Sel'skokhozyaistvennaya Biologiya [Agricultural Biology], 2011, № 6, p.116-121

UDC 636.93:636.018:636.087:591.05

PRODUCTIVITY AND VIABILITY OF MINK AND POLAR FOX UNDER THE INFLUENCE OF EMYCIDIN ANTI-OXIDANT

K.V. Kharlamov[1], T.M. Demina[1], O.V. Rastimeshina[1], I.S. Sugrobova[2], E.V. Momot[1]

[1] V.A. Afanasiev Research and Development Institute of Fur Animals and Rabbit Farming, RAAS
Moscow province, Ramenskoe region, Rodniki 140143, Russia
e-mail: niipzk@mail.ru
2 Veterinary Department of the Ministry of Agriculture of the RF, Moscow 107139, Russia
e-mail: i.sugrobova@vet.mcx.ru

Received August 17, 2011

S u m m a r y

The productivity and female viability and also viability of suckling puppies in sapphire mink and silver polar fox after application of emycidin water solution were studied. The use of preparation reduces the loss of mink females from lactation emaciation, increases the milkiness of female in polar fox and also growth intensity of suckling puppies and their viability. The doses and courses of emycidin application for females of mink and polar fox are proposed.

Keywords: the emicidin antioxidant preparation, mink, arctic fox, females lactation, safety females and cubs.

Antioxidants provide many positive effects on physiological state and productivity of farm animals and poultry, which it was proved by numerous studies (1-5). Today, there are many new non-conventional feeds available on the market, including those composed of dried meat and fish byproducts and low-quality feeds. Supplementing the diets of fur-bearing animals with antioxidants can prevent pathological state of fur animals caused by accumulation of toxic products of lipid degradation in cells of tissues and organs. Antioxidants have a number of other important functions: they refill essential reserves of natural antioxidants in the organism, provide metabolic balance of peroxidation products and vitamins, promote growth in young animals and milk production in lactating females, improve total resistance and reduce stress.

Stress is a specific condition of an organism that occurs in response to various adverse external factors; stress is peculiar to all animal species including low-domesticated fur-bearing animals (6, 7). Thus, removing kits from mothers is a strong stressor for kits. Stress causes death in lactating females and slow growth of kits separated from their mothers.

Nursing disease is most frequent in mink females exhausted by lactation who die in the second half of lactation or after removing kits from their mothers. The risk of nursing disease is particularly high in females whelped large litters of seven or more kits (8). Large fur animals, such as polar foxes, are less susceptible to nursing disease, although milk production in highly-productive dams and survival of their kits are the relevant problems in breeding polar foxes.

In the view of increasing human impact on fur-bearing animals, the main means to improve milk production of dams must be prevention of their stress along with carefully arranged processes of feeding and keeping

Emicidin (a derivative of 3-oxypyridine and succinic acid) has clearly expressed antioxidant properties. It binds free radicals, protects the structure of cell membranes from destructive influences and inhibits lipid peroxidation of biological membranes thereby reducing the intensity of oxidative processes in the organism. Emicidin has been confirmed as growth stimulator, immunostimulator and anti-stress medication for pets and farm animals (9).

Preliminary research on high-productive lactating mink females has shown a positive effect of emicidin on growth of suckling kits (relative body weight gain increased by 4-5%) and viability (survival increased by 16%) compared with intact animals (10).

The purpose of this work was studying productivity and viability of females along with survival of suckling kits in mink and polar fox against the use of water-soluble antioxidant emicidin.

Technique. The study was performed in the pedigree mink farm "Rodniki" and in the experimental farm of V.A. Afanasiyev Research Institute of Fur Animals and Rabbit Farming (Moscow province) in 2004-2009. The object of study were 217 females of sapphire mink aged 1 and 2 years. Groups of analogs were formed in April before whelping. Group I (control) consisted of intact females (90 individuals), groups II (52 individuals) and III (75 individuals) were given emicidin daily at a dose of, resp., 7 and 25 mg per individual. Feeding and keeping conditions were identical in all groups and corresponded to the adopted techniques of farming minks for pelt. Antioxidant emicidin was introduced to the diet in two courses: the first - during the whelping period (from April 26 to May 10), the second - before and during separating kits from mothers (4 to 13 June). The accounted parameters were a number of kits per female, survival of females and kits.

To assess the effect of emicidin on total protein content in early lactation (on the 2^{nd} and 20^{th} days), blood serum was investigated in dams safely whelped large litters (7 or more kits) from groups I and III. Blood was collected from tail vessels in four females who during 5 days post whelping had been parenterally injected with 1 ml saline (group I) and in 3 females similarly given 25 mg emicidin (1 ml) (group III). Total protein content in blood serum was determined refractometrically according to V.A. Berestov (11).

