Secondary metabolites of Siberian ginseng (*Eleutherococcus senticosus* MAXIM.) and their effect on biochemical parameters of poultry

**Blascakova, M. Poracova, J.**

1Excellence Centre of Human and Animal Ecology, Presov University, 01, 17th November Street, 081 16 Presov, Slovakia

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**ABSTRACT**

Eleutherococcus senticosus (*Eleutherococcus senticosus* MAXIM.) is one of the promising medicinal plants. It is significant for its secondary metabolites, called glycosides – eleuterosides. Secondary metabolites (eleuterozid B, C, D, syringaresinol, sesamin), contained in the plant possess a wide range of beneficial effects on human organism and animals. Eleutherococcus senticosus MAXIM. has antioxidant, antiglycemic, anti-stress, antibacterial, immunostimulating effects, it has also the ability to reduce insulin levels, it has an inhibitory effect against free radicals. In the model experiment (8 weeks) we observed the impact of dry extract of Eleutherococcus senticosus on the level of triglycerides and cholesterol in blood serum of laying hens Hisex braun hybrid. In the model experiment 15 pieces of laying hens of Hisex Braun hybrid were included. Laying hens were divided into three groups - control group (CG = 5 pcs), I. experimental group (EGI = 5 pc), in which the extract of Eleutherococcus senticosus was added (eleuteroside B 0.71% 1.14% eleuteroside E, the extraction agent 30% ethanol) at a concentration of 0.1% / kg, II. experimental group (EGII = 5 pc) in which the extract was added at a concentration of 0.5% / kg. Observed parameters (triacylglycerol and cholesterol) in blood serum were determined before the administration of the extract (1st measurement), after 4th week (2nd measurement) and after 8th week experiment (3rd measurement). Laying hens were kept in three storey battery cage and fed with a feed mixture HYD - 06 until 3rd week of experiment, from 4th week of experiment hens were fed with a mixture HYD – 10. Feed and water were available *ad libitum* Low-molecular substances - triacylglycerol and cholesterol in the blood serum of poultry were determined using automatic analyzer ADVIA 1200 (Siemens, Germany). The achieved data were processed by computer program MS Excel 2003. Individual parameters were evaluated using non-parametric analysis of variance - Kruskal - Wallis test. To find the differences we used the Dunn test in program UNISTAT version 4.53h and Statistica v. 6. In the statistical evaluation of triglycerides using the Kruskal - Wallis test we found significant changes (p <0.05) between control and I. experimental group (12.823 mmol. L-1, 5.518 mmol. l-1) where a decrease of values in I. experimental group was observed. Other significant changes (p <0.05) were monitored between I. and II. experimental group in 2nd measurement (5.518 mmol.l-1, 11.388 mmol. l-1), where we observed an increase in levels in II. experimental group in which more extract of Eleutherococcus senticosus was administrated. Also significant changes (p <0.05) between control group and II. experimental group in 3rd measurement were monitored (15.032 mmol. L-1, 11.338 mmol. L-1), the decrease in values in II. experimental group was found. We assume that the longer duration of experiment will lead to significantly higher statistical importance of triglycerides and cholesterol in laying hens with a dry extract of Eleutherococcus senticosus of a dose higher than 0.5% / kg.

**Key words:** Triacylglycerol, cholesterol, blood serum, Hisex braun
Introduction

Eleutherococcus senticosus (Eleutherococcus senticosus MAXIM.) is one of the promising medicinal plants. It is significant for its secondary metabolites, called glycosides – eleuterosides. Secondary metabolites in the plant possess a wide range of beneficial effects on human organism and animals [9,5]. Eleutherococcus senticosus MAXIM. has antioxidant, antitumoral, anti-stress, antibacterial, immunostimulating effects, it has also the ability to reduce insulin levels, it has an inhibitory effect against free radicals [10,2]. The plant has a positive effect on the concentration of low molecular substances (glucose, triglycerides and cholesterol) and enzymatic activity of aspartate and alanine aminotransferase in blood serum of laying hens [11].

The content of triglycerides in the blood is influenced by species, age, gender, lay of egg, nutrition, intestinal absorption, mobilization of body reserves, synthesis in the liver and energy needs. The decrease in their content in the blood occurs in pancreatitis, hypothyreosis, nephrosis, liver disease, hemolytic anemia and leukemia [8].

Endogenous cholesterol synthesis takes place in the liver, skin, the intestine, adrenal glands or in the aorta. It is excreted in bile in the forms of bile acids. The concentration of cholesterol in the blood is influenced by genetic factors and amount of fat taken in food [4].

In the model experiment (8 weeks) we observed the impact of dry extract of Eleutherococcus senticosus on the level of triglycerides and cholesterol in blood serum of laying hens Hisex braun hybrid.

