Original Report

Our Experience in Spirulina Feeding to Minks in the Reproduction Period

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Most widely applied in biotechnology Spirulina platensis (nordst) Jeilt is a filiform waterplant. The walls of its cells have mucopolymer murein that is easily digested by the digestive juices of human and monogastric animals unlike, for example, unicellular green waterplant chlorella that has cellulose coat, it can digest only microflora of cicatrix of ruminant. More over, in the cellular wall of Spirulina there are alginates – unique biocompatible polyanionic (acid) polysaccharides, which are enable to free living organism of radionuclides and heavy elements like lead. In the powder of this waterplant there are: 60 – 70% of protein (containing all the indispensable amino acids in optimal proportion), 10 …20% easily digested saccharum and about 8% fat including all the important fatty acids (Table 1). Besides Spirulina is rich in macro and micro elements necessary for normal metabolisms in the organism. It is important to notice that it is concentrated there in optimal proportion all the natural vitamins (unlike pharmacy synthetic preparations) synthesised by living cells which effectiveness is much higher.

We examined Spirulina on three mink-farms as a microaddition to the food allowance in the reproduction period.

On the farm 1 the experiment was carried out since February 20th till June 5th 1998 according to the following scheme: the 1st group (dark-brown mink) – 50 mg of Spirulina per 1 head a day; the 2nd group (dark-brown mink) – 200 mg of Spirulina per 1 head a day; the 3^{d} group (sapphire mink) – 200 mg of Spirulina per 1 head a day. All the experimental groups were formed on the basis of three different departments before beginning of the experiment. The control animals in every group were the least animals in their own department. To show the experimental background of feeding we made a list of average contents of the food allowance for the period of February – May (Table 2).

During the experiment we took into account the copulation, the quantity of empty, abortive and unsuccessfully-whelped females, the quantity of the stillborn young, recovering of the young from the moment of birth till their leaving the mothers, the social outlet at a rate per 1 successfully whelped and copulated female. The given data are presented in Table 3. As it is shown, addition of Spirulina into the food allowance has no negative reproduction index. In group 3 the social outlet is 0.49 whelp or 11% more than in the control group; in group 2 – it is accordingly 0.66 and 13% more; and in group 1 – it is 0.11 and 2% more. In the first and in the second cases the difference is statistically reliable.

During the second experiment carried out on the other fur-farm Spirulina was given to the sapphire minks (615 females). They had a preparation as a prepared feed-mixture in the quantity of 200 mg per animal a day (since February 20t^{h} till March 31st), and from the 1st of April till the 1st of May – 400 mg a day.

During the whole experiment it was noticed that the animals ate this feed very well, they started copulating actively, the pregnancy and whelping were without any complications, infant-feeding was also very good.

The analysis of whelping results among females that took Spirulina were considerably less

unsuccessfully-whelped and abortive females (2.3%) than in the control group that didn't take Spirulina (9.2%) (Table 4). The experimental females had less stillborn young (0.9%) than in the control group (3.1%). As the result every female that had Spirulina gave birth at an average to 0.45 more whelps than the control one (Table 4). At the same time it was noticed no abscess of females widely spread out in the herd of minks, this shows the raise of resistance index of the animal (in this case to the staphilococcic infection)

On the third fur-farm the experiment began on the 15th of March and was over on the 15th of May 1999.

Before the beginning of the experiment there were formed experimental and control groups (102 females in each group) from the animals of standard dark-brown colour. The animals of the experimental group were given daily 200 mg of Spirulina powder per 1 head with the food allowance in the morning. The control minks were not given Spirulina. The animals were kept under the usual conditions and had their usual food allowance.

The results of whelping showed that in this case as well as in the previous ones the addition of Spirulina into the food allowance in the quantity of 200 mg per animal a day had a positive influence on the reproduction indices. The fertility of females in this group had an average index of 6.75 whelp per female, and in the control group it was 5.98. There were born 563 living whelps, and in the control group – 508 whelps.