The anti-stress action of emicidin was studied in mink kits-analogs by live weight (control - 3 individuals from intact mothers of group I, test – 4 individuals from females of group III daily received 25mg/kg emicidin per orally), whose adrenal glands were weighted after slaughter.

The experiments with silver polar fox were performed on females of different ages and their offspring. Groups of analogs were formed considering age of females and date of mating: group I (control) – 10 intact females, group II – 9 females given emicidin per orally (50 mg per individual daily for 15 days starting in 5 days before the expected whelping). Feeding and keeping conditions corresponded to the adopted techniques of farming polar fox for pelt. The accounted parameters: milk productivity of females (assessed indirectly by body weight of kits aged 20 days), gender and number of kits in a litter per female at separation from mothers,

survival of kits and dams, body weight of 30-day-old kits and growth rate of kits. The kits were weighed every ten days from whelping to separation, precision of weighting within 10 g.

The obtained data were statistically processed in Microsoft Excel (12, 13).

Results. The studied groups of minks showed no significant differences in number of kits born alive and accounted, although group III showed a tendency to increase in number of accounted kits (Table 1).

1. Productivity and mortality of females, and litter survival in sapphire mink fed the diet supplemented with antioxidant emicidin (pedigree farm "Rodniki", Moscow province, 2004-2009).

Group	Number of females		Number of kits in a litter per female ($\bar{x} \pm S_x$)		Survival of kits by separation from mothers, %	Mortality of lactating females caused by nursing disease, %
	total	with large litter, %	born alive	accounted		
I	90	33,3	5,7±0,18	5,2±0,18	88,2	11,1
II	52	26,9	5,4±0,27	4,9±0,28	87,1	0
III	75	40,0	5,8±0,21	5,5±0,20	94,8	0

Note. Group I – control. Groups I and II – daily dose of emicidin, resp., 7 and 25 mg per animal.

2. Survival of females with large litter and their offspring in sapphire mink fed the diet supplemented with antioxidant emicidin (pedigree farm "Rodniki", Moscow province, 2004-2009).

Group	Number of females		Number of kits in a litter per female ($\bar{x} \pm S_x$)		Mortality of kits before the account, %	Survival of kits by separation from mothers, %	Mortality of lactating females caused by nursing disease,, %
	total	mature, %	born alive	accounted			
I	30	43,3	7,3±0,11	6,7±0,16	11,8	84,5	23,3
II	14	42,8	7,7±0,38	6,8±0,27	10,2	87,0	0
III	30	43,3	7,8±0,16	7,1±0,16	5,6	94,4	0

Note. See Table 1.

In group III, the maximum number females with large litter was recorded – 40,0 vs. 26,9 (group II) and 33,3% (group I) and the minimum mortality of kits (survival of kits by separation from mothers was 94,8% vs. , resp., 87,1 and 88,2%). Along with it, both experimental groups showed the absence of mortality in lactating dams, while 11,0% females of the control group died of nursing disease.

Emicidin significantly improved vitality of females with large litters (litter size 7 or more kits at whelping) and their offspring (Table 2). The number of kits born alive per female, as well as the number of accounted kits in groups II and III increased by an average of 0,4-0,5 and 0,1-0,4 individual, resp. Mortality of females after separation of kits was observed only in group I (Table 2).

3. Concentration (g %) **of total protein in the blood serum of sapphire mink females with large litter fed the diet supplemented with antioxidant emicidin (**pedigree farm "Rodniki", Moscow province, 2004-2009).

Group	Number of females	2nd day		20th day		Increase	
		$(\bar{x} \pm S_x)$	from-to	$(\bar{x} \pm S_x)$	from-to	absolute value, g%	relative value, %
I	4	6,3±0,98	4,5-8,8	7,7±0,40	6,8-8,8	1,4	18,2
III	3	4,8±0,88	3,5-6,5	7,6±0,51	6,6-8,6	2,8	36,8

Note. Females with large litters selected from groups I (control) and III were parenterally injected with 1 ml of, resp., saline and emicidin at a daily dose 25 mg per individual.

On the 2nd day after whelping, average level of total protein in blood serum of mink females was significantly lower than that on the 20th day of lactation (Table 3): 4,8-6,3 vs. 7,6-7,7 g% (norm 7,8 g%). On the 2nd day, this value in the test group was lower than in control; on the 20th day, these differences smoothed and the absolute increase amounted to, resp., 2,8 and 1,4 g%. Probably, the observed decline in level of total protein in the blood of mink females after whelping is physiologically normal symptom. Animals received emicidin exhibited more intense increase in total protein content in blood serum by the 20th day of lactation (relative to control), which can be the effect of this antioxidant. The obtained results are consistent with findings of other researchers about positive effects of antioxidants on protein synthesis in the liver and general physiological status of animals (14, 15).