Material and Methods

In the model experiment 15 pieces of laying hens of Hisex Braun hybrid were included. Laying hens were divided into three groups - control group (CG = 5 pcs), I. experimental group (EGI = 5 pc), in which the extract of Eleutherococcus senticosus (eleuteroside B 0.71% 1.14% eleuteroside E, the extraction agent 30% ethanol) at a concentration of 0.1% / kg, II. experimental group (EGII = 5 pc) in which the extract was added at a concentration of 0.5% / kg. Observed parameters (triaclyglycerol and cholesterol) in blood serum were determined before the administration of the extract (1st measurement), after 4th week (2nd measurement) and after 8th week experiment (3rd measurement). Laying hens were kept in three storey battery cage and fed with a feed mixture HYD - 06 (12% wheat, corn 48%, 24% soybean meal, rape seed expeller 0.5%, 0.8% rapeseed oil, calcium carbonate 8.5%, 2.7% corn husk, vitamin - mineral premix 1.7%, 0.2% scharausiil, DKZ methionine 0.1%) until 3rd week of experiment, from 4th week of experiment hens were fed with a mixture HYD - 10 (50% wheat, corn 22.8%, 14.3% soybean meal, rape seed expeller 0.5%, 4% wheat bran, calcium carbonate 2% monokalciumphosphate 0.8% vitamin - mineral premix 0.5% sodium chloride 0.3%, 0.2% DKZ ski). Feed and water were available ad libitum.

Low-molecular substances - triacylglycerol and cholesterol in the blood serum of poultry were determined using automatic analyzer ADVIA 1200 (Siemens, Germany). The achieved data were processed by computer program MS Excel 2003. Individual parameters were evaluated using non-parametric analysis of variance - Kruskal - Wallis test. To find the differences we used the Dunn test in program Unistal version 4.53h anad Statistica version. 6th.

Results and Discussion

Biochemical examination of blood, bones or eggs can significantly provide important information for a correct diagnosis of diseases or disorders of production.

Cholesterol is the longest known lipid fraction, which is the most often determined. Serum cholesterol is about 7% of total cholesterol. Physiological levels of cholesterol in the blood serum of poultry set by Jantošovič et al. [8] are presented in Table 1. In our experiment, the average cholesterol levels in blood serum of laying hens were determined: control group (1st collection: 3.582 mmol. l-1, 2nd collection: 3.417 mmol. l-1, 3rd collection: 3.408 mmol. l-1) I. experimental group (1st collection: 3.582 mmol. l-1, 2nd collection: 2.384 mmol. l-1, 3rd collection: 3.302 mmol. l-1) II. experimental group (1st collection: 3.582, 2nd collection: 3.142, 3rd collection: 2.92 mmol. l-1).

Achieved physiological values (Graph 1 and 2) related to those reported in the literature [8], except for 1st collection, in which the values were higher of 0.232 mmol. We assume that the hens were not sufficiently adapted to the new environmental factors.

Triglycerides are esters of glycerol tribasic alcohol, in the blood their bound to lipoproteins. Part of the fatty acids must be received in food (essential fatty acids), because the body is not able to synthesize them [4]. In our experiment average values of triglycerides (Graph 3 and 4) in blood serum of laying hens Hisex braun hybrid were determined: control group - (1st collection 8.605 mmol. l-1, 2nd collection 12.823 mmol. l-1, 3rd collection 15.032 mmol. l-1), I. experimental group (1st collection 8.605 mmol. l-1, 2nd collection 5.518 mmol. l-1, 3rd collection 3.142, 3rd collection: 2.92 mmol. l-1). Measured values were compared to data Jantošovič et al. [8] who present the ranges of values of triglycerides in the blood serum of laying hens 46, 0 to 53.0 g / l.
Graph 1: Comparison of cholesterol values during 3 collections in blood serum of Hisex braun.

Graph 2: Comparison of median values in concentration of cholesterol in the blood serum of laying hens of Hisex braun.

Graph 3: Comparison of median values of triglycerides in the blood serum of laying hens Hisex braun.
In the statistical evaluation of triglycerides using the Kruskal-Wallis test we found significant changes (p < 0.05) between control and I. experimental group (12.823 mmol \cdot L^{-1}, 5.518 mmol \cdot L^{-1}) where a decrease of values in I. experimental group was observed. Other significant changes (p < 0.05) were monitored between I. and II. experimental group in 2nd measurement (5.518 mmol \cdot L^{-1}, 11.388 mmol \cdot L^{-1}), where we observed an increase in levels of values in II. experimental group in which more extract of Eleutherococcus senticosus was administrated. Also significant changes (p < 0.05) between control group and II. experimental group in 3rd measurement were monitored (15.032 mmol \cdot L^{-1}, 11.338 mmol \cdot L^{-1}), the decrease in values in II. experimental group was found.

We assume that the longer duration of experiment will lead to significantly higher statistical importance of triglycerides and cholesterol in laying hens with a dry extract of Eleutherococcus senticosus of a dose higher than 0.5% / kg.

Summary:

In this work we focused on the impact of different doses of dry extract of Eleutherococcus senticosus (*Eleutherococcus senticosus* MAXIM.) on the level of low molecular substances in blood serum of laying hens during 8 weeks of experiment.

Concerning the determination of the values of biochemical parameters of blood of animals and people only very little works take into account the impact of environmental, social, and other factors [1]. Results of model experiment are affected by the endogenous factors - age, sex, race, possible subclinical disease, as well as exogenous factors - the way of nutrition, geography, and other stress factors. A frequent cause of instability of observed values is the statistical evaluation, selected methodology, inhomogeneity of observed animal group and already mentioned endogenous and exogenous factors of the studied animal population and the environment. *Eleutherococcus senticosus* MAXIM. is one of the promising medicinal plants, which were quite unknown in our country. Ingredients - eleuterosides have the ability to increase non-specific resistance of the organism, enabling better concentration, greater efficiency, they help to overcome fatigue and stress, and some processes related to civilization diseases.

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References