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Prophylaxis of Imune Deficiencies and Neonatal Diarrhea Syndrome Among Sucking Piglets by Administration of Organic Selenium (Sel-Plex)

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Abstract. In this study, it was investigated the action of the Sel-Plex product that was included in the combined forage for milking swine and sucker piglets. There were investigated 10 parturient swine and 101 piglets of 1-42 days.

It was concluded that the addition in basic ration of organic selenium has a benefic effect for swine growing and development that was expressed through:

- mortality and neonatal diarrhea reduction, weight increase with 2.5 kg for the swine treated with Sel-Plex ($P<0,05$);
- significant increase of the total number of T-lymphocytes ($P<0,001$), of the subpopulation of active T-lymphocytes ($P<0,01$) and of B-lymphocytes ($P<0,01$).

The postive action of the products is show at the level haemotopoiesis by increasing erythrocytes and hemoglobin ($P<0,01$) an dat the level of antioxidant system by reducing the level of DAM (Malonic dialdehyde) and increase of TAA (total antioxidant activity) in blood serum.

Key words: milking swine, neonatal diarrhea, profilaxy, sucking piglets, Sel-Plex.

INTRODUCTION

Currently, studies on birds, pigs and calves show that in the first days of life, in the first months respectively, diarrhea is the most significant cause of illness and treatments performed [13,6]. Animal health and performance depend on many factors and it is considered more and more that diet plays an essential role in maintaining health and preventing illness.

The main role of the gastrointestinal tract is to extract nutrients from the diet ingested, after which nutrients are absorbed into the bloodstream. Therefore, the gastrointestinal tract is principal interphase of the internal hostile environment and host organism metabolism.

Research conducted at the swine complexes and traditional farms in the Republic of Moldova have clearly shown that infant animals are in great danger of gastrointestinal tract illness following exposure to a variety of risks from pathogen germs invasion to toxins in alimentation, dangerous metabolites produced by normal intestinal microflora or due to the lack of a complex microflora and a functional system at full capacity [14,4].

In recent decades studies have shown that obtaining animal uncontaminated products with nitrates (nitrates) and nitrogen (nitrites), or presents of antibiotics residues represent one of the most important challenges in European Union countries.

Today it was necessary to find solutions to improve animal health by increasing their natural resistance to disease avoiding the use of antibiotics. Previous research conducted by us in industrial swine breeding conditions have certainly demonstrated that resulting from the

increased bioavailability and biological activity of organic selenium (Sel-Plex) than inorganic forms (sodium selenite), it is applied in practice Veterinary Medical our country [2,12,3].

It was found that supplementation of basic ration with organic selenium to pregnant sows and during piglet growth, besides improving animal performance, have a positive influence on their health.

In specialized literature we often find statements that affirm that the only way to combat antibiotic biopersistence is elaboration new products, more active than those previously elaborated. But the rush for an "ideal product" that would combat "supermicrobes" can not remove the "reality". So instead of "defeating" or reducing resistance to antibiotics it is necessary only to decrease the number of recommendations for antibiotics [10].

Currently, in the new European context, remarkable efforts are made to substitute antibiotics with natural growth promoters, such as acids, prebiotics, probiotics, feed enzymes. Their major effect is to correct and maintain healthy intestinal environment through which to potentiate the use of digestive food.

This paper is aimed at studying the action of Sel-Plex product included in the mixed fodder for milking swines and sucking piglets on clinical and paraclinical indicators of milking swines and sucking piglets in 1-42 days post-partum.

MATERIALS AND METHODS

The research was conducted on 10 multiparous milking swines with similar weights in 10-12 days before parturition and 101 piglets aged 1-42 days, belonging to tri-racial commercial hybrid (Large White, Landras, Diuroc), which were divided into two groups: control and experimental. Both groups of animals were kept inside the same technology equipped compartments entirely respecting the microclimate conditions, feeding, watering and free spaces.

Experimental and control groups were fed with mixed fodder for each animal category: milking swines in lactation period, sucking piglets, respecting the average structure and basic parameters recommended by the specialized literature. Basic ration of milking swines in the amount of 100 kg per-total included (in kg): corn - 32, barley – 19, grain - 19, sunflower meal - 5.5, soybean meal - 6.5, wheat bran - 13, calcium carbonate - 1.1, sodium chloride - 0.4, zoofort - 0.5. Recipe for mixed fodder used to feed sucking piglets in the amount of 100 kg per total included (in kg): corn - 41, wheat - 20, barley - 16, soybean meal - 12, vegetable fat - 1.9, calcium carbonate - 0.5, phosphate calcium - 0.9, sodium chloride - 0.2. zoofort - 1, bone-meat meal - 6,5.

