Acta Veterinaria (Beograd), Vol. 58, No. 1, 63-73, 2008.

DOI: 10.2298/AVB0801063S UDK 619:639.123.084.416

THE EFFECTS OF ORGANIC SELENIUM AND MANNAN OLIGOSACCHARIDES ON THE PRODUCTIVITY AND HEALTH OF PHEASANT CHICKEN (*PHASIANUS COLCHICUS*)

ŠPERANDA MARCELA*, FLORIJANČIĆ T*, BOŠKOVIĆ I*, BOGUT I*, GUTZMIRTL H**, GRGURIĆ D**, SENČIĆ Đ* and ANTUNOVIĆ Z*

**Faculty of Agriculture, Osijek, Croatia;*
***Center for Livestock Improvement, Osijek, Croatia*

(Received 14. June 2007)

The investigation included 37 pheasant chickens divided into three groups (control and two experimentals groups) which were all fed with a standard starter feed mixture (28% crude protein and 11.7 MJ ME/kg) for the first 28 days and then with a grower for pheasant chickens (24% of crude protein and 12.1 MJ ME/kg). Sel-Plex® was added to the first experimental group in a concentration of 0.2%. A biochemical investigation of the blood samples on the 70th day of the trial showed a significantly (P<0.05) lower concentration of creatinine and triacylglicerol (P<0.01), a significantly (P<0.05) higher level of band heterophils and a significantly lower (P<0.05) skin and offal weight (P<0.01). The highly valuable parts of the carcasses between groups were with no significant differences. Bio-Mos® (2 g/kg feed) was added to the second experimental group. These chickens had a higher level of glucose, triacylglicerol, lymphocites and monocytes, but with no statistical significance (P>0.05), when compared to the control.

Key words: common pheasant, growth intensity, Selplex®, Bio-Mos®, biochemical and haematological parameters, carcass characteristic

INTRODUCTION

The importance of feeding for body condition and the ability of pheasant chickens to breed have been pointed out by Draycott *et al.* (1998; 2002) appealing to increased pheasant feeding in intensive breeding in order to enhance production. Prior studies have reported body mass effects in adult wild birds exposed to different forms of selenium (Se), including selenomethionine, but the Se concentration was higher than the one used in this study (20-30 mg/kg versus 0.2 mg/kg; Green and Alberts, 1997; Wiemeyer and Hoffman, 1996). On the other hand, mannanoligosaccharides (MOS), derived from mannanes on yeast cell surfaces, act as high-affinity ligands and as a competitive binding site for the bacteria with mannose-specific fimbriae (Fairchild *et al.*, 2001). For this reason

adding MOS supports improved gut function, but without enchancing growth in weaned piglets (Burkey, 2004).

A strict and direct relationship between the dietary intake of Se and the efficiency of Se-dependent enzyme activities is well known. Animals usually take Se from plants in the form of selenomethionine (Combs and Combs, 1986) in quantities depending on the concentrations in the ground, which can vary significantly (Reilly, 1996). Although inorganic Se has been used as a feed additive for years, its poorer efficiency has been established in relation to organic Se, which is a natural component in plants. Furthermore, there has been established a pro-oxidative activity of sodiumselenite through reactions with reduced glutathione (Yan and Spallholtz, 1993; Wycherly *et al*., 2004). Today a commercial source of selenomethionine from yeast (*Saccharomyces cerevisia,* Selplex®) is in use and it is metabolized as methionine (Wolfram, 1999). Surai (2002) suggested that adequate Se supplementation is considered to be a crucial factor in maintaining the high productive and reproductive characteristics of poultry, despite the rare Se deficiency in modern poultry production. Mannan oligosaccharides are added to pheasant chickens to improve gut health and enchance feed utilization, because it is well known that oligosaccarides improve growth and feed efficiency of weaned pigs (Burkey *et al.,* 2004), and stimulated immunity in fish (Staykov *et al*., 2005).

The aim of our research was to establish the effect of added organic Se and Bio-Mos® into pheasant chicken feeds, especially their effects on health, production, haematologic, biochemical and some carcass parameters. This being importatnt as the soil of Eastern Slavonia is deficient in Se (0.18 mg/kg Se/ground, Antunović *et al*., 2005).

