

BLOOD LIPIDS PROFILE IN LACTATING COWS FED WITH SUPPLEMENT OF *OVOCAP*®

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Abstract: This study was conducted to test the effects of feeding supplemental Bulgarian nutritive additive *OVOCAP*® administrated per os, on blood lipid profile in lactating cows. Twelve lactating American Brown cows (BW = 695 ± 28 kg; at the beginning of the lactation) were separated to two treatments for 1,5 year. Cows were fed typical diets during the winter (corn silage, meadow hay, straw, wheat bran, potatoes and compound feed) and summer (pasture and compound feed). Experimental cows received in addition to concentrate part of their daily ration 2x23 ml *OVOCAP*® each every 28th day in the month, first doses being on the 3rd and 4th day post partum. Blood samples were collected after every giving doses of *OVOCAP*®, morning before feeding and sera were analyzed for triglycerides, HDL, LDL, VLDL and total lipids concentration. Feed intake was similar in the two groups. Observed levels of the HDL cholesterol were significant lowered ($P \leq 0,05$) under the influence of *OVOCAP*®. Observed levels of LDL and VLDL cholesterol as well as triglycerides and total lipids were significant lowered ($P \leq 0,001$) under the influence of *OVOCAP*®. This results suggest that *OVOCAP*® may posses hypocholesterolemia and hypotriglyceridemic effect in lactating cows. This experiment demonstrated that *OVOCAP*® is adjusted to use in lactating cows with sure definite benefit on blood lipoprotein profile.

Key words: cholesterol concentration, triglycerides, total lipids, blood, cows, *OVOCAP*®, BG.

Introduction

Improving the dietary status of farm animals, including ruminants, forms an important policy area for the European country. As such, the reduction of antibiotic and chemical additive intake is a priority topic in this agenda. There is a great interest on the development of new plants and plant extracts that would have influence on healthy nutrition of ruminants.

The physiological effect of the Bulgarian nutritional additive *OVOCAP*® (patented by *Kitanov*, 1998) is based on the seven alkaloids known under the common name CAP (Methyl-vanillyl-nonenamide-capsaicin), carotene and other biologically active substances. While the action of carotene is well studied, the action of CAP is not fully cleared. Our experiments showed that CAP has: bacteriostatic effect on some bacteria (poultry) (*Kitanova and Kitanov*, 1990); no deviation from normal values of transaminasic activity of the liver, hydrolytic activity of mycosis and histostructures of the jejunum, stomach, liver and kidneys (swine) (*Kitanov et al.*, 1996); 4-5% effect on real digestibility of the amino acids in standard compound feeds (geese) (*Kitanov et al.*, 2002); effect on the laying rate (pheasants) (*Kitanov et al.*, 2000b); effect on reproductivity (hens (*Kitanov et al.*, 2000a), turkeys (*Kitanov et al.*, 2003), ewes (*Djorbineva et al.*, 2006) and cows (*Petkova et al.*, 2008)); effect on milk fats (sheep) (*Djorbineva et al.*, 2006). There are no arguments in the literature for possible effects of this additive on the blood lipids metabolism in lactating cows.

The aim of this study was, taking into consideration the above, to study the action of *OVOCAP*® administrated per os, on the blood lipoprotein profile in lactating cows.

Materials and methods

Animals: A total of twelve lactating American Brown cows (BW = 695 ± 28 kg; at the beginning of the lactation) were separated into two equivalent treatments for 1,5 year, starting in the autumn to prevent so different pasture conditions at the beginning of the lactation.

Feeding: Cows were fed typical diets during the winter (corn silage, meadow hay, straw, wheat bran, potatoes and compound feed) and summer (pasture and compound feed). In addition to concentrate part of the daily ration the experimental cows received 2x23 ml *OVOCAP*® each every 28th day in the month, first doses being on the 3rd and the 4th day post partum. (table1).