Milking swines in both groups received daily 5 kg of mixed fodder for two times for each animal. The difference between groups was that in the fodder for the milking swines from the experimental group Sel-Plex was added at a rate of 1 kg / tone. The introduction of mixed fodder in sucking piglets forage was performed after the first week of life, which in the experimental group was supplemented with Sel-Plex in proportion of 1 g to 1 kg of mixed fodder.

The action of Sel-Plex on milking swines and sucking piglets was tested by assessment of the clinical state (body temperature, pulse, respiration, general condition, morbidity and mortality, feed consumption, daily surplus) and hematologic data (total number of leukocytes, leukocyte formula and classes of T and B lymphocytes, malonic dialdehyde content (DAM) and AAT (total antioxidant activity) in plasma and erythrocytes. Blood samples were taken in the 7th, 21st and 32nd day postpartum.

RESULTS AND DISCUSSIONS

Milking swines in both groups during the investigation were fed and watered, according to the established schedule. 10-12 days before parturition and during the 42 days postpartum, the basic daily ration of the animals from experimental group was supplemented with Sel-Plex (1 kg per tonne of mixed fodder), which corresponded to 5.76 kg of the product, which is an average consumption (table 1). Piglets in the experimental group after the first week of life together with mixed fodder daily received Sel-Plex in proportion 1g - 1kg of feed. Thus, milking swines in the experimental group from 10 to 12 days before parturition and piglets in this group after the first week of life received mixed fodder supplemented with Sel-Plex.

Table 1

Consumption of mixed fodder

Group	Milking swines daily consumption (kg/unit)	Piglets daily consumption (kg/unit)	Piglets total fodder consumption (10-42 days)
I (control)	5,64	0,365	11,68
II (experimental)	5,76	0,378	12,096

Data from Table 1 represent the consumption of combined fodder during the research. Both groups were healthy: food and water were consumed, animals were active and showed no deviations in behavior. However, in the experimental group an average daily consumption of fodder was with 0.12 kg more than in the control group.

Differences between the two groups of piglets were not significant, the total fodder consumption being by only 0.416 kg more than in the experimental group.

Table 2 presents the evolution of body weight of piglets from the control and experimental groups.

Table 2

Evolution of piglets body weight

Group	n	Statistic data	Body weight				
			Days 1-2	Day 13	Day 21	Day 32	Day 42
I (control)	50	M±m	1,22±0,04	2,8±0,076	5,1±0,16	6,75±0,25	10,3±0,91
		Lim	1,1-1,3	2,33-3,0	4,7-5,8	5,8-7,5	9,4-12,5
II (experimental)	51	M±m	1,23±0,10	3,013±0,162	5.3±0.08	7.6±0.957	12.8±1.04*
		Lim	1,2-1,25	2.41-3.75	5.3-7.37	6.25-9.5	10.8±15.2

* $P_{1,2}<0,05$

In the first day of life the piglets from both groups on average weighed 1.22 kg. At the age of 13 days piglets body weight consisted 2,8 ± 0,07 and 3,01 ±0,16 in the control group and experimental group accordingly. At the end of the third week piglets from the experimental which consumed Sel-Plex, had a daily surplus higher body mass daily, equal to 0.2 kg (P> 0.05). The trend of better growth was maintained during the 32-42 days that ended with a growth increase of 520 g / day in experimental group and 325 g / day in control group.

Average weight per capita was 10.3 ± 0.91 kg in control group and 12.8 ± 1.04 kg in the experimental group, the difference of 2.5 kg (24.2%) between the two groups being significant (P <0.05).

The positive effect of supplementation with organic selenium on growth and development of piglets is confirmed by leukocyte indices and in particular lymphocytes. Obtained indices are shown in Table 3.

The number of leukocytes in the first research (21 days after birth), consisted 7.95 ± 0.54 for animals in the control group and 9.28 ± I .33 for experimental group (P1, 2> 0.05). By the day 32 there was registered a significant increase (P1, 2 <0.05) of the total number of leukocytes that we consider as a positive effect of the refill of basic ration with Sel-Plex. Simultaneously, the dynamics of T-lymphocytes, which are key cells in the immune system expression, on the first survey (21 days postpartum) of piglets in the experimental group was expressed by a significant increase (P1, 2 <0.02). Also there was a fast growth to 25.4 ± 1.67% on the 21 day and to 36.0 ± 0.70% on the 32 day (P1, 2 <0.001).