Adrenal glands of kits (test and control - 7 and 6 samples, resp.) received similarly to their mothers 25 mg emicidin per individual daily, weighted 0,160 ± 0,0010 g ($p < 0,01$), or 80% of control (0,200 ± 0,0130 g). The exceeding value in control animals could be the indirect evident of stress and positive anti-stress effect of emicidin. According to reports of other authors, size of adrenal glands characterizes the quantity of produced steroids and functional activity of adrenal glands increases in response to stressful factors (16).

Productivity of polar fox females was most similar in control and test groups, although there was a tendency to its increase in group II (Table 4). In this group, survival of kits during the first 30 days of postnatal ontogenesis was higher than in control: 89,6 vs. 84,0%.

4. Productivity of females and survival of kits in silver fox fed the diet supplemented with antioxidant emicidin (experimental farm of V.A. Afanasiyev Research Institute of Fur Animals and Rabbit Farming, Moscow province, 2004-2009).

Group	Number of females	Date of mating (on average)	Productivity of females – $(\bar{x} \pm S_x)$	Number of kits born alive		Survival by the 20th day of lactation		
				males	females	Dams, %	Kits	
							number	%
I	10	March 2	11,4±0,84	44	37	100	68	84,0
II	9	March 3	12,0±1,10	42	54	100	86	89,6

Note. Group I – control, group II – average daily dose of emicidin 50 mg per individual.

To assess the effect of emicidin on milk production in polar fox females and development of kits, growth rate of young was compared in litters of similar size (Table 5) and in all kits of test and control groups.

In the test group, young animals grew much more intense then control kits till the age of 20 days. The absolute increase in bodyweight of kits of both genders reliably differed between these groups ($p < 0,001$), which indicates higher milk production in females of group II. By the 30-days age, inter-group differences in this parameter persisted, although reduced in males up to 2,9%, in females – to 2,2%, which could be the result of transition to a mixed type of feeding and decrease in share of mother's milk in daily diet.

Studying average live bodyweight and growth rate in all kits of polar fox whelped during the experiment (86 males and 91 females) by the age of 20 days, data for males and females were combined, because sexual dimorphism was very weak in the first month of life and the live weight of animals varied insignificantly.

By the 20-days age, average live weight of all kits in the control group was 362,0 ± 3,36, in test group - 380,1 ± 5,30 g ($p < 0,05$), while its absolute gain amounted to, resp., 287, 3 ± 4,50 and 304,2 ± 4,50 g ($p < 0,05$). By the 30th day of life, average daily increase in body weight of kits varied by periods of observation: in group I - from 15,5 to 31,5 g, in group II - from 16,5 to 32,4.

5. Dynamics of live weight of suckling kits from equalized litters of silver polar foxes fed the diet supplemented with antioxidant emicidin (experimental farm of V.A. Afanasiyev Research Institute of Fur Animals and Rabbit Farming, Moscow province, 2004-2009).

Parameter	2nd day	20th day	30th day
Males			
Obtained from females of group I (control)			
Number	30	29	29
Live weight, g ($\bar{x} \pm S_{\bar{x}}$)	79,7±0,93	362,0±5,42	649,3±10,62
Absolute increase in live weight, g ($\bar{x} \pm S_{\bar{x}}$)	–	283,4±5,43	569,6±10,80
Obtained from females of group II (test)			
Number	25	25	25
Live weight, g ($\bar{x} \pm S_{\bar{x}}$)	83,6±0,98	388,8±3,08*	669,6±10,84
Increase in live weight:			
absolute, g ($\bar{x} \pm S_{\bar{x}}$)	–	305,2±3,08*	586,0±10,98
relative to control, %		7,7	2,9
Females			
Obtained from females of group I (control)			
Number	26	26	26
Live weight, g ($\bar{x} \pm S_{\bar{x}}$)	76,5±1,45	349,2±4,11	646,2±11,50
Absolute increase in live weight, g ($\bar{x} \pm S_{\bar{x}}$)	–	272,7±3,92	569,6±11,30
Obtained from females of group II (test)			
Number	26	26	26
Live weight, g ($\bar{x} \pm S_{\bar{x}}$)	80,0±1,14	388,8±4,15*	662,3±8,11
Increase in live weight:			
absolute, g ($\bar{x} \pm S_{\bar{x}}$)	–	308,8±4,19*	582,3±8,63
relative to control, %		13,2	2,2

Note. See Table 4.
* $p < 0,001$.

