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Monitoring of heterogenous substances in milk and in cow-barn environment

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The objective of study was to monitor residues of heavy metals (Hg, Cd, Pb) in milk, feed ration, water, and separate of faeces in dairy farm. Milk samples were analysed as daily mixed samples of whole herd and as a samples from different stages of lactation too. Every component of feeding ration was analysed – straw, alfa-alfa hay, grass hay, corn silage, alpha-alpha silage, draft, waste brad, and supplement concentrates. The analyses of pure separate of faeces, separate of faeces mixed with sawdust, and well water were made too. Hg was determined in analysed samples of corn silage 2 times in excess level, 5 times in acceptable level and in remaining cases under limit value. Under limit value of Hg contents were found in milk and well water samples too. Two samples of feed ration were in non-detectable level and other samples were under limit value in case of Cd determination from feed rations, milk and well water together. Pb was detected in non-detectable values in all analyses (feed, milk, water). The analyses of Hg content were performed in AMA 254 equipment (Advanced Merkury Analyse) and Pb and Cd content analyses were performed with usage of AAS (Atomic Absorption Spectrophotometry).

Table 1: Maximum of admissible content of unfavourable substances in feed ration

substance	Feeding component	Max. admissible content (mg/kg, dry matter 88%)
Pb	Feeding components except:	10
	Pasture	40
	phosphates	30
	Yeasts	5
	Complete feeding except:	5
	Additional components except	10
	Minerál components	30
Hg	Feeding components except:	0.1
	Feeds from fishes	0.5
Cd	Feeding components of plant origin	1
	Feeding components of animal origin except	2
	Feeds for home animals	10
	Phosphates	-
	Complete feeds for cattle, sheep, and goats except:	1
	Complete feeds for suckling	0.5
	Other complete feeds except:	-
	Mineral feeds	5
	Additional feeds for cattle and goats	0.5

Table 2: The highest limiting values of heavy metals in drink water

Cd	5.0 mg/l
Pb	10 mg/l
Hg	1.0 mg/l

Table 3: Admissible content of heavy metals in milk

Cd	0.01 mg/kg
Pb	0.02 mg/kg
Hg	0.01 mg/kg

Material and methods

Samples were collected in dairy farm Ruda, which is part of Czech University of Life Sciences and where Holstein cows are bred. System of free housing is realized in this farm with addition of outside feeding area. Feeding is realized 2 times a day in relation to lactation period, daily milk production and reproduction status. Local source – well is used for dribling of animal. Milking parlour of Alfa Laval was built in farm in 1995.

Collection and analysis of samples

Samples of feeds were collected (straw, alpha-alpha hay, grass hay, corn silage, zplna-alpha grass silage, crushed barley, draff, bran, and concentrates DOVP1, DOVP2 and CALVING. Milk samples were collected individualy in relation to period of lactation and mixed samples wete taken too. Samples of water and separate of faeces were taken at the same time too.
Samples collection were performed in May, June, September, October and November. The analyses of Hg content were performed in AMA 254 equipment (Advanced Merkury Analyse) and Pb and Cd content analyses were performed with usage of AAS (Atomic Absorption Spectrophotometry).

Results and discussion

Table 4: Determination of Hg level in water

	n of samples	$\bar{x}$ mg/kg	S^2
May	11	0.0358	0.0015
June	11	0.0282	0.0010
September	11	0.0237	0.0007
October	11	0.0214	0.0004
November	11	0.0227	0.0003

Table 5: Determination of Pb and Cd level in water

	n of samples	Pb $\bar{x}$ mg/kg	Pb S^2	Cd $\bar{x}$ mg/kg	Cd S^2
May	10	2.2789	2.6679	0.2092	0.0359
June	10	2.4243	1.2070	0.0813	0.0036
September	11	2.7880	3.0158	0.0683	0.0037
October	11	3.4322	6.7378	0.0919	0.0086
November	11	4.6982	8.9170	0.1770	0.0165

Table 6: Determination of Hg, Pb and Cd level in samples of feeds

	Substance mg/kg	Min – max of values	$\bar{x}$	s_d	S^2	Admissible content (mg/kg)
Grass silage	Hg	0.028-0.069	0.0468	0.0165	0.003	0.100
	Pb	2.5-8.95	5.3420	2.955	8.7321	10
	Cd	0.068-0.289	0.1589	0.088	0.0078	1.0
aplha-alpha hay	Hg	0.016-0.055	0.0358	1.0364	1.0741	0.100
	Pb	2.19-4.5	2.978	1.0346	1.0741	10.0
	Cd	0.012-0.214	0.0854	0.0820	0.006	1.0
Bran	Hg	0.003-0.015	0.012	0.0075	0.0001	0.100
	Pb	1.557-2.210	1.980	0.2835	0.0804	10.0
	Cd	0.054-0.102	0.1452	0.0796	0.0003	1
Corn silage	Hg	0.06-0.102	0.085	0.019	0.004	0.100
	Pb	3.8-9.4	5.816	2.1584	4.6587	10.0
	Cd	0.099-0.578	0.3442	0.2305	0.0531	1.0

Table 7: Determination of Hg, Pb and Cd level in samples of feeds

	Substance mg/kg	Min – max of values	$\bar{x}$	s_d	S^2	Admissible content (mg/kg)
Grass hay	Hg	0.022-0.037	0.0273	0.0067	0.00005	0.100
	Pb	2.69-6.22	3.780	1.6698	2.7883	10
	Cd	0.063-0.148	0.1055	0.0457	0.0021	1
Straw	Hg	0.022-0.040	0.0308	0.4361	0.1901	0.100
	Pb	1.53-2.67	2.23	0.4361	0.1901	10.1
	Cd	0.024-0.488	0.082	0.0514	0.0026	1
Crushed grain	Hg	0.007-0.015	0.0106	0.003	0.00001	0.1
	Pb	1.32-4.12	2.483	1.4003	1.9609	10
	Cd	0.05-0.144	0.0855	0.057	0.0032	1
Separate of faeces	Hg	0.016-0.034	0.0273	0.0099	0.0001	0.100
	Pb	4.22-7.08	6.0625	1.3057	1.705	10
	Cd	0.105-0.497	0.3085	0.1455	0.021	1
Mixed milk	Hg	Under detection				

	Pb	Under detection				
	Cd	Under detection				

Positive samples for heavy metals were detected 2 times. In first case it was in corn silage, due to low homogeneity of sample. And second case it was sample of water from local well. However, values of positive samples were under admissible limits for this heavy metals.

Conclusion

Only 2 samples from 70 totaly collected samples were slightly over admissible limit. It was in case of Hg determination in corn silage. We can summarize that cattle breedin in dairy farm Ruda do not mean danger for environment of for food quality (milk, grain etc.).

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