According to data, received by Ştefan Ţurcanu and col. (2003) cellular immune status of piglets in ontogenesis is formed at a certain stage of physiological maturity of the body. As to the T-lymphocytes, a considerable increase up to 41.6% was observed by day 7 and 27.6% at the age of 3 weeks. An unessential increase of number of these cellules the authors observed by day 42 after birth, which consisted 13.4%.

Table 3

Dynamics of T and B lymphocytes in piglets blood

Group	Days	Lymphocytes (%)	T-total (%)	T-active (%)	T-helper (%)	T-supres. (%)	B-lymphocytes (%)
		M±m	M±m	M±m	M±m	M±m	M±m
I (control)	21	25,4±1,67	50,6±1,34	25,8±1,48	34,2±1,92	16,4±0,89	25,4±1,34
II (experim.)	21	31,8±2,77*	53,6±2,07	29,6±1,14 *	37,6±0,54	16,0±2,34	31,5±3,96*
I (control)	32	28,6±0,89	50,6±0,89	27,6±0,89	31,0±1,22	19,6±1,51	24,4±0,54
II (experim.)	32	36±0,70***	55,8±1,64	32,8±1,09**	39,8±1,3***	16,0±1,01	37,0±5,6**

* $P_{1,2}$<0,05; ** $P_{1,2}$<0,01; *** $P_{1,2}$<0,001

In Table 3 it can be noted that active T-lymphocytes subpopulation has essentialy increased, with a high degree of authenticity P1, 2 <0.05 in the first research and P1, 2 <0.01 in the second research (32 days after birth) for the piglets in the experimental group. The first survey (day 21) and the second one of the piglets in the experimental group showed that T-lymphocytes helpers subpopulation had a percentage of 37.6 ± 0.54 and 39.8 ± 1.30%,

accordingly. In the control group this index was 34.2 ± 1.92% on 21st day, and it was followed by a decrease of up to 31.0 ± 1.22% on the 32nd day after birth.

Regarding the dynamics of B-lymphocytes, during this study there was proved a significant increase (P1, 2 <0.05, day 21 and P1, 2 <0.01 on the 32nd day) at piglets from the experimental group.

In Table 4 there are presented data referring to the content of erythrocytes, quantity of hemoglobin and leukocytes at piglets in both groups.

Table 4

Hematological indices of piglets

INDICATORS	GROUP	STUDY					
		I Day 7			II Day 32i		
		n	M±n	P	n	M±n	P
Hemoglobin g/L	I – experimental	5	107,6±0,55	$P_{1,2}$	5	143,26±0,55	
	II - control	>0,05			5	122,9±0,56	P<0,001
		5	106,23±0,56				
Erythrocytes (x 10^{12}/L)	I – experimental	5	4,55±0,56	$P_{1,2}$	5	7,08±0,55	
	II - control	>0,05			5	5,41±0,56	P<0,05
		5	4,42±0,49				
Leukocytes (x 10^{9} / L)	I – experimental	5	7,76±0,49	$P_{1,2}$	5	6,98±0,56	
	II - control	>0,05			5	10,59±0,56	P<0,001
		5	20,72±0,56				

The first research showed similar data which are statistically unreliable (P> 0.05). It is necessary to mention that the second research showed that the number of erythrocytes of the amount of hemoglobin has essentially increased at the piglets in the experimental group (P <0.05) and (P <0.001).

The amount of leucocytes at piglets in the experimental group was stable and consisted 7.76 + 0.49 x 10^9/L initially and 6.98 + 0.55 x 109 / L at the following assessment. The piglets in the control group suffered a decrease of number of leukocytes from 20,72 + 0,56 at the first assessment to 10,59 + 0,58 x 10^9/L at the second one.

Table 5 presents data on Malonic dialdehyde content (DAM) determined in plasma and erythrocytes.