Table 1. Experimental design with lactating cows and the additive *OVOCAP*®
Tabela 1. Dizajn ogleda sa kravama u laktaciji koje su hranjene preparatom *OVOCAP*®

Components of the diet/ Sastojci obroka	Control winter diet/ Kontrolni zimski obrok	Control summer diet/ Kontrolni letnji obrok	Experimental winter diet/ Ogledni zimski obrok	Experimental summer diet/ Ogledni letnji obrok
Compound feed, g/kg milk /hranivo, g/kg mleka	350	350	350	350
Corn silage/Silaža kukuruza, kg	10	-	10	-
Meadow hay/Livadsko seno, kg	4	-	4	-
Brewery pulp/Pivarska pulpa, kg	15	15	15	15
Wheat bran/Pšenične mekinje, kg	2	2	2	2
Straw/Slama, kg	4	4	4	4
Potatoes/krompir, kg	5	-	5	-
Pasture/Ispaša	-	ad lib	-	ad lib
<i>OVOCAP</i> ®, ml to a respective scheme	-	-	22	22

Methods: The content of the basic nutrients were determined by international standard methods (*AOAC*, 1990). Blood samples were taken from the *V. jugularis* prior to the morning feeding without anticoagulant. Serum was separated by centrifugation at 2000xg for 15 min. Total lipids (Phosphovanillin method), total cholesterol (Enzymatic method) including high-density lipoprotein (HDL), low-density lipoprotein (LDL) levels and concentrations of triglycerides were analyzed in serum using enzymatic colorimetric end-point method (Human Gesellschaft für Biochemica und Diagonostica GmbH test kits) by spectrophotometer.

Calculated parameters: Following chemical analyses, N-free extract (NFE) of the diet components was calculated. The energy value of using feedstuffs were expressed in the actual chemical composition data through Gross Energy (GE) after *DLG* (1997), Metabolizable Energy (ME), calculated from partial chemical composition using the equation after *Waißbach et al.* (1990) and Net Energy for Lactation (NEL), after *GfE* (1995). The theoretical protein value of

forages was expressed as PDIA, PDIME, PDIMN, PDIE and PDIN after *Verite et al* (1987), using actual data for FOM.

Statistical Analyses: The results of the experiment were analyzed statistically with one-factor analysis of variance and Duncan's tests. Analysis of variance, T-test and correlation analysis were used to evaluate the relationships between different parameters.

Results

The chemical composition of the used feedstuffs can be found in table 2. The results suggest that all feedstuffs used were in standard composition and good quality.

Table 2. Chemical composition of feeds
Tabela 2. Hemijski sastav hraniva

Feedstuffs/hraniva	Dry Matter/ SM, %	Crude Protein*/ SP	Crude Fats*/ SM	Crude Fiber*/ SC	Nitrogen Free Extract*/ BEM
Compound feed/Smeša	89,85	16,80	1,81	7,67	66,80
Corn silage/Silaža kukuruza	25,63	7,82	3,31	22,47	58,31
Meadow hay/Livadsko seno	85,03	6,38	1,58	31,81	55,80
Brewery pulp/Pivarska pulpa	24,87	18,55	6,50	19,33	51,26
Wheat bran/Pšenične mekinje	82,15	16,10	4,14	9,15	65,61
Straw/Seno	87,38	6,20	1,62	35,77	50,43
Potatoes/krompir	20,49	9,72	0,35	2,65	82,94

* in % of dry matter/ u % SM

The empirically calculated energy nutritiveness of the experimentally used feedstuffs (Table 3) presents values, which are relevant to chemical composition. Gross energy is in the frame of 18,54 and 18, 58 MJ. Metabolizable Energy is within the limits of 11,16 and 11,67 MJ. Net energy values are between 0,614 MJ/kg DM and 0,627MJ/kg DM. The results do not show significant differences between the winter and summer nutrition and intake of nutrients.

