

THE EFFECT OF TANNIN SUPPLEMENTATION OF MID-LACTATION DAIRY COWS DIETS ON METABOLIC PROFILE PARAMETERS AND PRODUCTION CHARACTERISTICS

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Abstract: The aim of this study was to examine the effect of using tannin supplement in ration for mid-lactation dairy cows (90±17 days in milk) and the number of lactation on metabolic profile parameters values. Additionally, the effect of tannin supplementation on cows' production characteristics in the 2nd lactation was evaluated. Research was conducted on 80 Holstein cows divided into two groups of 40 cows (control and experimental group) that included 16 cows in 2nd and 12 in 3rd and 4th lactation. The tannin supplement Tanimil SCC (40 g/cow/day; 40% of tannins) was added in the total mixed ration (TMR) of experimental group, while the control group of cows was fed ration without the tannin supplement. The trial lasted 60 days. Dairy cows, fed diet supplemented with tannin, had markedly lower values ($P<0.05$) of β -hydroxybutyrate concentration (0.79 vs. 0.96 mmol/L) and lower blood urea concentration (5.89 vs. 6.93 mmol/L). Difference in the blood glucose concentrations (3.92 vs. 3.89 mmol/L) was not significant. The lactation number had no significant effect on values of metabolic profile parameters (concentration of glucose, β -hydroxybutyrate and urea). The effect of interaction of lactation number and tannin supplement on the values of examined parameters of metabolic profile was not significant. Supplementation of tannin in the diet for cows in the second lactation, had a positive effect ($P<0.05$) on the milk yield (4.42%) and yield of 4% fat corrected milk (FCM, 5.24%). The use of tannin, improved concentration (3.20 vs. 3.12%) and yield (from 1.16 to 1.24 kg/day) of milk protein ($P<0.05$). Addition of tannin also improved concentration and yield of milk fat, as well as the concentration of lactose. The supplementation of Tanimil SCC to mid-lactation dairy cows had a positive impacts on reduction of blood content of β -hydroxybutyrate and urea, and improved productive performances of cows in the second lactation.

Key words: tannins; lactating cows; nutrition; metabolic profile; milk yield and composition

Introduction

Maximizing animals' daily gain or milk yield per unit of protein intake is based on improved dietary protein utilization (1). However, one of the main problems in dairy cows nutrition is the excess of ruminal degradable and deficiency of undegradable protein in ration, in absolute and relative figures, relative to the dietary content of carbohydrate fractions and rates of their ruminal degradation.

Tannins have the potential to protect proteins from ruminal degradation, and to decrease rate of $\text{NH}_3\text{-N}$ accumulation in the ruminal content, which makes them suitable additives for dairy cows diets with surplus of ruminal degradable protein, and even nonprotein nitrogen (2). High concentrations of tannins (usually higher than 50 g/kg DM) reduce voluntary feed intake and nutrient digestibility to a great extent because they decrease feed palatability, slow down digestion, and development of conditional repulsiveness (3). Intake of low to medium quantity of condensed tannins (CT) (10-40 g/kg DM) may improve feed

digestion and feed conversion mainly due to the reduction of ruminal protein degradation which is related with lower production of $\text{NH}_3\text{-N}$ and higher availability of essential amino acids and non-ammonia nitrogen for absorption in the small intestine (4). Tannins modify the ruminal fermentation by formation of poorly degradable complexes with proteins that are stable within the pH range of 3.5 to 7.0, and also by reducing quantity of immediately degradable fractions. Such formed complexes, protect proteins from microbial hydrolysis and deamination in the rumen, and increased the quantity of proteins that are degraded in abomasum and small intestine (2). These secondary plant metabolites have also a property to form reversible and irreversible complexes with polysaccharides (cellulose, hemicelluloses, starch and pectin), alkaloids, nucleic acids and minerals (5).

