RESULTS OF INVESTIGATIONS ON THE QUALITY OF FEEDS GIVEN TO DAIRY COWS WITH DIFFERENT STATES OF DISEASE

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Abstract

In a dairy cow farm, during November 2006-March 2007, several morbid states were observed displayed as placenta retention (75-80%), uterus-vaginal secretions and losses by mortality of suckling calves, lower milk yield, etc. Several factors were analyzed to determine the causes of the health problems. Among the analyzed factors, an important role was played by the quality of feeds. The raw ingredients and compound feeds were examined oganoleptically, physico-chemically, mycologically and micotoxicologically in order to determine their involvement in worsening the health state. The results showed significant deviations of the crude protein content, a moderate contamination with toxicogenous fungi and the presence of mycotoxins in excess of the admitted maximal loads. Of the 9 samples examined mycotoxicologically, aflatoxin was determined in 3 samples (compound feed for cows, wheat bran and untoasted sunflower meal) and ochratoxin was determined in 5 samples (compound feed for nursing calves, toasted sunflower meal, compound feed for cows, coarse grinded wheat and corn and untoasted sunflower meal). The presence in feed of aflatoxin and ochratoxin establish the alteration of the health status of the dairy cows.

Key words: *dairy cows, morbid states, feed quality, mycotoxins, organoleptic and laboratory examination*

Introduction

Despite the fact dairy cow farming is no longer required to achieve yields established at the "center", some farms still can not observe the technological principles. There seem to be multiple causes, but the most frequent one being the acute lack of financing. Because of this reason they can not provide a rational, balanced feeding with safe feeds, as fresh as possible or preserved according to proper technological norms (1, 6). The lack of equipment for feed preparation and homogenization and the manual distribution of feeds are other factors contributing to an irrational feeding. It is an established fact that the dairy cows have to be fed according to their milk yield and to their genetic potential (4, 7), which can be done by individually tailoring their daily diets.

In some former communist states which have recently joined the European Union, the only measured taken in the dairy cow farms was to introduce the minimal guaranteed price for the delivered milk that meets EU quality parameters (9). Following this decision of the government, investment was done in modern milking parlours and in installation for feed preparation and automated distribution. It is known that even though the dairy cow diet is correctly formulated, it is not efficient if the feeds are not broke down in the nutrients which they contain so they can be absorbed into the blood stream (12). Digestion is done both with the assistance of the stomach enzymes and with the enzymes produced by the microorgsanisms from the forestomachs. If the feeds are contaminated by mycotoxins for long periods or if their level exceeds the admitted one, serious disturbances occur both in organs (2, 3, 8) and in the synthesis of proteins, therefore of the enzymes working for digestion. Cows' capacity to resist to the different pathogens is impaired with the decrease of specific immunoglobulin counts, which sometimes is significant (11).

Some dairy cows forms from Romania invested in modern milking parlours but didn't purchase automatic installations for forage preparation and distribution. Feed mixes are still done with the shovel and they are still distributed by the sack carried on the back. Under these conditions one can not speak of technological rearing and exploitation.

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In such a farm, which keeps the animals indoor for long periods worsening health state and poor production performance were observed. The calved cows displayed placenta retention (75-80%) and uterus-vagina secretions; the newborn calved got sick and died within 2-8 days from calving (77-100%), while the milk yield was at least 15% lower. The dead suckling calves revealed at necropsy serious haemorrhagic-dystrophic lesions of the myocardium, liver and kidney, cataral haemorrhagic enteritis with mucous denuding, thickened mucous of the urinary bladder with numerous red spots, sometimes hemorrhagic urine, dystrophic skeletal muscles with the looks of boiled muscle. All the information acquired during the visual examination and during the epizootologic inquest suggested us that the feeds might play a very important role in altering the health status.

Material and method

The investigations were conducted on 15 samples of raw ingredients and finished feeds (corn silage and compound feeds). The samples were examined organoleptically, physico-chemically, mycologically and mycotoxicologically. The samples were collected in February and June. Concomitantly, blood samples were collected from 10 cows with different disorders, placenta retention mainly, for biochemical examinations; hemogram was also done for 5 of them.

The biochemical examination determined the total proteins, albumins, globulins, calcium, phosphorus and gammaglutamyltransferaze (GGT). The laboratory examinations were conducted using the usual techniques.

Results and discussion

The organoleptic examination

The organoleptic examination revealed that 4 of the 9 samples collected in February were improper. The compound feed (CF) for calves smelled rancid, the sunflower meal (toasted or not) contained a large amount of husks, the compound feed for cows was dominated by bran and sunflower husks, the corn silage contained a large amount of earn corn. Upon sampling for laboratory examination it was observed that all operations for compound feed preparation were done with shovels.