Table 3. Energy value of the using diets
Tabela 3. Energetska vrednost korišćenih obroka

Items/Stavke	winter diet/zimski obrok	summer diet/letnji obrok
GE, MJ/kg	18,58	18,54
ME, MJ/kg DM/ ME, MJ/kg SM	11,67	11,16
NEL, MJ/kg DM/ NEL, MJ/kg SM	0,614	0,627

The protein value data of the used diets (table 4), calculated from the chemical composition of dietary components using the French system of protein evaluation allow to presume the development of the protein utilization compounds of different nature (dietary or/and microbial) during the two seasons. First of all, it is important to say, that the diets have close levels of parameter *PDIA* only, which reflect amount of intestine digestible rumen undegradable dietary protein. In comparison to the theoretical amounts of utilized protein as *PDIE*, represents the total quantity of intestine digestible protein (from diet and microbial origin), the results demonstrated great amounts during summer nutrition: 81,43 versus 67,54g/kg DM. The same situation in a small level occurs with another sum parameter – *PDIN*, which reflects intestine digestible protein as function of rumen degradability: 75,19 versus 66,67 g/kg DM. The *PDIA* and *PDIN* data analysis allow to calculate the balance between them, which is 1,30% and 8,30% for the winter and summer diet respectively. The reason for this great difference is the great level by 32% of *PDIMN*, which represents the microbial protein intestine digestible as function of rumen degradability. In such cases both the assimilative activity and the capacity of the intestine to utilize these great amounts of digestive protein are extremely important.

Table 4. Protein value of the using diets (g/kg DM)
Tabela 4. Proteinska vrednost korišćenih obroka (g/kg SM)

Items/Stavke	winter diet/zimski obrok	summer diet/letnji obrok
PDIA	35,75	34,37
PDIME	31,79	47,06
PDIMN	30,92	40,82
PDIE	67,54	81,43
PDIN	66,67	75,19

The values of the biochemical indices analysed in the cows' blood serum can be found in table 5. The serum total lipid content in control lactating cows ranged from 4,56 mmol/l to 6,50 mmol/l. Whereas in experimental cows supplemented with *OVOCAP*®, it ranged from 1,97 mmol/l to 5,14 mmol/l. Serum total lipids level was significantly ($P < 0.001$) lowered in the experimental cows compared to control group. *Eltohamy et al.* (1994) reported lower total lipid level in infertile buffaloes than those of fertile buffaloes. Low fat diet can contribute to low energy status due to which follicles fail to develop and early embryos are affected (*Robert, 1971*). The feeding system had significant effect on the content of triglycerides and total cholesterol in the cows' blood serum. Slightly lower levels of good cholesterol were determined in the blood serum of cows fed with supplemented diet, with ranged from 2,55mmol/l to 3,45mmol/l for control animals and between 1,04mmol/l and 2,93 mmol/l for experimental animals. Significant effect ($P \leq 0,001$) to decrease bad cholesterol (LDL and VLDL) so as triglycerides like total lipids were observed under the influence of additive. Similar findings were observed by *Kumar and Sharma* (1993) in dairy cows and *Jayachandranl* (2007) in buffaloes. Whereas *Nair et al.* (1987) reported lower cholesterol level in repeat breeding cow suggesting positive correlation between total cholesterol concentration and better reproductive performance. *Zala et al.* (1972) reported that cholesterol level has a correlation with gonadal steroid synthesis in buffalo heifers. There are similar effects of Bulgarian additive with *Tribulus terrestris* extract in poultry (*Grigorova et al., 2007; Grigorova and Kashamov, 2007; Grigorova et al., 2008*).

Table 5. Blood lipid profile in lactating cows (mmol/l) (n=20)
Tabela 5. Profil lipida u krvi krava u laktaciji (mmol/l) (n=20)

Items/Stavke	Control/Kontrola x ± SE	Experimental/Ogled x ± SE
HDL (good cholesterol/doobar holesterol)	2,89 0,09	2,42 0,16*
LDL (bad cholesterol/loš holesterol)	2.14 0,11	1,30 0,14***
VLDL cholesterol/holesterol	0,15 0,02	0,07 0,006***
Triglycerides/Trigliceridi	0,21 0,01	0,16 0,009***
Total lipids/Ukupni lipidi	5,38 0,14	3,95 0,26***

* $P \leq 0,05$

*** $P \leq 0,001$

With HDL (good) cholesterol, higher levels are better. In general there is a negative correlation between levels of triglycerides and HDL cholesterol: high blood triglycerides usually lead to lower HDL. In concerning to LDL levels they fall into these categories: optimal, less than 2,64 mmol/l and very high, 5.02 mmol/l and above. Triglyceride is a form of fat. Animals with high triglycerides often have a high total cholesterol level, including high LDL (bad) cholesterol and low HDL (good) cholesterol levels. The triglyceride level will fall into one of these categories: normal, less than 150 mg/dL, and very high, 500 mg/dL. Our results confirm these findings in general.