Values of some metabolic profile parameters, β -hydroxybutyrate (BHBA) and urea can serve to estimate cows' health status and to measure the adequacy of dietary protein levels as well as nitrogen utilization efficiency. Subclinical ketosis is characterized by elevated serum β -hydroxybutyrate concentrations (> 1.0 to 1.4 mmol/l) in the absence of clinical signs of ketosis (6). All precursors for the synthesis of milk components, reach mammary gland by blood, so the composition of the milk to the great extent depends of their blood content. Monitoring levels of blood urea nitrogen (BUN) or milk urea nitrogen (MUN) may provide information on how well the ratio of rumen degradable proteins is balanced with energy availability to optimize rumen microbial protein synthesis, as it is known that imbalance in protein and carbohydrate degradabilities may result in suboptimal animal health and lower production (7). However, the increased content of BUN and MUN could be the result of nitrogen inefficiency caused by the surplus of tissues protein supply (8). Szczechowiak et al. (9) reported that using condensed tannins in cattle nutrition significantly increased blood glucose level while concentration of BHBA was unchanged.

Several authors found that using condensed tannins in ruminant nutrition increases milk yield, milk protein, lactose and fat, decreases blood and milk urea nitrogen concentration (1, 10, 11, 12), and protects animal health (13). However, Benchaar and Chouinard (14), Aguerre et al. (15) and Broderick et al. (16) did not find

significant effect of low tannins content in cows ration, especially on the feed intake, milk yield, protein content and composition, N concentration, lactose, fat content and fatty acid profile in milk.

The objective of this study was to investigate the effects of supplementing diet for the mid-lactation dairy cows with different lactation number with tannin, and influence of these factors on some blood metabolic profile parameters concentration in cows, and also to explore the effects of tannin supplementation on the production performances of cows in the second lactation.

Materials and methods

Animals and the diets

The trial was conducted on the commercial dairy cattle farm (PKB Corporation –Padinska Skela), Serbia. Research was conducted on 80 Holstein cows (32 in 2nd, 24 in 3rd and 24 in the 4th lactation) that were housed in the individual tie stalls, divided into two groups of 40 cows (control and experimental group) that included 16 cows in 2nd and 12 in 3rd and 4th lactation. Experiment was designed as a 2×3 factorial arrangement of treatments (two rations, with and without added tannin, and three lactation number) for determination the effect on metabolic profile of cows, and as one factorial arrangement with two treatments (ration with and without added tannin) to estimate the effect on production performances of the 2nd lactation cows. The experimental groups were equalized according to the lactation number, stage of lactation (mid-lactation, 90 ± 17 days in milk), the average milk yield (38.6 ± 2.2 kg/d) and body condition score (3.2 ± 0.15). A trial period lasted for 60 days. Cows were offered a total mixed ration (TMR) two times a day (in the morning and evening) that were prepared according to the nutritional value and energy content, and balanced to meet nutritional requirements of cows for maintenance and milk production (Table 1). Cows in the control group were fed ration without supplemented tannin, while in TMR for experimental group, tannin (from horse-chestnut bark) based supplement „Tanimil SCC“ (Tanin, Sevnica, Slovenia) was added in quantity of 40 g/cow/day (contained 40% tannins). Rations were formulated for the cows of 600 kg BW with milk production of 39 kg/day, containing 3.7% milk fat

Table 1: Composition and nutritional value of the total mixed rations for dairy cows

Ingredients, kg DM/day	Control group	Experimental group
Alfalfa hay	1.78	1.78
Alfalfa haylage	1.77	1.77
Triticale silage	0.75	0.75
Corn silage	6.73	6.73
Beet pulp, ensiled	0.46	0.46
Brewers grain	1.09	1.09
Beet molasses	1.56	1.56
Barley grain	0.89	0.89
Corn grain	2.73	2.73
Wheat grain	1.33	1.33
Canola meal	1.28	1.28
Soybean full-fat, extruded	1.41	1.41
Soybean cake	1.86	1.86
Calcium carbonate	0.09	0.09
Monocalcium phosphate	0.04	0.04
Sodium bicarbonate	0.10	0.10
Salt	0.07	0.07
Vitamin - mineral mix ¹	0.18	0.18
Tanimil SCC	-	0.04
Nutrient composition		
DM, kg		24.1
CP, g/kg DM		178.0
RDP, g/kg DM		114.0
RUP, g/kg DM		64.0
NDF, g/kg DM		315.0
Forage NDF, g/kg DM		223.0
ADF, g/kg DM		192.0
NFC, g/kg DM		423.0
EE, g/kg DM		44.0
Ca, g/kg DM		6.0
P, g/kg DM		4.0
Energy value NE _l , MJ/kg DM		6.65

¹Mixture of vitamins and trace elements, 1 kg contains: Vitamin A – 500000 IU, Vitamin D – 300000 IU, Vitamin E – 1600 IU, Mg – 6.7 g, S – 1g, Fe – 1000 mg, Cu – 1300 mg, Mn – 6600 mg, Zn – 5500 mg, J – 90 mg, Se – 15 mg, and Co – 5 mg.