MATERIALS AND METHODS

Animals and diets

Research was made on pheasant chickens (n=37) over May, June and mid-July. They were held in a closed and controlled environment for the first 28 days after hatching. Over the first five days the average room temperature was 32°C. Thereafter, every two days the temperature was lowered by 1 degree C down to 21°C. Relative humidity was 73%. The pheasants were fed with a standard feed mixture of 28% crude proteins and 11.7 MJ ME/kg. After 28 days the chickens were divided into three groups (13, 11, 13 animals). Sex proportion was equal. After 28 days of life, the chickens were fed with a standard feed mixture containing 24% crude proteins and 12.1 MJ ME/kg up to 70 days of life (Table 1). They were accommodated in outdoor cages 1.5 x 3.3m^2 in size, surrounded with a high wire fence. The floor was covered with wooden shavings disinfected with 2% Na OH. The average daily temperature in the cage was 19.50°C, and relative humidity was 75%. The added vitamin-mineral premix for pheasants did not contain Se. The first experimental group received organic selenized yeast (Sel-Plex®, Alltech, inc., 200 g/ton) and the second experimental group received Bio-Mos®, 2g/kg. Each cage contained automatic drinkers and metal feeders for *ad libitum* feeding.

Table 1. Ingredients and chemical composition of the feed mixture for pheasant chicken (%)

Ingredient	Starter	Grower
Corn	40	42
Soybean grits 44%	30.7	32
Alfa-alfa meal	3.20	3
Sunflower grits 33%	5	6
Fish meal 65%	9	3
Yeast, dried 50%	6	2
Salt	0.2	0.4
Limestone	1.8	4.5
DCP	0.6	1
Whey powder	2.5	–
Premix[1]	1	1
Water	10.8	10.49
Crude proteins	28.3	23.8
Crude fat	4.8	5.4
Crude ash	4.87	6.65
Crude fibers	5.14	5.10

[1]Premix: Vit A 10000 IU, Vit D3 1500 IJ, Vit E 5 IJ, Vit K3 1.5 mg, Vit B1 1 mg, Vit B2 6 mg, Vit B6 2 mg, Vit B12 0.012 mg, Pantothenic Acid 15 mg, niacin 25 mg, folic acid 0.5 mg, antioxidant 100 mg, Fe 20 mg, Zn 40 mg, Co 0.4 mg, holin 500 mg, Mn 50 mg, Cu 2 mg, J 1 mg, Coccidiostatic 20 mg)

Sampling and analyses

Body mass was controlled at the beginning of the experiment and then on the 28th, 42nd, 56th, and 70th day. Blood was taken with a wing vein puncture. A quantity of 2 mL was drawn into a test tube with EDTA as an anticoagulant, as well as 2 mL into the Microtainer® (Becton-Dickinson Co., Rutherford) test tube for biochemical analysis. A differential blood test was carried out by a microscope using the prepared blood smears coloured by Pappenheim. For the metabolic profile (glucosis, urea, ceratinine, urates, proteins, albumins, cholesterol, triglycerides, as well as Ca, P, Na, K, Cl) the automatic analyser Olympus 640 was used. After slaughter (n=15), the following parts of pheasants' carcasses were weighed: skin, carcass and carcass without extremities and internal organs (heart, liver, pancreas, lungs). The meat pH value was measured in the chest muscles 45 minutes *post mortem*, after the meat was cooled to +4°C with a contact pH meter (Mettler Toledo). At the end of the experiment intestine samples (jejunum and cecum content) were analyzed. The below mentioned

microorganism group of intestinal content were detected by bacteriological studies:

1. Escherichia coli – grown on peptonic water and MacConcey Agar, 24 h, 30°C, fluorescence, indole positive test;
2. Coliform bacteria – added to EE broth Mosel and VRBG agar, 24-30 h, 37°C, oxidase-negative colonies;
3. Salmonella – added to semisolid media according to Chau-Huang, 48 h, 42°C and then to Salmonella-Shigella media, slide agglutination test;
4. Proteus – grown on Rappaport Vassiliadis medium, 43°C for 48 hours, aerobic dilution to extinction subculture on TSA.

