Original Report

Content of calcium, phosphorus, potassium, sodium and magnesium in feed rations for farm mink (*Mustela vison*)

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Summary

We studied the contents of Ca, P, K, Na, and Mg in usual feed rations for mink consisting of poultry heads, beef, fish offal (herrings), NOR II – mixture of meals, and dried milk in feed rations in various proportions. The content of macroelements was assessed by the spectrometric apparatus JUNICAM 939. The results were statistically processed. The highest content was noticed with calcium (33.73 $g.kg^{-1}$d.m.) and the lowest content with potassium (1.19 $g.kg^{-1}$d.m.). The contents of the studied macroelements in feed rations varied depending on the amount of individual components in the feed rations; however, the differences were not statistically significant.

Introduction

We studied the contents of selected mineral elements – calcium, phosphorus, potassium, sodium and magnesium – in feed rations for mink used on farms in the Slovak Republic. The content of mineral elements is an important indicator of feed value. Mineral elements have various functions in the body of animals. The basic functions are: participation in construction of supporting tissues in the organism, maintenance of homeostasis in the inner environment, keeping the balance of cell membranes, activation of biochemical reactions by influencing the enzymatic system, direct or indirect effect on function of endocrine glands, and effect on symbiotic microflora in the digestive system (*Georgievskij et al., 1982*). It is necessary to provide optimum amounts of mineral elements for fur animals, as mentioned by Mertin et al. (1994), and it is also necessary to take into account the form and interactions between the individual mineral elements in feed (*Slawoò, 1987, Anke et al., 1993*) to provide adequate production and reproduction of animals. Lohi et al. (1991) mention that the contents of some mineral elements in mink feed influence their fur content. They found a connection between fur colour and the content of Ca, P and Mg, and between Ca content and morphometric parameters of fur. Knowledge of mineral requirements and their supply prevents disorders in the metabolism which cause up to 90% of animal disorders at present (*Vrzgula et al., 1982*), the disorders caused by lack of mineral elements being more frequent than those caused by lack of other nutrients (Malík et al., 1984). Feeding of mink in Slovakia is based on certain native feeds, which are used to compose the feed rations after the needs of individual animal categories. Mertin et al. (1995) give the content of mineral elements in the most often used feeds. It is necessary to know the mineral composition of feed rations to give adequate nutrition to fur animals under our conditions. Kangas (1974, 1976, 1978), Nielsen (1975), Glem-Hansen (1984), Hansen (1986), Vejgaard and Lohi (1988), and Lohi and Jensen (1991) studied the content of mineral elements in feed rations used in Scandinavia. The authors found considerable variability in the content

of mineral elements in feed rations mainly due to the large proportion of sea fish among the individual regions.

Materials and methods

The content of selected macroelements (Ca, P, K, Na, and Mg) was studied in feed rations for mink. We analysed four feeds composed of identical feedstuffs (poultry heads, beef, fish offal – herrings, NOR II – mixture of meals, dried milk) represented in various amounts. Feed formulations are shown in Table I. The nutritive value of the feeds (Table II) corresponded with the norm given by Mertin et al. (1994). We used approx. 100 kg homogenised mixture of each type of feed. We took three average samples weighing 200 g from the prepared feeds. We weighed 1 g of homogenised average samples in a platinum bowl and burned them in a muffle furnace at 550°C for six hours. The ash was covered with 10 ml HCl 1:3 and set to evaporate in a sand bath. After evaporation it was covered with 10 ml HCl again and poured into 100 ml volumetric flask. Ca, K, Na, Mg were analysed using a spectrophotometric apparatus JUNICAM 939. Spectrophotometric determination of P was performed after reaction with an orthophosphate molybdovanadate agent. Two average measurements were done with each feed sample. We evaluated statistically the obtained values of the studied macroelement concentrations *(Grofík and F¾ak, 1990)*:

- basic variation and statistical characteristics x, s_x were determined,
- the content in individual feed rations was compared by 1-way variance analysis with fixed effects.

Table I. Composition of feed rations for mink

Feed (g / animal /day)	Feed ration			
	A_1	A_2	A_3	A_4
Poultry offal – heads	36.0	60.0	81.0	105.0
Beef	96.0	81.0	75.0	60.0
Fish offal – herrings	15.0	15.0	4.5	2.4
NOR II	18.0	18.0	18.0	18.0
Dried milk	3.0	3.0	2.4	-
Totally	168.0	177.0	180.9	185.4
Chemical composition (%)				
Dry matter	31.65	33.41	37.34	38.04
Water	68.35	66.59	62.66	61.96
Crude protein (N. 6.25)	14.44	13.61	14.60	12.93
Fat	6.75	9.64	11.63	14.94
Carbohydrate	6.50	6.10	6.67	5.85
Ash	3.96	4.06	4.44	4.31

NORII – commercially produced mixture of meals for carnivorous fur animals (PNZP Galanta, SR) - composition (%): dried skimmed milk 4, molasses yeast 9, soybean meal 5, maize 20, wheat 20, barley 23, oats 16, mineral supplement MD NORVIT 3.