Table 5

Enzymatic components of antioxidant system of piglets following administration of Sel-Plex by milking swines

INDICATORS	GROUP	STUDY			
		I Day 7		II Day 32	
		n	M±n	n	M±n
DAM in plasma (nmol/L)	I – experimental	5	11,926±	5	9,57±
	II - control	5	14,205±	5	14,296±
DAM in erythrocytes (nmol/L)	I – experimental	5	0,87±0,01	5	0,75±0,016
	II - control	5	0,89±0,10	5	0,82±002
Antioxidative activity in plasma (%)	I – experimental	5	66,43±3,34	5	67,7±2,44
	II - control	5	63,43±3,21	5	47,29±3,12
AAT in erythrocytes (%)	I – experimental	5	134,85±12,4	5	126,09±9,31
	II - control	5	127,74±11,02	5	100,77±4,95

During lipid metabolic processes, particularly through oxidation, the body accumulates a number of intermediate compounds and final products of their peroxidation, among which is the DAM. Data show that in the blood of piglets in the experimental group there was marked a tendency of decreasing concentration of DAM in plasma (P <0.02) and erythrocytes (P <0.05) compared to piglets from the control group, which is characteristic in case of reduction of lipid peroxidation processes.

Plasma total antioxidant activity is an index that reflects the ability of blood plasma to inhibit induced oxidation process of a model system. AAT shows us therefore that the summary content of compounds in blood plasma with antioxidative properties. Table 3 shows that AAT in plasma of animals from the experimental group has a tendency to be maintained at the level of 66.43 $\pm$ 3.34% at the first survey (the 7th day of piglets life) and 77.2 $\pm$ 2 , 44% at the end of research (32nd day of the piglets life), while among the animals from the second control group, this index essentially decreased from 63,43 $\pm$ 3,21% to 47,29 $\pm$ 3,12%.

AAT in erythrocytes on the 7th day after birth in the control group initially was 127,74 $\pm$ 11,02% which at the end of research (day 32) reached 100,77$\pm$ 4,95%;, in the experimental group it was 134,85 $\pm$ 12,9% and decreased to 126.09%.

Given that research has been conducted on young animals, i.e in the development, the dynamics of AAT in plasma can be interpreted as a consequence of age particularities.

The results clearly demonstrate a beneficial effect of organic selenium (Sel-Plex) on clinical indices, hematologics and antioxidant system.

The data presented in Table 6 represent the percentage of the morbidity of piglets in both groups during the period from birth until weaning.

Table 6

Morbidity and mortality of sucking piglets

Group	n	Diarrhea suffering (%)	Died		Survived (%)
			due to diarrhea (%)	Due to other infections (%)	
I control	50	22	12	6	82
II experimental	51	9,8	3,92	3,92	92,2

It was found a higher percentage of morbidity among piglets from the control group and it constituted 22%, compared to 9.8% in the experimental group. Lethality percentage was 18% and 7.8% accordingly. At the age of 42 days there survived 82% of piglets from the control group and 92.2% in II-experimental group, the ration of which was supplemented with selenium of organic origin.

V. Cociu et.al (2005) communicates that in the R.of Moldova there are two essential trace elements - Iodine and Selenium are not included in the premixes composition. Here is meant that the deficiency of these minerals is usually manifested latently affecting animal productivity and achieved product quality. These indices, however, in the subsisting village farms are not always taken into account.

Deficit of a single element in the organism such as Selenium, which is necessary in insignificant amounts (0.5 to 0.7 ppm) causes a variety of morbid states in various animal species [1]. Rations containing large amounts of unsaturated fat which are lacking protein as well, particularly those in sulfur amino acids, are factors that cause disease [8].

P.F. Surai, 2007, communicates that the content of selenium in foddle depends on region of cultivation, soil and a number of other factors. N. Abraham (1992) states that the

content of selenium in foddle depends to a large extent on the amount of selenium in the soil, there being a close soil-plant-animal relation.

In recent years several studies have been devoted to testing Sel-Plex product action in maintaining the antioxidant-prooxidant balance in the digestive tract, blood and in prevention of the decline of productive and reproductive performance of milking swines and their offspring (11.2.12).

Our results allow us to conclude that the inclusion in the basic ration of Sel-Plex product had a positive impact on the general condition of milking swines and their offspring on, being manifested by a lower morbidity and mortality, so that the percentage of viability consisted 92.2% for the experimental group and 82% for the control group.

