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EVALUATION OF THE NUTRITIONAL QUALITY OF VEAL SUPPLEMENTED WITH ORGANIC SELENIUM AND ITS EFFECT ON SELENIUM STATUS OF PEOPLE

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ABSTRACT

In the first stage of our research we found out a higher content of selenium in the meat of calves of experimental group (with added the organic form of selenium to the feed mixture) compared to control group (fed without organic form of selenium). In the second stage of our research we focused on monitoring the impact of selenium enriched veal meat and on selenium concentration in blood serum and the selected biochemical parameters of lipid spectrum of the experimental group of volunteers. Ten people who were participating in the research were at the age range between 29 – 56 years. All the volunteers consumed veal meat enriched with organic selenium for 4 weeks. Before starting the experiment we took venous blood of the volunteers and this blood was considered as a control sample of selenium in blood serum of the experimental group. Selenium concentration in blood serum of the examined group was determined by an average of 58.31 ±5.36 μg.L^{-1} and none of them reached the optimal level of selenium. Consequently, we carried out the additional blood sampling after 2 and 4 weeks of the consumption of veal meat. There was registered a slight increasing of selenium status, whereas after the finishing the consumption, we determined the average selenium concentration in blood serum of the experimental group 60.73 ±4.05 μg.L^{-1}. The evaluation of lipid profile of the experimental group showed (after input blood sampling) higher values of total cholesterol level and lower levels of HDL cholesterol. This fact shows the higher risk of starting the cardiovascular diseases. Reported research results didn't show statistically significant changes of blood lipid spectrum of the experimental group. We concluded that the consumption of supplemented veal meat can positively affect the level of selenium in our body and thereby increase it can increase the protective effect against the influence of free radicals.

Keywords: organic selenium; supplementation of veal; veal quality; selenium status; lipid profile of poeple

INTRODUCTION

The importance of selenium was proved in 1957, when the presence of selenium was found in so-called factor 3 which is the prevention against necrosis in the liver of the rats. In 1976 many experiments showed obvious necessity of selenium for people, in spite of that, it was pointed on its negative effects in the 1940s of last century. Nowadays, an interest about selenium and its role and significance in food considerably increased because many researches point out the importance of this element for the health of people. In the past, we only knew its toxic effect on the organism but present studies focus on, that a lack of selenium can cause cardiovascular diseases and also oncogenous diseases **(Hegedus et al., 2007)**. Selenium belongs to the important antioxidants which improve defensive power of the organism and these antioxidants also protect some elements of food, mainly vitamins and food fats against unwilling oxidation. It is important essential mineral element which is important for the health of people and animals. The selenium together with the vitamin E positive influence on the technological characteristics (properties) of meat because of its antioxidants features **(Pavlata et al., 2002**). In food of animal origin the concentration of selenium is given by the nourishment of the animal or its content in feedstuff **(Lyons et al., 2007)**. According to several publications, the use of organic selenium in animal nutrition and consumption the products of these animals are accessible source of selenium in the human diet **(Fisinin et al., 2009)**. Mainly at red meat in this regard refers **Wiliams (2007)**, however probably its concentration is of the heavily influenced by nutrition. **Marounek et al., (2006)** in the experiment found out differences in the content of selenium in veal. In group experimental group (with selenium yeast) was content Se higher compared to the control group. In the different parts of world there are also different intake of selenium in people and animals. It is also regarded according to the selenium status, it means saturation of the organism by this microelement and its combinations. Selenium status depends on different factors such as absorption, food intake, excretion according to biological accessibility **(Ermidou-Pollete et al., 2005)**. The concentrations of selenium in blood plasma/serum of people in the European countries are in the scale between 60 – 111 μg.L^{-1}. Selenium status in Slovak population is in the low limits of this scale **(Combs, 2001)**. **Thomson (2004)** confirmed starting concentration of selenium in blood serum for protective effect against the influence of free radicals 100 - 200 μg.L^{-1}. Selenium has a strong antioxidant activity and participates in the system of conversion of aggressive oxidant products, transforms intracellular free radicals into less reactive or neutral elements **(Elasal et al., 2014)**. Increased intake of selenium decreases the risk of starting the cancer and

softens the progress of other pathological processes causing oxidative stress and an irritation **(Lukáč, 2007)**. Sufficient supplementation with selenium of the animals is important not only because of good health state and utility of the animals, but it can be increased in human population by higher content of selenium in the products. The features of organic form of selenium allow an effective transfer in foodweb. It is used in the world practise in modern approach of the production of so-called functional articles of food. The animal products can belong to this category and they are enriched by organic selenium **(Lagin et al., 2009)**.