Statistical processing

The given values of the researched indicators were processed with the computer programme Statistica (StatSoft Inc., 2001). The significance of differences between the control and experimental groups were specified with a non-parametric Mann-Whitney U-test with independent variables.

RESULTS

Neither organic Se (Selplex®) nor Bio-Mos® additions to the feed given to the phesants over the 70 day period caused deaths or illnesses. Equal body masses were achieved (Table 2), while the average daily gains were higher in the first control period (from the 28th to the 42nd day) in group E1, but without statistical significance ($P>0.05$).

Table 2 Body mass of the pheasant chicken fed the mixture with supplemented organic Se and mannan oligosaccharide until the 70th day

Age (days)	Groups		
	Control (C) N=13	Experimental 1 (E1) N=11	Experimental 2 (E2) N=13
	± s	± s	± s
28	193.46 ± 34.05	180.45 ± 23.17	191.92 ± 24.88
42	321.53 ± 51.25	317.72 ± 35.45	310.00 ± 49.37
56	476.15 ± 80.31	447.72 ± 47.29	435.00 ± 75.11
70	615.00 ± 77.62	5 28.72 ±148.72	603.46 ±103.55

Hematological tests in the blood of pheasant chickens showed similar values of red and white blood cells (Table 3). The share of heterophile leukocytes was significantly higher ($P<0.05$) in the first experimental group (E1). In group E2 the share of lymphocythes and monocytes was higher in relation to groups C and E1, while the share of hertertophiles was lower ($P>0.05$). Biochemical research of

serum in pheasant chickens on the 70th day of the experiment established significantly lower ($P<0.01$) levels of creatinine and triglycerides ($P<0.05$) in group E1 (Table 3). There was a higher concentration of total proteins and albumins and a lower concentration of total LDL-cholesterol in relation to group C, but with no statistical difference ($P<0.05$). Higher glucose and triglyceride levels were determined in the group E2 in relation to groups C and E1 ($P>0.05$). There were no differences established in the electrolite concentrations in the serum of pheasant chickens that received Selplex® or Bio-Mos® (Table 4). Cutting the carcasses after slaughter, a greater mass of control group carcasses was detected in relation to group E1 (C:E1= 615.00g:569.00 g), but equal in relation to group E2 (C:E2= 615.00 g : 610.00 g). A significantly ($P<0.05$) greater mass of skin and offal ($P<0.01$) in the control group of animals was determined in relation to group E1. The share of valuable carcass parts was similar (Table 6). By bacteriological research of jejunum and caecum in pheasant chickens, more coliform bacterias and *E. coli* bacterias in the bowels of the control group of animals was found (Table 7).

Table 3 Hematological parameters in the blood of pheasant chickens on the 70thday

Haematological parameters	Groups		
	Control (C) N=13	Experimental 1 (E1) N=11	Experimental 2 (E2) N=13
	$\bar{x} \pm s$	$\bar{x} \pm s$	$\bar{x} \pm s$
Eritrocytes $x10^{12}L^{-1}$	2.55 ± 0.63	1.75 ± 1.5	3.05 ± 0.57
Leukocytes x $10^{9}L^{-1}$	6.89 ± 2.40	6.91 ± 2.43	7.01 ± 2.39
Eosinophils %	3.25 ± 2.63	6.40 ± 1.67	2.75 ± 0.96
Basophils %	0.20 ± 0.44	0.00 ± 0.00	0.20 ± 0.45
Band heterophils %	5.00 ± 2.44	9.60 ± 0.54*^{C}	3.25 ± 0.96
Heterophils %	19.20 ± 25.66	13.80 ± 3.03	8.00 ± 3.46
Lymphocytes %	61.80 ± 25.83	56.20 ± 4.86	68.00 ± 1.63
Monocytes %	12.20 ± 4.38	14.00 ± 2.54	17.75 ± 3.95