Physical-chemical examination

Table 1 shows the results of the physical and chemical examination being analzsed the moisture, crude protein, ether extractives and crude fiber.

Table 1

Values of the physical and chemical parameters

No.	Feed	Moisture%	CP%	EE%	CF%
1.	Corn silage	31.94	2.90	-	
2.	CF for suckling calves	8.80	**13.65**	3.01	4.88
3.	Sunflower meal	9.03	24.03	1.10	25.84
4.	Corn meal	11.36	8.6	5.30	4.20
5.	CF cows	10.00	**18.02**	2.51	6.20
6.	Wheat and barley coarse grinding	8.69	10.75	2.36	4.20
7.	Ground peas	13.07	22.20	3.58	6.08
8.	Wheat bran	7.14	14.00	3.58	10.84
9.	Sunflower meal, not toasted	7.18	35.01	2.20	20.25

Table 1 shows many deviations from the normal values. Thus, moisture ranged between 7.14% (wheat bran) and 31.94% (corn silage). In 7 of the 9 samples, humidity was below the normal values (normal values are 12-14% for the raw ingredients and for the finished feeds, and 40-55% for the silage). The dietary crude protein from the compound feed for cows was 18.02% higher than the normal 13-14%, and of only 13.65% for the calves. The level of ether extractives from the compound feed for cows was 4.88% and 6.20% much lower than the normal values 15-18%. These results show that the deviations observed during the organoleptic and physical-chemical examination may characterise the feeds as improper.

The mycological examination

The examinations conducted on the samples collected in February and June revealed the presence of different types of fungi, some of them known as very toxicogenous. The total fungi count (TFC) was evaluated according to the value imposed by the EU and by the Romanian authorities (SR 7954/2001 and Ord 249/2003), which is ≤ 5000/g feed. Table 2 show the results of the mycological examination.

Table 2

Mycological examination

No.	Specification	Fungi genera	TFC	
			February	June
1.	Corn silage	Yeasts	**47,000**	NT*
2.	CF for suckling calves	*Aspergillus, Penicillium, Fusarium*, Cladosporidium, Mucor, Rhisopus	**7,000**	5,000
3.	Sunflower meal	*Aspergillus,* Cladosporidium, yeasts, Mucor	**6,000**	**16,000**
4.	Corn meal	*Aspergillus, Penicillium*, yeasts, Cladosporidium, Absidia	**6,000**	NT
5.	CF cows	*Penicillium, Fusarium*, Aspergillus, yeasts, Absidia	**24,000**	**16,000**
6.	Wheat and barley coarse grinding	*Aspergillus, Penicillium*, Fusarium, yeasts, Absidia	**10,000**	5,000
7.	Ground peas	*Aspergillus*, Cladosporidium, Mucor, Rhisopus	**8,000**	5,000
8.	Wheat bran	yeasts	**27,000**	5,000
9.	Sunflower meal, not toasted	yeasts (February); Aspergillus, Fusarium, Penicillium, Mucor, Rhisopus (June)	**36,000**	NT

*NT = Non-tested

During the first TFC examination, all analyzed samples exceeded the maximal count of 5000, but during the examination of June, only 2 of 6 samples exceeded this value. At 6 of 9 samples collected in February and in 7 of 9 samples collected in June, toxicogenous fungi were detected, at least one of the three genera very much involved in the veterinary pathology, respectively *Aspergillus*, *Penicillium* şi *Fusarium*.

The mycotoxicological examination

The samples of raw ingredients, compound feeds and corn silage were examined mycotoxicologically. Tables 3 and 4 show the results of the examination.

Table 3 shows that two of the most active mycotoxins have been identified in all samples: **aflatoxin and ochratoxin**. In 3 and 5 feeds, they had values in excess of the admitted limit, i.e. 4 ppb for aflatoxin and 5 ppb for ochratoxin. The compound feed for dairy cows contained both mycotoxins, while the compound feed for suckling calves contained ochratoxin. Both mycotoxins have been identified in the not-toasted sunflower meal and only ochratoxin was identified in the toasted sunflower meal.

Table 3

Mycotoxicological examination – February 2007

No.	Specification	Aflatoxin ppb	Ochratoxin ppb
1.	Silage	0.64	2.05
2.	CF for suckling calves	3.01	**5.07**
3.	Sunflower meal	2.23	**5.02**
4.	Corn meal	0.71	2.32
5.	CF cows	**4.64**	**8.76**
6.	Wheat and barley coarse grinding	3.03	**5.91**
7.	Ground peas	0.79	3.69
8.	Wheat bran	**4.09**	3.21
9.	Sunflower meal, not toasted	**4.91**	**7.76**

In June, the samples were collected for the second examination, while the results showed lower values than in winter, with the values exceeding the upper allowed limit rarely. Table 4 shows that the CF for cows and for the nursing calves still has ochratoxin in large amounts, particularly the CF for cows.

