of the main mycotoxins encountered in foods

Mycotoxin	TDI ( $\mu\text{g}/\text{kg BW}$ )
Deoxynivalenol (DON)	1
T2-toxin and HT-2	0.060
Aflatoxin B1 (AFB1)	NA
Aflatoxin M1 (AFM1)	0.002
Zearalenone (ZEN)	0.25
Ochratoxin A (OTA)	0.017
Fumonisin B (FB)	2
T-2 and H-T2	0.1



# Aflatoxin

**Max tolerated levels for feed in  
lactating dairy animals in Canada**

**20 ug/kg**

- Most intensively studied – carcinogenic potential and carry-over
- AF levels in milk = approx. 1.7 % of AF in diets
- Most countries have **legislated max tolerated levels** of AF-M1 in dairy products:
  - 0.5 ppb (ug/kg) – US FDA, Canada
  - 0.05 ppb - Europe and some other countries

**Does the current legislation on AF in feed for lactating animals enough to keep AF-M1 in milk below limits?**

# Deoxynivalenol

**Max tolerated levels for feed in  
lactating dairy animals in Canada**

**1 mg/kg**

- One of the most commonly detected mycotoxins in feed
- metabolised in rumen → less toxic metabolite DOM that is eliminated in urine, milk and feces
- ~0.001 % estimated carry-over rate of DON/DOM to milk
- Few reports of the natural occurrence of DON/DOM in milk samples for human consumption

# Zeralenone

**Recommended levels for feed in  
lactating dairy animals in Canada**

**10 mg/kg**

- Metabolism occurs in rumen → zeranol (more estrogenic but poorly absorbed)
- 0.06–0.08% estimated carry-over rate to milk
- Reports of measurements in milk but levels very low and often below limit of detection

# Fumonisin

<b>Recommended levels for feed in lactating dairy animals in US</b>	<b>30 mg/kg</b>
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- Not metabolised by rumen microbes
- Accesses the liver
- 0 - 0.05% estimated carry-over rate to milk
- Levels in milk have been previously reported but inconsistent
- Not extensively studied
- Stable to heat treatments such as pasteurization

# T-2/HT-2

**Recommended levels of HT-2 for  
feed of dairy cattle in Canada**

**0.025 mg/kg**

- Some of the most toxic trichothecenes detected in feeds
- Ruminants can rapidly convert T-2 toxin to HT-2 toxin
- Excreted via bile and feces
- 0.05% - 2% carry-over rates to milk
- No reports in the literature describing the natural occurrence of T-2/HT-2 in milk samples intended for human consumption

# Ergot alkaloids

<b>Recommended levels for feed of cattle in Canada</b>	<b>2-3 mg/kg</b>
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- Metabolised by the liver
- Excreted via bile and feces
- Not typically excreted in the milk of dairy cattle
- Alkaloid exposure of 3 ppb BW over a period of 5 weeks did not cause any detectable amounts of ergot alkaloids in the milk
- No reports in the literature describing the natural occurrence of ergot alkaloids in milk samples intended for human consumption



# Uncertainties in exposure and carry-over of mycotoxins in milk

1. Ability of mycotoxins to modify rumen microflora
2. Interactive effects of mycotoxin mixtures
3. Immune effects of mycotoxins → affect absorptive and barrier functions in the animal