* $P<0.05$

Table 4. Biochemical parameters in the serum of pheasant chicken on the 70th

Parameters	Groups		
	Control (C) N=5	Experimental 1 (E1) N=5	Experimental 2 (E2) N=5
	$\bar{x} \pm s$	$\bar{x} \pm s$	$\bar{x} \pm s$
Glucose (mmol/L)	18.34 ± 2.32	17.32 ± 1.75	20.68 ± 2.54
Urea (mmol/L)	0.98 ± 0.25	1.02 ± 0.44	0.55 ± 0.19
Creatinine (ìmol/L)	11.00 ± 2.54	3.60** ± 0.55	7.75 ± 1.71
Urates (μmol/L)	926.20 ± 327.00	549.80 ± 264.66	517.50 ± 117.76
Total proteins (g/L)	36.20 ± 3.62	39.60 ± 4.16	34.08 ± 2.90
Albumin (g/L)	16.38 ± 1.38	18.48 ± 1.98	15.65 ± 1.84
Cholesterol(mmol/L)	4.55 ± 0.81	4.27 ± 0.45	4.66 ± 0.44
HDL-Ch (mmol/L)	2.93 ± 0.34	3.12 ± 0.30	3.00 ± 0.25
LDL-Ch (mmol/L)	1.18 ± 0.48	1.00 ± 0.20	1.02 ± 0.14
Tryglicerids (mmol/L)	0.96 ± 0.35	0.44* ± 0.11	1.42 ± 0.33

*P<0.05; ** P<0.01

Table 5. Electrolites in the serum of pheasant chicken on the 70th day

Parameters	Groups		
	Control (C) N=5	Experimental 1 (E1) N=5	Experimental 2 (E2) N=5
	$\bar{x} \pm s$	$\bar{x} \pm s$	$\bar{x} \pm s$
Calcium (mmol/L)	2.45 ± 0.10	2.55 ± 0.18	2.45 ± 0.06
Phosphate (mmol/L)	2.97 ± 0.16	3.01 ± 1.25	2.48 ± 0.46
Sodium (mmol/L)	162.00 ± 0.00	163.33 ± 0.57	159.50 ± 3.54
Potassium (mmol/L)	5.20 ± 0.98	5.23 ± 0.47	5.15 ± 0.21
Chloride (mmol/L)	115.50 ± 2.12	115.33 ± 1.52	114.50 ± 3.54

Table 6. Slaught characteristics of pheasant chickens carcasses the 70th day

Parameters, g	Groups		
	Control (C) N=5	Experimental 1 (E1) N=5	Experimental 2 (E2) N=5
	$\bar{x} \pm s$	$\bar{x} \pm s$	$\bar{x} \pm s$
Carcass Mass	615.00 ± 77.62	569.00 ± 62.38	610.00 ± 50.37
Carcass Mass Without Extremities	368.56 ± 43.77	357.68 ± 39.28	366.12 ± 22.72
Skin	122.16 ± 15.76	108.65* ± 11.17	125.92 ± 13.66
Insides	92.20 ± 20.49	60.94** ± 7.38	85.94 ± 11.68
pH Meat	6.00 ± 0.29	6.13 ± 0.14	5.97 ± 0.18

*P<0.05; ** P<0.01

Table 7. Isolates of bacterial species in the jejunum and cecum of pheasant chickens

Families and species	No. of positive reactions / No. of samples tested					
	Jejunum			Cecum		
	Control (C)	Experi-mental 1 (E1)	Experi-mental 2 (E2)	Control (C)	Experi-mental 1 (E1)	Experi-mental 2 (E2)
Salmonella	0/5	0/5	0/5	0/5	0/5	0/5
Coliform bact.	4/5	2/5	5/5	4/5	2/5	3/5
E. coli	3/5	1/5	0/5	1/5	0/5	0/5
Proteus	2/5	0/5	1/5	2/5	0/5	3/5