Table 4

Mycotoxicological examination – June 2007

No.	Specification	Aflatoxin, ppb	Ochratoxin, ppb	Citrinin (ppb)
1.	CF dairy cows	1.56	**7.34**	60.42
2.	CF for suckling calves	1.63	**4.50**	43.79
3.	Wheat bran	1.72	2.78	61.36
4.	Wheat and barley coarse grinding	1.24	0.66	68.95
5.	Ground peas	0.95	1.19	52.52
6.	Sunflower meal	**4.25**	2.64	177.02
		LA≤4 ppb	LA≤5 ppb	

Citrinine was detected in the samples collected in June, a mycotoxin produced like ochratoxin, by *Penicillium fungi*. Citrinine has structural similarities with ochratoxin A, poteting it in its adverse effects on the renal function (5).

The results of this study support the literature data (10) which show that the mixtures of ingredients increase the risk that the feed contains mycotoxins, which produce toxicological synergies, increasing the severity of the mycotoxicoses. Thus, at the first examination, in the compound feed for cows were determined both the aflatoxin and ochratoxin, while at least one mycotoxin was found in the raw materials (wheat bran, sunflower meal and wheat+barley coarse grind).

The literature (2, 3, 10) shows that all three mycotoxins are involved in altering the health status of the dairy cows. The degradation of aflatoxin B_1 in the rumen is low, being under 10% for the concentration ranging from 1 to 10 μg/g. **The aflatoxicosis** of cattle produces jaundice, diffuse hemorrhagic syndrome, serious hepatic disorders, ascitis and serous oedema, while in the very young calves, which are very sensitive, it appear the acute diarrhoea syndrome and depression. In the dairy cows, a few days after the intake of feeds contaminated with aflatoxin, the milk yield decreased drastically. **The ochratoxicosis** affects more seriously the kidney compared to the liver, the weight gain decreases very much, the calves display depression, oliguria and dehydration, diarrhoea syndrome and ciphosis. **Zearalenone** is involved particularly in the reproductive disorders producing abortion, placenta retention, prolonged puerperium and anestrum, chronic endometritis followed by infecundity, estral cycle deregulations, hipertony or hipotony of the uterine horns, serous, leucoreic or yellowish discharges at the lower corner of the vulva in impuber females. All these pathological aspects were present in the dairy cows in February, when the investigations started.

The biochemical examination

The biochemical investigations on 10 cows which displayed reproductive disorders showed the increase of the total proteins, of the albumin and globulin, supporting the literature data (2) which show that *aflatoxin produces metabolism disorders, especially hiperproteinemia* due to its concentration in the liver, determining the fatty chronic hepatitis, inducing enzymatic misbalances, and affect of the hepatic function. Table 5 and fig. 1 show the increase of the total protein (8 samples), albumin (7 samples) and globulin (all 10 samples).

Table 5

Biochemical examination

Sample	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Calcium (mg/dl)	Phosphor (mg/dl)	GGT (U/l)
1.	**9.20**	3.21	**5.99**	9.20	**8.35**	NT
2.	7.85	3.17	**4.68**	8.40	**7.21**	**58**
3.	**9.36**	**4.35**	**5.01**	9.60	**8.86**	12
4.	**9.35**	**4.36**	**4.99**	NT	**8.76**	NT
5.	**9.20**	**4.14**	**5.06**	10.4	**8.51**	**34**
6.	**8.97**	**4.27**	**4.70**	NT	**8.30**	**65**
7.	8.38	3.50	**4.88**	NT	**8.88**	**33**
8.	**9.71**	**5.23**	**4.48**	NT	**9.12**	NT
9.	**9.49**	**4.18**	**5.31**	NT	**7.15**	NT
10.	**8.96**	**4.41**	**4.55**	9.6	**7.79**	**53**
Normal value	7.6 ±0.8	3.4±0.5	4.2±0.3	9-10	6.7-5.6	14.9±3.6

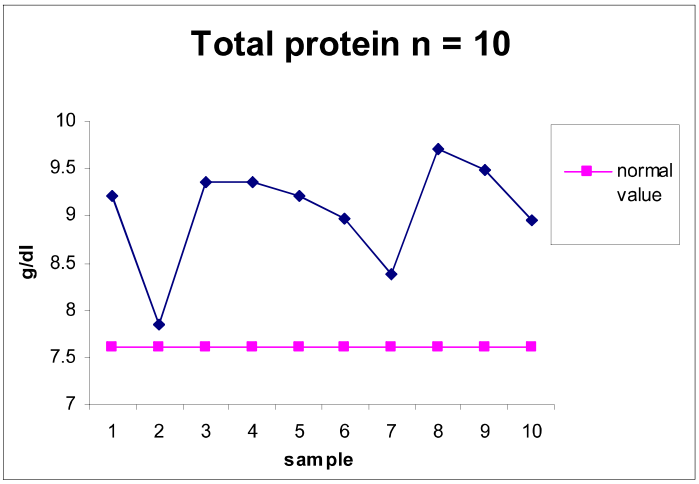

Fig. 1

The **haemogram** generally had results similar in the 5 examined samples (Table 6).