Conclusions

According to the obtained results it can be concluded:

- * Feed intake was similar in the two groups.
- * Observed levels of HDL cholesterol were significant ($P \leq 0,05$) but slightly lowered under the influence of *OVOCAP*®.
- * Observed levels of LDL and VLDL cholesterol as well as triglycerides and total lipids were significant lowered ($P \leq 0,001$) under the influence of *OVOCAP*®.

This experiment demonstrated that *OVOCAP*® is adjusted to use in lactating cows with sure definite benefit on blood lipid profile.

Profil lipida u krvi krava u laktaciji koje su hranjene dodatkom *OVOCAP*®

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Rezime

Cilj ispitivanja je bio utvrđivanje efekta korišćenja u ishrani dopunskog bugarskog prirodnog aditiva *OVOCAP*® per os, na profil lipida u krvi krava u laktaciji. Dvanaest krava američke smeđe rase (BW = 695 ± 28 kg; na početku laktacije) je podeljeno u dva tretmana u periodu od 1,5 godine. Krave su hranjene tipičnim obrokom tokom zime (silaža kukuruza, livadsko seno, slama, pšenične mekinje, krompir i smeša) i leta (ispaša i smeša). Ogladne krave su dobijale kao aditiv koncentrovanom delu dnevnog obroka 2x23 ml *OVOCAP*® svaka 28. dana u mesecu, prve doze su davane 3. i 4. dana post partum. BUzorci krvi su uzimani nakon davanja svake doze preparata *OVOCAP*®, jutro pre

hranjenja i serumi analizirani na trigliceride, HDL, LDL, VLDL i ukupnu koncentraciju lipida. Konzumiranje hrane je bilo slično u obe grupe. Uočeni nivoi HDL holesterola su bili signifikantno niži ($P \leq 0,05$) pod uticajem preparata *OVOCAP*®. Uočeni nivoi LDL i VLDL holesterola, kao i triglicerida i ukupnih lipida su bili signifikantno smanjeni ($P \leq 0,001$) pod uticajem preparata *OVOCAP*®. Ovi rezultati ukazuju da preparat *OVOCAP*® možda ima dejstvo hipoholesterolemije i hipotrigliceridemije kod krava u laktaciji. Ovaj ogled je pokazao da je *OVOCAP*® pogodan za korišćenje u ishrani krava u laktaciji sa sigurnom koristi sa stanovišta profila lipoproteina u krvi.

Ključne reči: koncentracija holesterola, trigliceridi, ukupni lipidi, krv, krave, *OVOCAP*®, BG

References

- AOAC, (1990): Association of Official Analytical Chemists, Official Methods of Analysis, 15th Edition. Arlington, Virginia, USA.
- DLG, (1997): Universität Hohenheim – Documentations-Stelle (Ed.) DLG – Futterwerttabellen Wiederkäuer, 7th ed. Aufl., DLG- Verlag, Frankfurt/M, 212.
- DJORBINEVA M., KITANOV I., MIHAILOVA G., DIMITROV I., (2006): The effect of supplemental feeding by “*OVOCAP*” over some milk and reproductive characteristics in dairy sheep, Proc. of scientific conference “The science under the globalization conditions”, Stara Zagora, 2, 327-332.
- ELTOHAMY M., AHMED W.M., ABDOON A.S., (1994): Studies of reproduction in farm animals under the conditions of newly reclaimed areas - ovarian activity in relation to blood composition. Proc. 4th World Buffalo Congress, Brazil, 3, 612-614.
- GfE, (1995): Zur Energiebevertng beim Wiederkäuer, Proc. Soc. Nutr. Physiol., 4, 122-123.
- JAYACHANDRAN S., SELVARAJ P., VISHA P., (2007): Blood Biochemical Profile in Repeat Breeding Buffaloes, Tamilnadu J. Veterinary & Animal Sciences 3 (2) 70-73.
- GRIGOROVA S., KASHAMOV B., SREDKOVA V., SURDJIISKA S., KURTENKOV A., (2007): Effect of Tribulus terrestris extract on semen quality and serum total cholesterol content in White Plymouth Rock-mini cocks, Sovremennii nauchen vestnik, 3 (5(13)), 11-18.
- GRIGOROVA S., KASHAMOV B., (2007): Effect of Tribulus terrestris extract on morphological and sensor properties of table. Science conference with international participation, Scientific works, volume LIV, Issue 2, Plovdiv: 247-251