Table II. Nutritional value of feeds for mink

Parameter	A_1	A_2	A_3	A_4
ME (kJ / animal /day)	1259.39	1275.59	1281.35	1289.65
Dig. nitrogen (g / animal /day)	24.96	25.05	24.90	25.29
Dig. Fats (g / animal /day)	15.03	15.39	15.69	15.90
Dig. carbohydrate (g / animal /day)	12.00	12.03	11.85	11.43

ME – metabolizable energy
$ME_{(kJ)}$ = (18.81 . Dig. nitrogen) + (38.87 . Dig. fats) + (17.14 . Dig carbohydrate) (Pereldik et al., 1987)

Results and discussion

The concentrations of the studied macroelements in the tested feeds are given in g.kg^{-1} dry matter in Table III. The highest content was in feed A_4 (38.04 ± 0.54), the lowest in feed A_1 (31.65 ± 0.52). A significant difference in dry matter content ($P \leq 0.05$) is found between these feed rations. Calcium was found to have the highest content (average = 33.73!3.06. The highest calcium content was in feed A_4 (38.40 ± 4.79) with the highest proportion of poultry waste and a lower content of beef and fish; the lowest Ca content was in feed A_2 (30.99 ± 3.18), however, the differences were not significant. The differences in phosphorus content in the feeds were small; the highest P content was in feed A_3 (11.85 ± 0.66), the lowest in feed A_2 (9.36 ± 1.96). The average P content in the feeds was 10.99 ± 0.95 g.kg^{-1} dry matter. The differences in potassium content in the feeds were also insignificant (average content 4.98 ± 0.54). Its highest content was in feed A_1 (6.72 ± 0.34) with a high proportion of beef, fish and milk and a low content of poultry offal. The K content decreased in feed rations with an increasing proportion of poultry offal and a decreasing proportion of beef, fish and milk. The lowest K concentration was in feed A_4 (3.05 ± 0.16). The sodium content in feeds had a similarly decreasing tendency. Its content was the highest in feed A_1 (3.03 ± 0.01) and lowest in feed A_4 (2.51 ± 0.47), the differences being non-significant. The average Na content was 2.76 ± 0.15 g.kg^{-1} dry matter. The average content of magnesium was 1.19 ± 0.08 g.kg^{-1} dry matter and, similarly to Na and K, it had also a decreasing tendency from feeds A_1 (1.36 ± 0.08) to A_4 (1.02 ± 0.25), the differences being non-significant. The contents of the macroelements varied depending on the proportion of the individual components in the feeds. Mertin et al. (1995) show a high Ca content in poultry offal (heads), but a low content in beef. The mineral composition of feed is dependent on the individual ingredients, however, the differences were not significant. Mertin et al. (1994) give the requirements of Ca in carnivorous fur bearing animals as being 5 – 6 g.kg^{-1} dry matter, P 4 – 6 g.kg^{-1} dry matter and Na 5 g.kg^{-1} dry matter. Our analyses show that Ca and P content is high, however, Na content is lower than recommended. The proportion Ca : P, which should be from 1 : 1 to 1.7, is not kept, the content of calcium is higher than the content of phosphorus.

Table III. Content of macroelements (g . kg^{-1} dry matter) in feed rations for mink, n = 8

Feed ration	Dry matter		Ca		P	
	x	s_x	x	s_x	x	s_x
A_1	31.65	0.52	33.13	1.02	11.80	0.70
A_2	33.41	1.92	30.99	3.18	9.36	1.96
A_3	37.34	0.82	32.39	0.03	11.85	0.66
A_4	38.04	0.54	38.40	4.79	10.97	4.03
Mean	35.11	1.09	33.73	3.06	10.99	0.95
	K		Na		Mg	
A_1	6.72	0.34	3.03	0.01	1.36	0.08
A_2	5.24	0.73	2.57	0.31	1.27	0.17
A_3	4.92	0.85	2.92	0.32	1.09	0.06
A_4	3.05	0.16	2.51	0.47	1.02	0.25
Mean	4.98	0.54	2.76	0.15	1.19	0.08

Table IV. One-way variance analyses of macroelement contents in feed rations for mink