CONCLUSIONS

- Sel-Plex administered with food in proportion of 1kg per ton has a positive effect on reproductive indices (total number of piglets born alive, the birth weight, sucking piglets viability).
- Mortality losses in the experimental group from birth to weaning were lower (7.8% of actual) than in the control group (18%).
- Body weight of 42 days old piglets constituted alcătuit 10,3±0,91 kg and 12,8±1,04 kg in experimental and control groups respectively, the difference between the two groups being significant (P1, 2 <0.05) .
- Sel-Plex has a positive impact on the immune system, which is manifested by a significant increase (P1, 2 <0.05) of the total number of leukocytes, of total T-lymphocytes (P1, 2 <0.001 of active lymphocyte subpopulations (P1, 2 <0.01). Dynamics of B-lymphocyte growth was manifested by authentic (P1, 2 <0.05) and day 21 (P1, 2 <0.01) in the 32-day piglets in the experimental group.
- Sel-Plex exercises an antioxidant effect at enzyme and hematopoietic level on the body, which is manifested by the significant increase of the number of erythrocytes and amount of hemoglobin (P <0.05), the reduction of the DAM level (Dealdehid Malonic) in blood plasma, the significant increase (P <0.01) of AAT (total antioxidant activity in blood serum.
- The results show that it is time to replace sources of organic and inorganic selenium with organic sources such as the product enriched with selenium, Sel-Plex.

REFERENCES

1. Baker D.S., Ahola I.K., Birus P.D., Eugle T.E. Trace mineral metabolism in ruminant: impact production, reproduction and the enviroment. In: Nutritional Biothechnology in the Feed and Food indastries. Proceedinos of Alltech is Nemeteenth Anual Sympozous., 2003, p.275-289.
2. Balanescu S., Holban D., Voinițchi E. Acţiunea produsului Sel-Plex asupra puilor de găină. În: Ştiinţa Agricolă, UASM, Chişinău, 2005, nr.2, p.59-64.
3. Balanescu S., Popovici M. Statutul Seleniului în furaje colectate din zona de nord şi centru al R. Moldova. În: Lucrări ştiinţifice, UASM, Chişinău, 2008, vol.19 (Medicină Veterinară), p.72-75.
4. Barza H., Popovici A., Coman Sofia. 2000 Intervenţii curative-profilactice în gastroenteropatiile suinelor. Analele Universităţii Spiru Haret. Seria Medicina Veterinară.anul 1. nr. 1 Bucureşti. p.169-179.

5. Cociu V., Coşman S., Holban D., Balanescu S. Research on the hight againtst oligomineraloses of bovins. In: Buletinul Universităţii de Ştiinţe agricole şi Medicină Veterinară, Cluj-Napoca, seria Medicină Veterinară, vol.62, 2005, p.369-374.
6. Spring, Peter. Cre;terea reyisten'ei antiinfec'ioase la nivel intestinl. Rolul glicobiologiei]n optimiyarea s[n[t[,ii intestinale. Viitorul promotorilor de cre;tere. European Lector Tour, p.89/102.
7. Peter F.Surai. Selenium in Nutrition and Health Hottingham University Press., 2007, p.974.
8. Surai K.P. , Surai P.F., Speake D.K. Antioxidant-prooxidant balance in the intestine. Food for thoregh. Nutrition Genomies and Functional Foods, vol.1, 2003, p.51-57.
9. Ţurcan S., Farguţu N. 2003. Cercetări privind formarea statusului imunologic celular la purcei în antogeneză. Lucrări ştiinţifice. Vol. 11. Chişinău. P.75-80.
10. Zoltan Peter, Voinițchi E., Beţivu I, Balanescu S. Situaţia actuală şi tendinţele dezvoltării sectorului avicol din R. Moldova la nivel internaţional, Chişinău, 2011, 116 p
11. Баланеску С. Использование препарата Sel-Plex для профилактики иммунодефицитных состоянии у поросят-сосунов. Материалы международной научно-практической конференции / Использование молодых ученых в решении проблем животноводства. Витебск,2001, с. 6.
12. Баланеску С. Использование препарата Sel-Plex для профилактики гастроэнтеритов у поросят-сосунов. В: Научно-практический жкрнал. Ученые записки учреждения образования «Витебская ордена «Знак почета». Государственная академия Ветеринарной Медицины». Том 4, выпуск 1, январь-июнь,2007, с. 13-16.
13. Баланеску С., Парий Б. Сравнилеьная эффективность физиологически активных препаратов при лечении поросят больных интоксикационным гастроэнтеритом. Физиологические основы профилактики и терапии незаразных болезней животных. Сб. науч. Тр. Кишинев, 1985, с. 19-27.
14. Голбан Д., Баланеску С., Доника Г. 1989. Молозивный токсикоз поросят. Труды «Болезни ягнят и поросят», Целиноград, С.70-76