DM: dry matter; CP: crude protein; RDP: rumen-degradable protein; RUP: rumen-undegradable protein; NDF: neutral detergent fibre; ADF: acid detergent fibre; NFC: non-fibre carbohydrates; EE: ether extract; Ca: calcium; P: phosphorus

and 3.4% protein by using NRC (17) model and programme package Version 1.1.9. The cows had ad libitum access to water.

Analytical procedure

Chemical analysis of feeds and TMRs were performed in the Laboratory for quality management EKO - LAB DOO in Belgrade. For chemical analysis, the TMR samples were collected twice weekly during the trial period. The proximate and detergent fiber analysis parameters were determined according to the AOAC methodology (18).

Blood biochemical parameters

Blood sampling was performed only at the end of trial. Approximately six hours after morning feeding, by venipuncture of *v. coccigea*, 20 mL of blood, from all cows in the experiment, were taken into the test tubes, and immediately transported to the laboratory in a portable freezer. Whole blood samples were centrifuged for 10 minutes at 3000 rpm and serum samples were analyzed by standard biochemical procedures. Determination of values for basic parameters of the cows metabolic profile: concentration of blood glucose, BHBA and urea, was performed using semi-automatic biochemical analyzer RT-1904C (Rayto Life and Analytical Sciences Co. Ltd) in the laboratory for diagnostic analysis of the PKB Corporation - Centre for livestock production, Belgrade.

Milk yield and composition

The milk yield and chemical composition (content of milk fat and milk protein) were determined at the end of the trial. Milk was sampled according to the internationally agreed principles ICAR (19), by using the MK V Milk Meter (Waikato Milking Systems New Zealand Ltd.). The sample (25 g/kg milk) was a proportional part of a total milk quantity. After milking and milk homogenization by the above mentioned sampler, the milk was poured in bottles in an amount of 100 mL and conserved by the addition of 0.2-0.5 % of potassium dichromate ($K_2Cr_2O_7$). Milk chemical composition (content of milk fat and protein) were estimated by infrared spectroscopy using the Milko Scan 104/SN (Foss Electric, Hillerod, Denmark) in the ECO - LAB DOO laboratory in Belgrade.

Statistical analysis

In order to investigate the effects of tannin based supplement and lactation number, and interaction of these factors on metabolic profile basic parameters, the multivariate analysis of variance was used.

The significance of the tannin addition effect on production performances of the 2nd lactation cows was estimated by Student's t-test. Statistical significance was determined at the level of $P < 0.05$.

For statistical analysis of the obtained results, a free version of statistical software PASW Statistics 18 SPSS Inc. package was used (20).

Results

Results of the effects of tannin supplementation, lactation number, and interaction of these factors on the values of the examined blood metabolic profile parameters (concentration of glucose, BHBA and urea) of mid-lactation dairy cows are presented in Table 2.

Blood glucose concentration was slightly increased for cows fed ration supplemented with tannin (0.77%), which was not significant. Cows fed TMR supplemented with tannin, had markedly lower average BHBA concentration in blood and content of blood urea ($P < 0.05$) in comparison to the control group (by 17.71% and 15.01%, respectively). A significantly lower concentration of BHBA was found ($P < 0.05$) in the group fed ration supplemented with Tanimil SCC only for the cows in the second lactation, while the blood urea concentration was significantly lowered ($P < 0.01$) in the experimental group only for cows in the third lactation. In the present study it was documented that lactation number did not influence values of glucose, BHBA and urea. Results obtained in this study indicate that there is no interaction of lactation number and tannin supplement addition in TMR of mid-lactation dairy cows, regarding the effect on basic parameters of cows' metabolic profile.

Effects of tannin supplement on the cows production performances in the second lactation are presented in Table 3.