The given results of the experiments testified only the positive influence of Spirulina on the organism of pregnant mink-females. The results showed the importance of Spirulina use in the fur-farming in the period of reproduction (from the 15th of January till the 1st of June). Spirulina can undoubtedly be used for fur-bearing animals during the other biological periods too. The research is going on.

The author would be very grateful to anyone who could share his experience of Spirulina use in the fur-farming.

Table 1. Biochemical contents of microwaterplant SPIRULINA PLATENSIS

Amino acids	%	Nutritive	%
Isoleucine	5.7	Protein	60-70
Leucine	8.7	Carbohydrate	10-20
Lysine	5.1	Fat	5
Methionine	2.6	Ash content	7
Phenylalanine	5.0	Cellulose	2
Threonine	5.4	Humidity	6
Tryptophan	1.5	Pigments	%
Valine	7.5	Carotinoid	0.22-0.34
Alanine	7.9	Chlorophyl	0.80-1.00
Aspartic acid	9.1	Phycocyanin	15.0-20.0
Cystein	0.9	Vitamins	mg/kg
Glutaminic acid	12.7	B-carotin (provitamin A)	1,700
Glysine	4.8	B 12	1.6
histidine	1.5	B 5	11
Proline	4.1	BC	0.5
serine	5.3	Inositol	350
Tyrosine	4.6	Niacin (PP)	118
Arginine	6.5	Pyridoxine (B 6)	3
Fatty acids	%	Tiamine (B1)	55
laurinic C 12	200	Tocopherol (E)	190
Myristic C 14	600	Minerals	mg/kg
Palmitic C 16	16,500-21,141	Calcium	1,180
Palmitoleinic C 16	1,490-2,035	Phosphorus	8,280
Palmitolinolic C 16	350	Iron	528
Heptanodecanic C 17	90-142	Sodium	34
Steaic C 18	0-353	Chlorine	4,200
Oleic C 18	1,970-3,009	Magnesium	1,663
Linolic C 18	10,920-13,784	Zinc	3
Gamma-linolic C 18	8,750-11,970	Potassium	14,353
Beta-linolic C 18	160-427	Copper	5
Others	7,000-699	Iodine	3
		Selenium	2
Others		%	
RNA		3.6	
DNA		0.8	
Assimilation of lysine		85	
Digestibility by pepsin		85	
Permitted mistake		2.4	
Use of pure protein		57	

Table 2 Monthly contents of mink food allowance in the period of Spirulina use

Index	Quantity, g/ 100 Kcal of metobolistic energy			
	February	March	April	May
Contents of food allowance:				
meagre beef	-	0.2	-	1.8
liver	2.8	3.6	3.6	3.3
blood	-	-	-	0.2
soft beef subproducts	20.1	21.2	19.7	18.2
freshly crushed bone	8.0	7.8	9.6	8.9
paltus	24.9	19.1	16.6	20.0
fish stuffing (cod)	8.2	10.0	10.7	12.7
unskimmed milk	8.2	8.9	11.1	8.0
meagre cottage cheese	0.1	0.8	3.2	3.9
melange	6.7	8.0	8.7	6.5
barley	9.1	8.8	8.6	8.7
pressed bakery yeast	-	0.3	0.9	0.6
natural fat	0.3	0.1	-	0.3
fish garbage	5.0	4.8	-	-
Digestible substances:				
protein	10.2	10.2	10.3	10.5
fat	3.8	3.8	3.7	3.6
carbohydrate	4.7	4.6	4.7	4.7

Table 3 The result of whelping of experimental and control minks

Group	The amount of females for April 1st 1998	From females left for the 1st of April			Born whelps at a rate per successfully whelped female		Dead whelps before the registration, %	Stillborn and dead whelps before the registration, %	Whelps per standard female
		empty	unsuccessfully whelped and abortive	dead	in the whole	living whelps			
1*	48 329	10.4 11.6	- 1.2	2.1 0.9	7.2 6.9	6.6 6.6	10.6 10.9	18.5 16.2	5.13 5.02
2	49 328	4.1 9.1	- -	- 2.7	7.3 7.5	6.6 6.8	12.5 15.1	22.8 24.0	5.65 4.99
3	46 343	- 5.5	4.3 1.7	2.2 1.5	6.5 6.4	6.4 6.0	16.4 17.1	18.6 23.2	4.96 4.47