Table 6

Haemogram results

Analyzed parameters	MU	Sample					Normal values
		1	2	3	4	5	
Leukocyte number	Thousands/mm^3	8.30	7.30	9.00	15.90	4.20	8.00±1.5
Red cells number	Million/mm^3	5.27	4.94	5.13	5.40	5.13	6.5±1.4
Haemoglobin (Hb)	g/dl	2.30	8.80	8.50	9.70	8.80	10.2±1.0
Hematocrit (Ht)	%	22.90	25.00	23.50	26.80	24.30	35.0±3.0
VEM	μ^3	43.00	51.00	46.00	50.00	47.00	53.4±2.2
HEM	pg	15.70	17.80	16.70	17.90	17.10	16±2.5
CHEM	g/dl	36.20	35.10	36.30	36.10	36.10	29.1±2.1
Nr platelets	Thousands /mm^3	544	301	124	201	452	about 300.000

VEM = volume of average erythrocytes
HEM = haemoglobin of average erythrocytes
CHEM = amount of haemoglobin of average erythrocytes

Table 6 shows that the number of red cells and the haemoglobin were close to the normal values. Ht was lower, while CHEM was increased. These data were supported statistically after the hemogram results have been processed (table 7).

Table 7 shows that the number of leukocytes, Ht values, VEM and the number of platelets display very high values of the standard deviation and standard error.

Table 7

Statistical analysis of haemogram results

Parameters	MU	Average ($\overline{X}$)	Standard deviation	Standard error of the average
Leukocyte number	Thousands/mm^3	8.94	4.301	1.923
Red cells number	Million/mm^3	5.174	0.172	0.077
Haemoglobin (Hb)	g/dl	8.82	0.535	0.239
Hematocrit (Ht)	%	20.5	9.913	4.433
VEM	μ^3	47.4	3.209	1.435
HEM	pg	17.04	0.898	0.401
CHEM	g/dl	35.96	0.487	0.218
Nr platelets	Thousands /mm^3	324.4	173.52	77.601

For CHEM, with almost homogenous values for the 5 samples (a standard deviation of 0.487), the average being 35.96 compared to 29.1±2.1 considered normal value. The number of platelets varied very much, from animal to animal (from 544 thousands /mm^3 to 124 thousands /mm^3).

Conclusions

The complex examinations of feed samples collected in February and June revealed an improper quality of the feeds both for dairy cows and for calves.

1. The organoleptic examination revealed a rancid smell of the compound feed for calves and a large amount of sunflower husks and wheat bran in the dairy cows compound feed; the corn silage had a high level of earn corn.
2. The physico-chemical examination of the feed revealed a lower than normal moisture, a high dietary crude protein level of the compound feed for dairy cows and a low dietary crude protein level of the compound feed for calves. The ether extractives and the crude fiber were also lower than the normal values.
3. The mycological examination conducted in February showed that all analyzed samples exceeded the higher limit of TFC, while in June only 2 of 6 samples exceeded the higher limit. Most raw feeds and finished feeds had at least one of the three genera of toxicogenous fungi involved in the veterinary pathology: *Aspergillus, Penicillium* and *Fusaruim*.
4. The mycotoxicological examination revealed levels in excess of the aflatoxin in the compound feed for dairy cows, wheat bran and toasted sunflower meal; other five samples, respectively feeds for dairy cows and calves, wheat and barley coarse grinding, toasted and untoasted sunflower meal were positive for ochratoxina Both mycotoxins are involved in altering the health status of the dairy cows and of the very young calves.
5. The dairy cows with reproductive disorders displayed at biochemical examination hyperproteinemia, a characteristic feature of the aflatoxicoses.
6. Haemoglobin showed dramatic alterations of the leukocytes count. Of the hematocrit, VEM and for the thrombocyte count, the standard deviation and the standard error of the mean being very high. The mean and individual value of

CHEM was much higher compared to the normal values. These results show important alterations of the blood parameters following the administration of feeds with mycotoxic load.

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These conclusions were supported by the response of the animals after measures were taken to alleviate the mycotoxic effect on the pregnant and lactating cows and on the suckling calves during their first two months of life. Thus, the number of diseases and mortalities in calves decreased (with 7-12%) and so did the placenta retention disorders (with 18%), while the milk yield returned to normal.

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