The aim of work was evaluation physical and chemical patrameters of veal enriched of organic selenium and its effect on selenium status of people.

MATERIAL AND METHODOLOGY

Two groups of calves (10 +10 heads) to 150 kg of the body weight (at the same time, the same age and rearing condition) were reared for the purposes of the experiment. The difference between the groups was in the feeding after weaning to the end of experiment. The organic form of selenium was added to the feed mixture in the experimental group (selenium content per 1 kg of mixture was: E8 form 1.12 mg and 3b8.10 form 0.8 mg). The control group was fed without organic form of selenium.

There was analysed an effect of supplementation of veal meat on selenium status and we also examined chosen biochemical parameters of lipid spectrum of the consumers. In the experiment was selected group of people. People who participated in the research were represented by 5 women and 5 men at the age scale between 29 – 56 years, with the average age of the experimental group which was 46.3 ±8.34 years. The experimental group consisted of the healthy volunteers, without any healthy problems and pathologic changes in basic biochemical parameters in blood. All the members of the experimental group didn't use supplements before starting the clinical study, and not also during the realization of the research.

Referring to our experiment which was focused on monitoring the impact of supplementation of selenium to the feeding mixture for the calves, we gain meat from the MLT in the experimental groups of the animals. Meat which was enriched by selenium was canned in 1% salt brine in the airtight cans and sterilised them in the thermostatic pot.

Meat was sterilised for 3 hours and the temperature was 100 °C. The consumption of veal meat was done three times a week during 28 days individually. The amount of meat was 130 g.

The biochemical examination of blood tests before starting the consumption was carried out. The 1st blood sampling was determined total cholesterol level, a level of HDL-cholesterol, LDL-cholesterol level, triglycerides and concentration of selenium in blood of the experimental group of the volunteers. We did the 2nd (repeated) blood taking after two weeks of consumption of supplemented veal meat and the last (the 3rd) blood taking was done immediately after finishing the consumption. The samples of blood serum were stored in the fridge on the temperature 80 °C after their separation and consequently after de-freezing them we specified (estimated) biochemical parameters of blood serum of the experimental group.

Biochemical parameters of blood were defined by the estimation analyser (estimation device) Biolis 24i premium (Tokyo Boeki Medisys, Japan). Total cholesterol, triglycerides were determined by calorimetric method fy Randox CHOD-PAP and HDL cholesterol level, LDL cholesterol level were defined by direct method clearance fy Randox.

The atomic absorptive spectrometer made by the company Perkin-Elmer 4100ZL (Norwalk, CT, USA) was used for defining the concentration of selenium. This spectrometer has cross heating electrothermic atomizer (THGA, Part No.B050-4033). And this spectrometer was also used in connection with automatic feeder machine with the samples AS-70. We used corrector of Zemanovsky for the correction of the background. EDL (System 2) for Se (Perkin-Elmer) was used as a source of radiation, which was working in 260 mA. The wave length was 196.0 nm and width of the gap (crack) was 2.0 nm.

We evaluated gained data from the experiments by adequate biostatistical methods using applicative programmes. Statistical data processing was realised by algorithms which were found in the applications SAS in 9 and also by statistical functions in MS Excel. Data processing was also done by one factor analysis of dispersion using ANOVA.

RESULTS AND DISCUSSION

The Table 1 showes the higher content of selenium in the meat of calves of experimental group compared to control group. There was not found significant differences in the chemical composition between groups. Ing the meat of the control group was higher decrease in pH levels at 24 hours after slaughter. **Marounek et al., (2006)** in the experiment found out higher Se content also in the control of the experimental group (with the addition selenium yeast) and also in the control group, compared with our results.

By the determined significant differences in selenium

Table 1 The physical and chemical patrameters and selenium content of *m. longissimus thoracis et lumborum* (MLT).

Parameters	Control group $\bar{x}$ ±SD	Experimental group $\bar{x}$ ±SD	Significance
Se content (mg.kg^{-1})	0.064 ±0.003	0.101 ±0.006	+++
Protein content (g.100g^{-1})	22.510 ±0.467	22.880 ±0.798	-
IMF content (g.100g^{-1})	1.703 ±0.358	1.893 ±0.148	-
Water content (g.100g^{-1})	74.707 ±0.682	74.420 ±0.349	-
pH_1	6.313 ±0.152	6.377 ±0.037	-
pH_{24}	6.033 ±0.029	6.173 ±0.065	+

content between the control and the experimental group we can perform the second stage of the experiment. The veal from the experimental group was used in the second stage.