* In each group the first line is the index of experimental minks, the second line – control minks

Table 4 The results of copulation and whelping of the sapphire minks that were given Spirulina and were not given it (1998)

Groups			Experimental	Control
Total number of females on the 1st of April 1998			615	1,567
From the females on the 1st of April 1998	empty	heads	78	180
		%	12.7	11.5
	abortive, unsuccessfully whelped	heads	14	144
		%	2.3	9.2
	dead	heads	3	8
		%	0.48	0.5
	females without offspring	heads	95	332
		%	15.4	21.2
	successfully whelped	heads	520	1,235
		%	84.6	78.8
Whelps of successfully whelped females	living		2,655	6,033
	dead		24	193
	total		2,679	6,226
	per 1 female	living	5.1	4.88
		living & dead	5.15	5.04
Dead whelps before the registration		heads	189	517
		%	7.1	8.3
Unsuccessfully whelped and dead before the registration		heads	213	710
		%	7.9	11.4
Registered whelps	quantity of registered whelps		2,442	5,516
	per successfully whelped female		4.7	4.47
	per permanent female		3.97	3.52

Physiological Changes in Mink (*Mustela Vison*) Dams Subjected to Weaning at Different Times during Lactation

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The influence of time of weaning on weight changes, and on hormone and electrolyte status in domestic mink (*Mustela vison*) dams raising ≥5 kits/litter was examined. The kits were weaned either at day 42 (group 1) or 49 (group 2) after birth. The dams were weighed and urine and blood were sampled from day 29 through day 56 after delivery. A considerable loss of dams' body weight constituting 6.3% in group 1 and 8.1% in group 2 was noticed the day after weaning pointing to a much reduced food consumption at the day of weaning. No changes in plasma aldosterone and no significant decrease in urinary sodium concentration were seen in dams after removal from their litters, whereas, irrespective of time of weaning, urinary sodium and chloride concentrations were halved a few days after weaning compared to the other group. The plasma cortisol concentration was high before and during weaning and was nearly halved one week after weaning implying less strain on the dams after weaning. It is concluded that the weaning period is a most vulnerable and stressful period to the dams irrespective of the actual time of weaning.

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Connection between Levels of Vitamin A, E and Activity of Erythrocyte Super-Oxidedismutase in Farm-Bred Mink and Polar Fox

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The aim of our investigation was to determine the levels and connection between the concentrations of some non-enzymatic antioxidants (vitamin E, and vitamin A) in the blood serum and CuZn-superoxidedismutase (SOD) in erythrocytes of healthy fur animals in relation to different period of the life cycle (mating, lactation, moulting and anestrus). Both vitamins and the enzyme displayed seasonal variation in mink and polar fox. Vitamin E and SOD activity changed similarly in both species while the changes of vitamin A differed. Direct correlation between SOD activity and vitamin A and E levels in polar fox in mating and lactation period was demonstrated. No differences where recorded in the vitamins and the SOD levels between young male and female minks in the moulting period and anestrus.

7th symposium on Vitamins and Additives in the Nourishment of Humans and Animals, 22 – 23 September, 1999, Jena/Thüringen, 2 figs., 1 table, 11 refs.

Indices of Thiamine Metabolism in Mink Blood in Pregnancy Period

T.N. Ilyina

The specific biochemistry indices of vitamin B_1 (thiamine) metabolism were studied during pregnancy period in the minks females blood in conditions of various provision by thiamine. The researchers have shown that the moderate vitamin deficiency was detected in the mink group with alimentary thiamine deficiency and the level of phisiologically active forms of thiamine decreased. the pregnancy period in all groups of minks was characterized by the change of thiamine metabolism at a level of vitamin phosphorylated form and enzymes of biotransformation as the reaction of the organism to the pressure connected with reproduction.

7th symposium on Vitamins and Additives in the Nourishment of Humans and Animals, 22 – 23 September, 1999, Jena/Thüringen, 2 figs., 1 table, 6 refs.