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Supplementation of the diet with chelated selenium yeast and vitamin E and their effect on reproductive performance of farmed female American mink (*Neovison vison*)

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Selenium is one of the micronutrients regarded as necessary for the correct functioning of the body. It occurs in all tissues, permanently incorporated into their protein structures. As a component of selenium proteins, it has both structural and enzymatic function. Glutathione peroxidase enzyme (GSH-Px), one of the elements of the antioxidant mechanism, was one of the first proteins in which the presence of selenium in the form of a covalent combination with selenocysteine was found. The effect of selenium in the body is closely related to vitamin E, the synergy of which enhanced its action (Flohé et al., 1973). Therefore, the role of an antioxidant was assigned to selenium, which together with vitamin E protects the cell membranes from the harmful effects of reactive oxygen species (McKenzie et al., 2002). High GSH-Px activity was found in the organs of the reproductive system.

Selenium was considered to be toxic element only for a very long time. This view was reinforced by studies conducted in the 1930s, which demonstrated that animals from some regions of the globe (North and South America, Australia, South America, Africa, Asia) suffered from the so-called alkali disease and blind staggers, resulting in acute or chronic poisoning with selenium (Rosenfeld, 1964). Only in the 1960s. its important functions in the body were discovered, and today this element is listed among the microelements of vital importance for living organisms.

Selenium deficiency in the feeding dose for farm animals causes serious disorders in the reproduction, the effect of which include e.g. fertility disorders, fetal deaths, miscarriages and stillbirths, as well as the occurrence of perinatal complications, for example, placenta retention. Supplementing this deficiency increases the number of normal births. In addition, muscular dystrophy, food-related liver degeneration, an increase in the incidence of cases of disseminated liver necrosis, sudden cardiac death, diarrhea and abnormalities in hard tissue formation: teeth, hairs, feathers (Bostedt & Schramel, 1990; McGuire et al., 1993; Grela & Sembratowicz, 1997) have been observed in animals with selenium deficiency. Also in fur animals, selenium plays a significant role because of its beneficial effects on reproduction, improvement of the general condition and animal immunity, which translates into a reduction in the disease development, and thus affects the profitability of breeding (Hanusova et al., 2000; Flohé, 2007). Additionally, the scarcity of certain mineral compounds – including selenium – in the diet has a negative impact on the quality of the fur and its color (Lohi & Jensen, 1991; Hanusova et al., 2000).

Selenium is taken up from the food in the form of inorganic compounds, such as lenins (Me_2SeO_3) or selenates (Me_2SeO_4) or organic compounds such as selenomethionine (SeMet) and selenocysteine (SeCys). Selenium found in organic compounds is best absorbed (90–95%), and its bioavailability from inorganic connections is smaller (Mahima et al., 2012).

An interesting method used by selected companies to improve the absorption of elements is the formation of chelated preparations, including selenium yeast chelate. The history of chelation dates back to 1913, when Swiss chemist Alfred Werner developed a method of binding metals by organic molecules which later became the basis of the modern chemical chelation method. In chelates, the mineral or metal is connected by a chemical bond with a chelating substance, thus forming forms of well-absorbed compounds, selenium in this case. Chelates have two functions: they deliver minerals and metals to the body, and additionally they collect toxins from the body, e.g. heavy metals. The most well-known chelates found in nature include: hemoglobin (found in blood, it binds and releases oxygen) and chlorophyll – hemoglobin's plant equivalent. Thanks to their specific structure and high bioavailability, chelates can be a perfect complement to minerals in animals with high productivity (Grela et al., 2005).

The intensification of production, which has been carried out for many years, resulted in increased animal demand for supplied nutrients. Having considered that, a well-balanced diet should not only include the basic nutrients, but also all kinds of mineral and vitamin supplements. Literature, supported by the results of many years of research carried out over the years, indicates the beneficial effect of dietary supplementation with selected mineral and vitamin supplements, including selenium, on the correct animal body functions.

Due to this, the aim of the experiment was to determine the effect on dietary parameters of American mink females in case of diet supplementation with the preparation of inactive *Saccharomyces cerevisiae* yeasts chelated with selenium and vitamin E.

Material and methods

The experiment was carried out on a mink farm located in the West Pomeranian Voivodeship. The animals on the farm were maintained in universal double-row complexes and fed, a33ccording to generally accepted standards, with semi-fluid feed based on chicken and fish meal.

The basic feed used on the farm contained mineral and vitamin supplements with selenium in an inorganic form. The research material consisted of 2140 female American mink, colored "pearl" variety (aged 1 and 2 years), divided into three research groups.

Group I – the selenium in chelated form was used for basic feed (the yeasts were the chelate substance, the preparation was made through permanent combination of chelate with inactive yeast cells) (725 females).

Group II – supplementation of vitamin E was used for basic feed (793 females).

Group III – basic feed only (622 females).

After completing the whelping, the effect of individual feed additives on female fertility and the number of born kits was analyzed.

Results and discussion

As a result of the conducted study, it was found that in the first study group, which constituted 725 females supplemented with a feed additive in the form of selenium chelate, 681 females were whelped, which constituted 93.9% of all females of this group. The highest fertility rate was recorded in group II (95.2%), while in the third group this parameter was at the level of 93.4%. It should be emphasized that these results presented a high level.

Table 1. Some reproductive parameters of American mink in different study groups

Group	Number of females	Number of whelping females		Number of non-whelping females		Number of kits born	Average litter size
		head	%	head	%		
I	725	681	93.9	44	6.1	4208	6.18 b
II.	793	755	95.2	38	4.8 a	4484	5.93
III	622	581	93.4	41	6.6 a	3218	5.54 b

Values marked with same letters in columns within the parameters differ significantly at 0.05.

As can be seen from Table 1, females of group I were characterized by the highest fertility rate; in this case, the average number of born kits per one female is 6.18. The lowest fertility, at the level of 5.54 was recorded for group III females receiving the basic feed dose.

It should be added that the obtained fertility rates were at a high level compared to those recorded in other studies (Seremak et al., 2011; Socha et al., 2003).

Recapitulation

Based on the obtained results, it can be concluded that the supplementation of the American mink diet with an additive of selenium-chelated inactive *Saccharomyces cerevisiae* yeasts, as well as with vitamin E, has a positive effect on the number of kits born to a female. It should be also notet that chelates – apart from good micro-nutrient absorption – also have the advantage of no toxicity, which is important considering the possibility of micronutrient overdosing, and its health-related consequences.

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SUPPLEMENTATION OF THE DIET WITH CHELATED SELENIUM YEAST AND VITAMIN E AND THEIR EFFECT ON REPRODUCTIVE PERFORMANCE OF FARMED FEMALE AMERICAN MINK *(NEOVISON VISON)*

Summary

The intensification of production has increased the nutrient requirement of animals. Therefore, the objective of the study was to determine the effect of dietary supplementation of inactive *Saccharomyces cerevisiae* yeast chelated with selenium and of vitamin E on reproductive parameters of female American mink. It is concluded from the results obtained that the dietary supplementation of American mink diets with *Saccharomyces cerevisiae* yeast chelated with selenium and of vitamin E has a beneficial effect on the number of kits born per female.

Key words: American mink, reproduction, selenium, vitamin E

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