Source of variation		Feed rations A $f_A = 3$	Error of experiment e $f_e = 4$	Significant comparisons
Dry matter	MS	18.8920	2.4481	1 : 4$^+$
	F	7.717$^+$		
Ca	MS	20.9718	114.9578	
	F	0.182		
P	MS	2.7073	10.4708	
	F	0.259		
K	MS	4.5453	0.6972	
	F	6.520		
Na	MS	0.1339	0.2103	
	F	0.637		
Mg	MS	0.0499	0.0504	
	F	0.990		

$F_{0.05}(3,4) = 6.591$; $F_{0.01}(3,4) = 16.695$

Conclusion

The study of the content of selected mineral elements – calcium, phosphorus, potassium, sodium, magnesium – in four types of feeds for mink commonly used on farms in the Slovak Republic docu-

ments that between the individual feeds with various proportions of feedstuffs but balanced according to the physiological needs of farm mink there were no statistically significant differences in the content of the studied mineral elements in the dry matter. The results show that sodium is insufficiently represented in feed for mink and it is necessary to add it to the feed e.g. in form of kitchen salt, first of all for females in the period of reproduction as they are more sensitive to the lack of this element. It is also necessary to maintain a correct proportion of calcium and phosphorus.

References

Anke, M., Groppel, B., Müller, M. 1993. Spurenelementmangeler – scheinungen bei Tier und Mensch. In: Anke, M., Gürtler, H.: Mineralstoffe und Spurenelemente in der Ernährung. Verlag Media Touristik, Gersdorf: 157 – 196.

Georgievskij, V.I., Annenkov, B.N., Samochin, V.T. 1982. Minerálna výž iva zvierat. Príroda, Bratislava: 430 pp.

Glem-Hansen, N. 1984. Nutrition of Mink. In: Mink Production. Scientifur, Denmark: 189 – 248.

Hansen, N.E. 1990. Mineraler i pelsdyrfoder. Kursus for fodercentralerne i herning. The Royal Vet. and Agric. University, Copenhagen. In: Moller, S.H. et al.: Production of Mink. 688 Beretning fra Statens Husdyrbrugsforsog, Foulum: 101.

Kangas, J. 1990. Minkens och rävens mineralbehov. State Veterinary Medical Institute, Finnish Fur Breeders Association 1974. In: Moller, S.H. et al.: Production of Mink. 688 Beretning fra Statens Husdyrbrugsforsog, Foulum: 101.

Kangas, J. 1976. I. Inter. Scient. Congress in Fur Animal Production, Helsinki.

Kangas, J. 1987. Minkfoders kemiska sammansättning och minkens näringsforbrukning. Helsinkfors 1978. In: Pere¾dik, N.Š., Milovanov, N.V., Erin, A.T.: Kormlenie pušnych zverej. Moskva vo Agropromizdat : 119.

Lohi, O., Jensen, L.V. 1991. Mineral composition of mink feed and mink hair. In: Moller, S.H. et al.: Production of Mink. 688 Beretning fra Statens Husdyrbrugsforsog, Foulum: 99 – 114.

Lohi, O., Rasmussen, P.V., Jensen, L.V.: Mineral content of feed and hair and microscopic studies on hair. In: Moller, S.H. et al.: Production of Mink. 688 Beretning fra Statens Husdyrbrugsforsog, Foulum: 97 – 98.

Malík,V. et al. 1984. Výž iva a kàmenie zvierat v drobnochovoch. Príroda, Bratislava: 17 – 21.

Mertin, D., Oravcová, E., Süvegová, K., Toèka, I. 1994. Potreba ž ivín a výž ivná hodnota krmív pre kož ušinové zvieratá. Nitra, VÚŽ V: 60 pp.

Mertin, D., Süvegová, K., Sviatko, P., Toèka, I. 1995. Sledovanie koncentrácie niektorých minerálnych látok v natívnych krmivách pre mäsož ravé kož ušinové zvieratá. Ž ivoèíšná výroba, Vol. 40, No. 10: 465 – 470.

Nielsen, J.J. 1990. Mineralstofferi dansk Minkfoder. Minkfoderundersogelsen. Danish Fur Breeders Association 1975. In: : Moller, S.H. et al.: Production of Mink. 688 Beretning fra Statens Husdyrbrugsforsog, Foulum: 101.

Vejgaard, J., Lohi, O. 1988. Correlation between mineral content in feed and mink hair and the relation of mineral content to fur characteristics. 4th International Scientific Congress in Fur Animal Production, Rexdale, Ontario, August 21 – 24.

Slawon, J. 1987. Ž ywienie lisów I norek. Panstwowe Wydawnictwo Rolnicze i Lesne, Warszawa: 60 – 70.

Vrzgula, L. et al. 1982. Poruchy látkového metabolizmu hospodárskych zvierat a ich prevencia. Príroda, Bratislava: 93 – 242.