Cows in the second lactation, that were fed tannin supplemented ration had a significantly higher milk yield and higher yield of 4% fat corrected milk (FCM) when compared to cows from the control group (by 4.42 and 5.24%, respectively) ($P < 0.05$). Higher

Table 2: Effect of tannin supplementation (T), lactation number (L) and interaction of these factors (T×L) on blood metabolic parameters at mid-lactation dairy cows (mean ± SD)

Parameters ¹	Without tannin			Supplemented tannin			<i>P values</i>		
	Lact. 2	Lact. 3	Lact. 4	Lact. 2	Lact. 3	Lact. 4	T	L	T×L
Glucose (mmol/L)	4.10±1.26	3.95±0.36	3.69±0.35	3.77±0.29	3.93±0.59	3.95±0.65	0.856	0.271	0.302
\bar{X}		3.89±0.74			3.92±0.53				
BHBA (mmol/L)	1.11±0.34	0.86±0.21	0.94±0.57	0.84±0.19	0.82±0.35	0.70±0.14	0.014*	1.549	0.365
\bar{X}		0.96±0.39			0.79±0.26				
Urea (mmol/L)	7.26±3.28	7.15±1.38	6.31±1.24	6.50±1.18	5.73±1.46	5.50±1.76	0.018*	1.732	0.752
\bar{X}		6.93±2.09			5.89±1.50				

¹Mean values ± standard deviation are showed in the same row

BHBA – β-hydroxybutyrate

* - P<0.05

Table 3: The effect of tannin supplementation on milk yield and chemical composition (mean ± SD)

Parameter ¹	Diet with tannin	Diet without tannin
Milk yield, kg/day	38.95±4.7 ^a	37.30±4.1 ^b
4% FCM yield, kg/day	37.33±4.2 ^a	35.47±4.0 ^b
Milk fat concentration, %	3.73±0.38	3.68±0.51
Milk fat yield, kg/day	1.45±0.29	1.37±0.31
Milk protein concentration, %	3.20±0.12 ^a	3.12±0.13 ^b
Milk protein yield, kg/day	1.24±0.10 ^a	1.16±0.11 ^b
Milk fat : protein ratio	1.17	1.18
Milk lactose concentration, %	4.63±0.10	4.50±0.12

¹Mean values ± standard deviation are showed in the columns

FCM: 4% fat corrected milk calculated as (0.4 x kg milk + 15 x kg milk fat)

a, b - Values within the same row not sharing a common letter were significantly different (P<0.05)

milk fat content, fat yield and milk lactose were also found for a group that received tannin in TMR, but determined differences were not significant. The TMR that included tannin provided a higher milk protein concentration by 2.56% (P<0.05) and a higher protein yield by 6.89% (P<0.05) relative to ration without tannin.

Discussion

The aim of this study was to examine the effect of using tannin supplement in ration for mid-lactation dairy cows and the number of lactation on metabolic profile parameters values, as well

as, on the production performances of cows in the second lactation. Blood glucose concentration was analyzed since its concentration in the blood of dairy cows is important for energy balance and lactose production in the mammary gland. Determined values were within the physiological range (21, 22). In the present study, similar glucose levels indicated that physiological values exist in all experimental animals. Soltan (11) also reported that replacing of row soybean by processed or tannin supplemented soybean (extruding, addition of plant tannins extract and essential oils, addition of plant tannins and pelleting) in diet for dairy cows did not influence glucose

concentration in blood serum. After addition of leaf meal mixture of different tanniferous plants, the blood glucose level of dairy cows was within the range of physiological values without marked variations (1). It was reported that tannins increase blood glucose concentration, due to their ability to modulate the activity of rumen microorganisms and consequently ruminal fermentation (9). As a result, there is a change in the ratio (%) of volatile fatty acids, with an increase of the ruminal production of propionate, which is a precursor for glucose synthesis. In the present study, values determined for blood BHBA concentration indicate moderate mobilization of body fat reserves, because the physiological concentration of blood BHBA for lactating cows is within the range of 0.6 to 1.0 mmol/L (23). Bjerre-Harpøth et al. (24) stated that increase in the glucose level influence lowering of the blood BHBA, and in the present study a similar tendency was observed.