DISCUSSION

Differences in the average pheasant chicken body mass of the experimental groups were not statistically significant because the deviations were quite large. This was probably because the female birds exhibited highly variable body masses. Lower body masses of the experimental group were established by other researches (Yamamoto and Santolo, 2000). The published results show the inclusion of Se into the metabolic turnover of the nutrients. It is already known that the effect of Se on the conversion of tetraiodine (T4) into triiodtironine (T3) is responsible for the anabolic effect of proteins, decreased concentration of blood cholesterol and increased glucose absorption. Thus, the experimental group E1

had a lower level of serum glucose and a higher level of total proteins and albumins (Table 4), so it is obvious that the experimental group had a higher level of globuline proteins. A significantly lower level of triacylglicerols and total cholesterol, as well as LDL cholesterol was recorded in the experimental group, this being in concordance with Iizuka *et al*. (2001). Dhingra *et al*. (2003) have found that with hyperlipidemy there is an increased need for Se for normalizing T4 and T3 concentrations whose excretion is reduced if the food is rich in fats. A positive correlation of the Se blood concentrations and T4 and T3 levels had been established by Gursu *et al*. (2003). That is, in thyroid hormone deficiency, the levels of cholesterol and triglycerides in the serum are growing, while fat metabolism is decreasing, which results in hypercholesterolemia. The addition of Se to food can result in hyperlipidemy prevention. As Se directly influences the increased activities of glutathione peroxidase in the liver (Kang *et al*., 2000). Our researches have been following immunohematological indicators and there was a significantly higher ($P<0.05$) share of non-segmented leukocytes, which tells us about the enhanced insertion of new neutrophiles into the circulation. At the same time, the number of monocytes was higher also (Table 5). Gursu *et al*. (2003) have established an increased concentration of Ca, P and K, but a lower concentration of Na when Se was added, while in our researches we have found no differences. The antioxidant effect of selenomethionine affects meat quality which is an important feature for the selective consumer. It has been found that addition of 0.25 ppm Se enhances the glutathionperoxidase activity (GSH-Px) up to four days after meat storage at +4 C and the lipid peroxidase level stays low (De Vore *et al*., 1983). The consequence of that is an oxidatory stability of skeletal muscle and decreased drip loss. The characteristic capacity to bind water and the stability of the eritrocite membrane are connected (Edens, 2001). A more favourable condition of the intestinal microbiotic population was established in the experimental group E1 and supports the picture of an improved immune system.

The results of previous studies concerning the effect of Bio-Mos® on the fattening performance in broiler chickens are conflicting. Kumprecht *et al.* (1997) reported that Bio-Mos® improves live weight gain and efficiency of food utilization; Cetin *et al*. (2005) reported a moderate effect on growth performance. Burkey *et al*. (2004) found that mannans did not enchance the growth of weaned piglets, but improved gut function as evidenced by improved gain/feed ratio. Fairchild *et al*. (2001) confirmed that Bio-Mos improved poultry body weight with and without *Escherichia coli* challenge. According to hematological parameters, Bio-Mos added to the feed mixture elevated RBC, lymphocytes and monocytes in relation to the control group. This finding is in accordance with the investigation of Klebaniuk *et al*. (2006). In group E2 a higher level of triacylglicerols was determined, while the concentrations of other metabolites were like those in the control group, which is similar with the investigation of Cunningham *et al*. (2006). The current study found that the inclusion of Bio-Mos® did not influence the composition of intestinal microflora which included coliforms, *Salmonella*, *E. coli* and *Proteus*. Similar results were reported by Fairchild *et al*. (2001) on poultry without *E. coli* challenge. Newman (1994) reported that Bio-Mos® can effectively

alter the intestinal microflora, probably because of the decreasing numbers of unfavourable bacteria in the intestinal lumen.

In conclusion, the addition of Selplex® and Bio-Mos® to pheasant chicken feed did not increase the growth ratio, but ensured a better immune response and improved antioxidative features. However, the addition of Selplex® indicated a more remarkable effect than Bio Mos®.