The impact of supplementation of veal meat with organic selenium on the concentration of selenium in blood of the experimental group

In the second stage of our research was focused on monitoring of veal meat enriched with organic selenium and its influence on the concentration of selenium in blood serum in the experimental group and we also examined chosen biochemical parameters of lipid spectrum of consumers.

The volunteers in the nutritional protocols where they wrote what kind of food they ate during the whole day. The nutritional software Alimenta version 4.3e was used to intake of selenium from food of the volunteers (the experimental group) during the days when they didn't eat veal meat enriched by selenium. Average daily taking of selenium in the group of ten people we registered an amount 131.34 μg.day^{-1}. The selenium intake of veal meat supplemented was 10 μg.100g^{-1}. According to The World Health Organization taking selenium per day moves between 50 to 200 μg.day^{-1} **(Rayman, 2012)**.

The first blood sampling in the experimental group before starting our research and we noticed that average concentration of selenium was 58.31 ±5.36 μg.L^{-1}, and we can say that none of the volunteers had an optimal level of the concentration of selenium in blood. The second blood sampling we did after two weeks of consumption of supplemented veal meat with organic selenium and we marked slight increasing of selenium in blood serum in average 59.99 ±4.16 μg.L^{-1}. The last blood taking was done after finishing the consumption of veal meat enriched by selenium. It was after four weeks and was also noticed increasing of the concentration of selenium in blood in average 60.73 ±4.05 μg.L^{-1}. The results didn't show evidentiary changes in concentration of selenium in blood serum of the experimental group. The results were made after short time of consuming of veal meat with selenium content. The particular concentrations of selenium in blood are shown in the figure 1 and table 2.

According to determined concentrations of selenium in blood is probably that the interval of the concentrations in monitored group, which is 49.6 – 67.8 μg.L^{-1}, is comparable with the results of the last study which was done in Slovakia by **Maďarič and Karabová (1998)**.

They determined concentrations of selenium in blood plasma of 1056 chosen people who were examined and they were from different parts of Slovakia. This concentration was in the range 46 – 77 μg.L^{-1}. Another similar research was done in Czech Republic by **Střitecká et al. (2009)**. In this study was experimental group of 386 healthy people and the concentration of selenium in their blood was in the range 52.9 – 73.43 μg.L^{-1}. This study also approved slight deficiency of selenium concentration similarly than it was shown in our experiment. Low levels of selenium in blood which were shown in above mentioned studies are connected with low saturation of selenium in soil.

The influence of supplementation of veal meat enriched with organic selenium on lipid profile of the experimental group

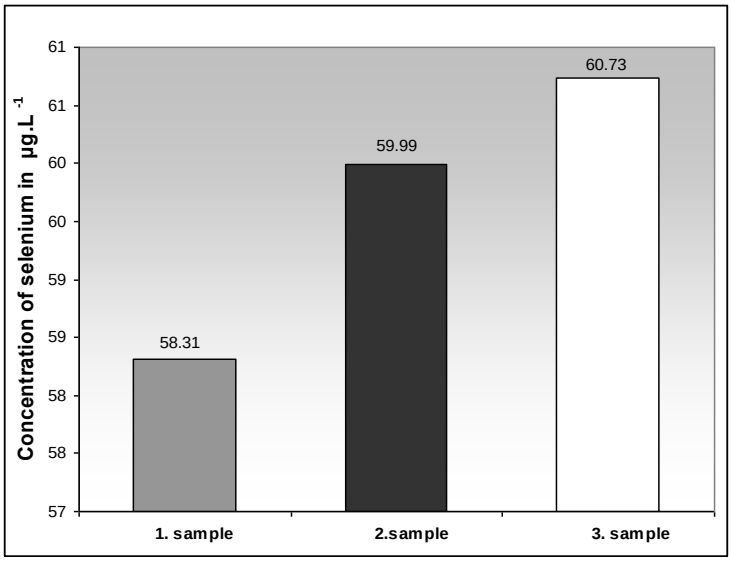

Figure 1 Comparing the concentration of selenium in blood serum of the experimental group during the realisation of the research.

Table 2 Selenium concentration in human blood serum.

Sex	1.sample μg.L^{-1}			2. sample μg.L^{-1}			3. sample μg.L^{-1}		
	$\bar{x}$	s	min-max	$\bar{x}$	s	min-max	$\bar{x}$	s	min-max
Men	61.28	3.72	58.8 – 67.8	62.30	2.75	58.8-65.4	60.88	3.91	56.7 – 66.9
Women	55.34	5.37	49.6 – 62.2	57.68	4.25	54.5-63.4	60.58	4.64	55.4 – 65.5
Total	58.31	5.36	49.6 – 67.8	59.99	4.16	54.5-65.4	60.73	4.05	55.4 – 66.9

significance $p \geq 0.05$.