Concentration of blood urea in both experimental groups of cows was within the physiological range values (2.0-7.5 mmol/L) according to Radostitis et al. (22), with markedly lower average content of blood urea in the group of cows fed TMR supplemented with tannin, which indicated more efficient protein utilization. Obtained results are in line with earlier findings (1, 25) that indicated reduced protein degradation and production of NH_3 in rumen, and therefore, consequently, lower absorption of ammonia through the rumen wall into the blood. Dairy cows fed rations that contained processed or supplemented soybean had reduced blood urea N (4.9, 6.0 and 7.7%, respectively, $P < 0.05$) in comparison to the control group fed raw soybean diet (11). The lower blood urea N concentrations reflected improvement in nitrogenous components metabolism from diet and increased absorption of essential amino acids (26). Our results are consistent with those of Sarker et al. (27) reporting that blood urea nitrogen value did not differ significantly between cows in different lactation. However, Roussel et al. (28) found that circulating BUN levels significantly varied in respect to the lactation number. Prpić et al. (29) also found significant effects of the lactation number on metabolic profile parameters of high-yielding cows (higher urea concentration with increased lactation number). Increased urea concentration is an indicator of disproportion between rumen degradable protein intake and fermentable for the rumen microorganisms, as it indicates an

increased rate of the ureagenesis in the liver which requires large amounts of energy (30).

The results of our study are in line with those of Dey and De (1) about positive impact of condensed tannins (CT) from tanniferous *Ficus bengalensis* leaves on milk production and milk fat content, and their additive significant positive effect on 4% fat corrected milk yield in crossbred cows during mid-lactation. Same authors also found improved milk production efficiency (kg of feed/kg of FCM yield) ($P < 0.05$) for cows fed CT. Wanapat et al. (31) reported that CT rich cassava hay in the diet of dairy cows, may provide additional volatile fatty acids required for the synthesis of milk fat. According to Mabjeesh et al. (26) a higher percent of milk fat, in cows fed ration supplemented with tannin, was the result of additional postruminal digestion. The effect of condensed tannin in improving production characteristics can be explained by increased availability in the intestines and increased supply of tissues with the essential amino acids from protected feed proteins (32). Methionine plays an important role as a methyl donor during the synthesis of milk fat, and also as the precursor for phospholipids components i.e. choline synthesis (33). However, feeding dairy cows with the addition of large quantities of tannin, such as 100 or 200 g/day of commercial tannin product (QT_{100} and QT_{200} , respectively), resulted in a decrease ($P < 0.05$) of the daily milk yield from 30.17 to 26.34 and 25.92 kg in the experimental group of cows when compared to the control (13.0 and 14.2%, respectively) (34). Benchaar and Chouinard (14) reported that supplementation of diet with quebracho condensed tannin extract (*Schinopsis balansae*) (150 g/day, 0.45% DM) had no effect on milk fat composition.

Supplemented tannin did not have a profound effect on the milk lactose content. As lactose is synthesized in the mammary gland directly from blood glucose, and in ruminants the gluconeogenesis is predominantly carried out from propionic acid and amino acids, increased availability of amino acids, especially methionine, lysine and amino acids with branched chains, contributes to the extensive synthesis of lactose (35).

In the present study, a somewhat higher values for milk protein concentration were found in cows from the experimental group (3.2%) than the average value of this parameter in Holstein cows, which according to Kirovski et al. (36) is 3.06%. The aim of the modern cattle production

is to achieve protein content of 3.4% in the milk of high-yielding cows, which is in accordance with the tendency for the purchase price of milk to be based on milk protein content (37). The results obtained in our study are consistent with the results of Attia et al. (34) who claimed that using QT_{100} and QT_{200} increased ($P<0.05$) milk protein percentage (3.59% and 3.48%, respectively) when compared to the control group (3.29%). One of the reasons for these effects is an increase in metabolic supply with the undegradable protein due to binding of proteins with CT. The milk fat to protein ratio in our trial did not differ significantly between examined groups of cows. According to Stoop et al. (38), a fat to protein ratio lower than 1.05 reflects milk fat depression, a dietary problem causing an energy imbalance, associated with an increase in the milk fat proportion of total unsaturated fatty acids.