ACKNOWLEDGEMENTS:
This study is part of e research project financed by The Ministry of Agriculture, Forestry and Water Management of the Republic of Croatia

Address for correspondence:
Marcela Šperanda,
Faculty of Agriculture,
Trg sv. Trojstva 3,
31000 Osijek, Croatia,
e-mail: marcela.speranda@pfos.hr

REFERENCES

1. *Antunović Z, Steiner Z, Steiner Z, Šperanda M, Domaćinović M, Karavidović P,* 2005, Content of selenium and cobalt in soil, plants and animals in Eastern Slavonia, XII International Conference Krmiva 2005, Opatija June 6-9, Croatia
2. *Burkey TE, Dritz SS, Nietfeld JC, Johnson BJ, Minton JE,* 2004, Effect of dietary mannanoligosaccaride and sodium chlorate on the growth performance, acute-phase response, and bacterial shedding of weaned pigs challenged with *Salmonella enterica* serotype Typhimurium, *J Anim Sci,* 82, 397-404.
3. *Cetin N, Guclu BK, Cetin E,* 2005, The effect of probiotic and mannanoligosaccaride on some haematological and immunological parameters in turkeys, *J Vet Med Physiol Patol Clin Med,* 52, 6, 263-7.
4. *Combs GF, Combs SB,* 1986, The Role of selenium in Nutrition, Academic Press, Inc. New York.
5. *Cunningham D, Savage TF, Allen CA, Christian RL, Hermes JC, Cheeke PR,* 2006, The effect of feeding mannan oligosaccarides on the performance of Emu, Alltech's 22nd Annual Symposium, April 24-26, Lexington.
6. *De Vore VR, Colnago GL, Jensen LS, Greene BE*, 1983, Thiobarbituric acid values and glutathion peroxidase activity in meat from chickens fed a selenium-supplemented diet, *J Food Sci,* 48, 300-1.
7. *Dhingra S, Singh U, Bansal MP,* 2003, Protective role of selenium status on T3/T4 kinetics in rats under hyperlipidemia, *Ind J Biochem Bioph*, 40, 4, 260-4.
8. *Draycott RAH, Hoodless AN, Ludiman MN, Robertson PA*, 1998, Effects of spring feeding on body condition of captive-reared ring-necked pheasants in Great Britain, *J Wildlife Man,* 62, 2, 557-63.
9. *Draycott RAH, Parish DMB, Woodburn MIA, Caroll JP*, 2002, Spring body condition of hen pheasant Phasianus colchicus in Great Britain, *Wildlife Biol*, 8, 4, 261-6.
10. *Edens FW*, 2001, Involement of Sel-Plex® in physiological stability and performance of broiler chickens, Proceedings of Alltech's 17th Annual Symposium, Lyons and Jacques.
11. *Fairchild AS, Grimes JL, Jones FT, Wineland MJ, Edens FW, Sefton AE*, 2001, Effect of hen age, Bio-Mos® and Flavomycin® on poultry susceptibility to oral *Escherichia coli* chalenge, *Poultry Sci,* 80, 562-71.
12. *Green ED, Alberts PH*, 1997, Diagnostic criteria for selenium toxicosis in aquatic birds: histologic lesions, *J Wildlife Dis,* 33, 385-404.