Thus, emicidin has a positive impact on productivity of minks and polar foxes kept under the conditions of cage farming. This antioxidant prevents mortality of lactating females caused by nursing disease; it increases milk production in females of minks and polar foxes, and improves growth rate and vitality of suckling kits. To increase survival of lactating mink females, it is advisable to supplement the diet with emicidin at a daily dose of 25 mg/individual applied by courses of 15 and 10 days (during the whelping and not later than 5 days prior to separating kits from mothers). The best effect of emicidin was observed in females with big litters and their whelps. Recommended dose of emicidin for polar fox females - 50 mg per individual daily within 15 days, starting 5 days before whelping.

REFERENCES

1. Galochkin V.A., Boryaev G.I. and Koloskova E.M., Productivity and Immunity of Beef Calves against the Use of Selenopiran, in *Tez. mezhd. konf. "Aktual'nye problemy biologii v zhivotnovodstve"* (Abstracts of Papers Int. Conf. "Relevant Problems of Biology in Livestock Breeding"), Borovsk, 2000, pp. 275-276.
2. Belyaev V.I., Degtyarev D.V. and Mel'nikova T.E., Selecor in Veterinary, in *Soedineniya selena i zdorov'e* (Selenium Compounds and Health: Compilation of Sci. Works), Moscow, 2004, pp. 130-134.
3. Makarov M.I., Effects of Selecor on Survival and Growth of Young Farm Animals, in *Soedineniya selena i zdorov'e* (Selenium Compounds and Health: Compilation of Sci. Works), Moscow, 2004, pp. 185-187.
4. Konovalov A.M., Effects of Complex Antioxidant Feed Supplement on Productive Properties of Minks, in *Sb. nauch. tr. po materialam Mezhd. nauch.-prakt. konf. "Resursosberegayuschie priemy i sposoby povysheniya produktivnosti sel'skokhozyaistvennykh zhivotnykh"* (Papers of Int. Sci.-Pract. Congress "Efficient Approaches to Improve Productivity of Farm Animals"), Tver, 2010, pp. 101-103.
5. Kasanova N.R. and Mikhailova R.I., Antioxidant Endox in Ration of the Young Mink, *Uch. zap. Kasanskoi gosudarstvennoi akademii veterinarnoi meditsiny im. N.E. Baumana,* 2011, vol. 205, pp. 101-107.
6. Kovalenko Ya.R. and Sidorov M.A., Effects of Environmental Factors on Organism Resistance and Immunogenesis, *Vest. s.-kh. nauki,* 1978, no. 2, pp. 43-53.
7. Kavtarashvili A.Sh. and Kolokol'nikova T.N., Physiology and Productivity of Poultry under Stress, *S.-kh. biol.,* 2010, no. 4, pp. 25-37.
8. Slugin V.S., *Bolezni plotoyadnykh pushnykh zverei i ikh jetiologicheskaya svyaz' s patalogiei drugikh zhivotnykh i cheloveka* (Diseases of Fur Carnivores and Their Etiological Relation to Pathology of Other Animals and Man), Kirov, 2004, pp. 328-333.
9. Burkov V.I., Kolesnichenko I.S. and Mel'nichenko V.I., Antioxidant Emicidin in Veterinary Practice, in *Veterinarnyi antioxidant Jemitsidin* (Veterinary Antioxidant Emicidin: Compilation of Sci. Works), Moscow, 2007, pp. 10-12.
10. Sugrobova I.S., Demina T.M., Rastimechina O.V., Tinaeva E.A. and Melnichenko V.I., The Influence of Antioxidant Emicidin on Minks Physiological Condition and Reproduction, *Proc. VII International Scientific Congress in Fur Animal Production*, *SCIENTIFUR*, 2004, vol. 28, no. 3, pp. 222-224.
11. Berestov V.A., *Biokhimiya i morfologiya krovi pushnykh zverei* (Biochemistry and Blood Morphology of Fur-Bearing Animals), Petrozavodsk, 1971, pp. 201-206.
12. Plokhinsky N.A., *Rukovodstvo po biometrii dlya zootekhnikov* (Biometrics Manual for Zootechnicians), Moscow, 1969, pp. 7-53.
13. Lakin G.F., *Biometriya* (Biometry), Moscow, 1980, pp. 40-45.
14. Belyaev V.I., Degtyarev D.V. and Mel'nikova T.E., Effects of Selenium Compounds on Hematological and Biochemical Parameters of Blood of Farm Animals, in *Soedineniya selena i zdorov'e (*Selenium Compounds and Health: Compilation of Sci. Works), Moscow, 2004, pp.134-146.

15. Yapparov I.A., Hematological Indices in Young Mink after Addition to Their Ration of Promising Seleben Food Additive, *S.-kh. biol.,* 2010, no. 4, pp. 90-94.
16. Osadchuk L.V., Reproductive Endocrinology of Fur Animals the Family *Canidae*: Effects of Short-Term and Long-Term Anthropogenic Impact, *Extended Abstract of Doctoral Dissertation,* Novosibirsk, 2001, pp. 33-40.