Unlike our results, Aguerre et al. (15) reported that the addition of a quebracho-chestnut tannin extracts (ratio 2:1) did not affect the milk yield, and also determined a trend of linear reduction in branched-chain volatile fatty acid concentration, milk protein concentration and yield, and decrease in fat-and-protein-corrected milk yield, with the increase in tannin levels in the nutrition of cows. Addition of large amounts of tannin caused a decline in milk yield, milk fat and protein concentration, showing a low potential to alter ruminal bio-hydrogenation process and to modify fatty acid profile of milk fat (14). Disagreements in the obtained results may be explained by different sources and levels of added tannins, animal physiological status and diet composition. Effects of mildly excessive CT supplementation can be tolerated for short periods (weeks), but prolonged feeding of CT can slow down digestion rates, increase rumen digesta mass and reduce productivity (39). Moreover, the addition of condensed tannin reduced digestibility of the starch, leading to a decrease in the production of volatile fatty acids, wherein the decrease in the amount of propionate limited glucose synthesis and therefore altered lactose synthesis.

Conclusions

According to the results of this study it may be concluded that mid-lactation dairy cows fed TMR supplemented with tannin had significantly lower concentrations ($P<0.05$) of blood BHBA

and urea, with slightly increased concentration of glucose. There was not significant effect of the lactation number, neither interaction of the tannin supplementation in diet and lactation number on values of basic parameters of cows metabolic profile. The addition of tannin in diets for cows in the second lactation had a positive effect on milk production, content and yield of milk proteins ($P<0.05$), while differences in the content and yield of milk fat and lactose were not significant. Results of the present study indicate that tannin supplement „Tanimil SCC“ may be successfully used in nutrition of lactating dairy cows, whereby added to the TMR in quantity of 40 g/cow/day probably has protective effects on rapidly degradable dietary protein and decreases their ruminal degradation. This improves protein utilization, having a positive effect on a significant reduction of blood urea and BHBA concentrations, and improving production performances.

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UČINEK PREHRANSKEGA DODATKA S TANINOM V PREHRANI KRAV SREDI LAKTACIJE NA PARAMETRE PRESNOVNEGA PROFILA IN NJIHOVE PROIZVODNE LASTNOSTI

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Povzetek: Cilj študije je bil proučiti učinek dodajanja tanina v obroku pri kravah molznicah sredi laktacije (90 ± 17 dni v mleku) in števila dojenj telet na nekatere parametre presnovnega profila. Poleg tega je bil ovrednoten tudi učinek dodajanja tanina na proizvodne lastnosti krav v drugi laktaciji. Raziskave so bile izvedene pri 80 kravah pasme Holstein, razdeljenih v dve skupini po 40 krav (kontrolna in poskusna skupina), ki so vključevale 16 krav v 2. in 12 v 3. in 4. laktaciji. Dodatek tanina Tanimil SCC (40 g/kravo/dan; 40 % taninov) je bil dodan v skupni mešani obrok (TMR) poskusne skupine, medtem ko je bila kontrolna skupina krav krmljena brez dodatka tanina. Poskus je trajal 60 dni. Krave molznice, hranjene s krmo z dodanimi tanini, so imele izrazi-to nižje vrednosti ($P < 0,05$) koncentracije β -hidroksibutirata (0,79 v primerjavi z 0,96 mmol/L) in nižjo koncentracijo sečnine v krvi (5,89 v primerjavi z 6,93 mmol/L). Razlika v koncentraciji glukoze v krvi (3,92 v nasprotju z 3,89 mmol/L) ni bila statistično značilna. Dojenje ni značilno vplivalo na vrednosti parametrov presnovnega profila (koncentracije glukoze, β -hidroksibutirata in sečnine). Medsebojni vpliv števila laktacij in dodatka tanina na vrednosti pregledanih parametrov presnovnega profila ni bil statistično značilen. Dopolnilo tanina v krmi krav v drugi laktaciji je imelo pozitiven učinek ($P < 0,05$) na mlečnost (4,42 %) in na količino mleka s popravljeno vrednostjo 4-odstotne maščobe (FCM, 5,24%). Uporaba tanina je izboljšala koncentracijo beljakovin (3,20 v primerjavi z 3,12%) in izkoristek mlečnih beljakovin (od 1,16 do 1,24 kg/dan) ($P < 0,05$). Dodatek tanina je izboljšal tudi koncentracijo in izkupiček mlečne maščobe ter koncentracijo laktoze. Dodatek Tanimila SCC kravam na sredini laktacije je pozitivno vplival na znižanje vsebnosti β -hidroksibutirata in sečnine v krvi ter izboljšal produktivnost krav v drugi laktaciji.

Ključne besede: tanini; krave v laktaciji; prehrana; presnovni profil; mlečnost in sestava mleka