- GRIGOROVA S., VASILEVA D., KASHAMOV B., SREDKOVA V., SURDJIISKA S., (2008a): Investigation of Tribulus terrestris extract on biochemical parameters of eggs and blood serum in laying hens, Archiva Zootechnica, 11, 1, 39-45.
- KITANOV I., (1998): Patent No 061634 – 1998.
- KITANOVA G., KITANOV I., (1990): The capsaicin alkaloid effect on gram negative bacteria's, Vratza, Bulgarian young researchers contribution in ecological problems solving, Scientific Conference, 97-101.
- KITANOV I., DICHEVA L., TONCHEVA E., (1996): The capsaicin - an effect on some morphological and biochemical parameters in swine organism, Sofia, Scientific Conference "Problems in Animal Husbandry", 89.
- KITANOV I., DIMITROV D., KITANOVA G., (2000a): Biological and histological studies in hens treated by "OVOCAP", Veterinary Medicine, 4, 4, 82-86.
- KITANOV I., NIKOLOV B., TIUFEKCHIEV K., KITANOVA G., (2000b): The "OVOCAP" – ecological feed supplement to active the reproduction in pheasants, LTU, Jubilee Book Proc., Sofia, 41-45.
- KITANOV I., PENKOV D., CHRISTOVA T., (2002): A comparative study on the real metabolite energy and real amino acids digestion of the standard concentrate forage in experimental geese before and after feed supplementary treating "OVOCAP", Bulgarian J. Anim. Sci., 33, 3, 40-43.
- KITANOV I., OBLAKOVA M., LALEV M., (2003): Effect of the *Ovocap* Preparation on Reproductive Parameters of Hens and Turkeys, Bulg. J. Agr. Sci., 9, 521-526.
- KUMAR S., SHARMA M.C., (1993): Haematobiochemical changes during fertile and non fertile estruses in rural buffaloes, Buffalo Journal, 1, 69-73.
- NAIR S., KHARCHE, K. G., SHIRVASTAVA O. P., (1987): Study on blood glucose and cholesterol in normal and abnormal cycling crossbred cows, Indian Journal of Animal Reproduction, 8, 12-13
- PETKOVA M., KITANOV I., ZHELEV K., (2008): Effect of *OVOCAP*® on the cows reproduction, Bulg. J. Anim. Sci. (in press).
- ROBERT S. J., (1971): Veterinary Obstetrics and Genital Diseases. CBS Publishers. India.
- VERITE R., MICHALET-DOREAU P., CHAPOUTOP J., PEYROUD L., PONCET C., (1987) : Revision du systeme des proteines digestibles dans l'intestine (PDI). Bulletin Technique C.R.Z.V. Theix, INRA, 70, 19-37.
- WAIßBACH F., KUHLA S., PRYM R., (1990) : Modell und Methode zur Schötzung des energetischen Futterweites auf der Basis der erweiterten Futtermittelanalyse, 102, VDLUFA-Kongress, 17-22.Sept., Berlin, Deutschland, 499-504.

ZALA P.M., JANAKIRAMAN K., MENON G.N.,(1972): Ascorbic acid and cholesterol of blood and adrenal during estrous cycle in Surti buffalo heifers, Indian Journal Experimental Biology, 10: 312-314.