13. *Gursu MF, Sahin N, Kucuk O*, 2003, Effects of vitamin E and selenium on thyroid status, adrenocorticotropin hormone, and blood serum metabolite and mineral concentrations of Japanese quails reared under heat stress (34 degrees C), *J Trace Elem Exper Med,* 16, 2-3, 95-104.
14. *Iizuka Y, Sakurai E, Tanaka Y*, 2001, Effect of selenium on serum, hepatic and lipoprotein lipids concentration in rats fed on a high-cholesterol diet, *J Pharm Soc Jap*, 121, 1, 93-6.
15. *Kang BPS, Mehta U, Bansal MP*, 2000, Hyperlipidemia and Type-1-5'-monodeiodinase activity: Regulation by selenium supplementation, *Ind J Biochem Biophys,* 37, 3, 183-7.
16. *Kumprecht I, Zobac P,* 1997, The effect of mannan-oligosaccarides in feed mixtures on the performance of chicken broilers, *Czech J Animal Sci*, 42, 3, 117-24.
17. *Newman K*, 1994, Mannan-oligosaccarides: Natural polymers with significant impact on the gastrointestinal microflora and the immune system. 167-174 in: Biotechnology in the Feed Industry. Proceedings of Alltech's Tenth Annual Symposium. T. P. Lyons And K. A. Jacques. ed. Nottingham University Press, Nottingham. UK.
18. *Reilly C*, 1996, Selenium in Food and Health, Blackie Academic & Professional, an inprint of Chapman&Hall, London.
19. StatSoft, Inc, 2005, STATISTICA (data analysis software system), version 7.1 www.statsoft.com
20. *Staykov Y, Spring P, Denev S*, 2005, Influence of dietary Bio-Mos® on growth, survival and immune status of rainbow trout (*Salmo Gairdneri irideus* G.) an common carp (*Cyprinus carpio* L.), Proceedings of Alltech's 21st International Feed Industry Symposium.
21. *Surai P*, 2002, Selenium in poultry nutrition-1. Antooxidant properties, deficiency and toxicity, *Worlds Poultry Sci J*, 58, 3, 333-47.
22. *Surai P,* 2002, Selenium in poultry nutrition-2. Reproduction, egg and meat quality and practical applications, *Worlds Poultry Sci J*, 58, 4, 431-40.
23. *Wiemeyer SJ, Hoffman DJ*, 1996, Reproduction in eastern screech-owls fed selenium, *J Wildlife Man,* 60, 332-41.
24. *Wycherly BJ, Moak MA, Christensen MJ*, 2004, High dietary intake of sodium selenite induces oxidative DNA damage in rat liver, *Nut. Cancer,* 48, 78-83.
25. *Wolffram S*, 1999, Absorption and metabolism of selenium: difference between inorganic and organic sources. In: Biotchnology in the Feed Industry. Proceedings of 15th Alltech's Annual symposium, Edited by Lyons TP and Jacques KA, Nottingham University Press, Nottingham, UK, 547-66.
26. *Yan L, Spallholtz JE*, 1993, Generation of reactive oxygen species from the reaction of selenium compounds with thiols and mammary tumor cells, *Biochem Pharmacol* 45, 429-37.
27. *Yamamoto JT, Santolo GM*, 2000, Body condition effects in American kestrels fed selenomethionine, *J Wildlife Dis,* 36, 4, 646-52.

UTICAJ ORGANSKOG SELENA I MANAN OLIGOSAHARIDA NA PROIZVODNE OSOBINE I ZDRAVLJE FAZANSKIH PILIĆA (*PHASIANUS COLCHICUS)*

ŠPERANDA MARCELA, FLORIJANČIĆ T, BOŠKOVIĆ I, BOGUT I, GUTZMIRTL H,
GRGURIĆ D, SENČIĆ Đ i ANTUNOVIĆ Z

SADRŽAJ

Ovim ispitivanjima je bilo obuhvaćeno ukupno 37 fazanskih pilića podeljenih u 3 grupe (kontrolnu i dve eksperimentalne). Svi pilići su tokom prvih 28 dana hranjeni standardnom smešom koja je sadržavala 28% sirovih proteina i 11,7 MJ ME/kg. U drugom delu ogleda, pilići su hranjeni smešom sa 24% sirovih proteina i 12,1 MJ ME/kg. U smešu za ishranu prve ogledne grupe dodavan je preparat Sel-Plex® u koncentraciji od 0,2%. Biohemijske analize uzoraka krvi 70. dana ogleda ukazale su na značajno nižu koncentraciju kreatinina ($p<0,05$) i triacilglicerola ($p<0,01$). Procenat štapićastih heterofilnih leukocita bio je značajno niži ($p<0,05$) dok su prosečne težine kože i perja bile značajno veće ($p<0,01$). Udeo pojedinih delova trupa nije se značajno razlikovao u obe grupe. Drugoj oglednoj grupi dodavan je preparat Bio-Mos® u količini od 2 g po kilogramu smeše. Ovi pilići su imali veći nivo glukoze i triacilglicerola kao i veći broj limfocita i monocita u krvi, ali nisu utvrđene statistički značajne razlike između ove i kontrolne grupe.