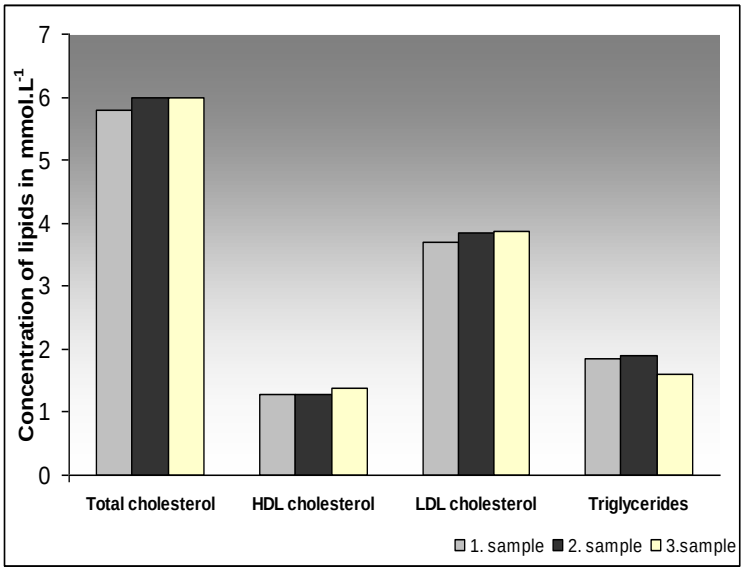

Figure 2 Comparing the concentration of lipids in blood of the experimental group.

Table 3 The lipid profile in human blood serum.

PARAMETERS	**1. SAMPLE** $\bar{x}$ **±SD**	**2. SAMPLE** $\bar{x}$ **±SD**	**3. SAMPLE** $\bar{x}$ **±SD**
Total cholesterol (mmol.L^{-1})	5.80 ±1.34	5.98 ±1.28	5.99 ±1.53
LDL cholesterol (mmol.L^{-1})	3.70 ±1.02	3.84 ±1.05	3.87 ±1.18
HDL cholesterol (mmol.L^{-1})	1.27 ±0.29	1.29 ±0.26	1.39 ±0.34
Triacylglycerols (mmol.L^{-1})	1.86 ±0.69	1.91 ±0.48	1.60 ±0.56

significance $p \geq 0.05$.

In evaluation of lipid profile of the volunteers we recorded increased values of total cholesterol which were seen in entry blood taking and these values were in average 5.80 ±1.34 mmol.L^{-1} and was found out low levels of HDL cholesterol in average 1.27 ±0.29 mmol.L^{-1} which in 30% of the volunteers points on higher risk of cardiovascular diseases. **Ferenčík et al., (2002)** states that the following parameters belong to the most important effects of supplementation of selenium: they are - decreasing of the risk of starting arteriosclerosis and cardiovascular diseases, stimulation of immune system, preventive effect against inflammatory diseases, decreasing of virulence of some viruses.

Opposite of results of **Ferenčík et al., (2002)** we didn´t found out a positive effect on concentration of total cholesterol in blood in the experimental group during the experiment, we can say that after short time of the consumption of veal meat enriched with organic selenium we found out that metabolism of lipids was better whereby the concentration of HDL cholesterol increased and the level of triglycerides slightly decreased. The results of our research didn't show statistically significant changes in lipid spectrum of the volunteers in the experimental group. The average values of the parameters of lipid profile are shown in the Figure 2 and Table 3.

The impact of selenium on lipid profile was examined on the experimental group of the animals. It was shown that the supplementation of selenium decreased the value of total cholesterol and also LDL cholesterol level and increased the value of HDL cholesterol level whereas the lack of selenium had an opposite effect.

It was found that an inactivation of synthesis of selenoproteins of the mice causes increasing concentration of cholesterol in plasma, increasing an amount of apolipoprotein E, improves gene expression for biosynthesis of cholesterol and decreases gene expression which is responsible for metabolism and transport of cholesterol. Relevancy of these studies connected with people is a questionable. It is supposed that the association between selenium status and the risk of starting the cardiovascular diseases depends on selenium status of monitored population **(Rayman, 2011)**.

CONCLUSION

According to our results was concluded that the application of organic selenium to feed mixture in the fattening process of the calves has the significance for effective transfer / transmission of essential microelement selenium to the foodweb. Integration of veal meat enriched with selenium to food of people leads to the increasing of selenium status of consumers and it can also lead to the protection of the cells of immune system against the damage during oxidative stress.

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