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EFFECT OF *YUCCA SCHIDIGERA* ON SOME BIOCHEMICAL PARAMETERS IN LAMBS[1]

D. Gudev, Simona Popova-Ralcheva, Penka Moneva, L. Kozelov, F. Iliev[2]

Abstract: Sixty days old lambs (n=30), fed a concentrate mixture and meadow hay at a ratio 57:43 were allocated into 2 groups. Experimental lambs diet was supplemented with 2 g *yucca schidigera* per lamb daily. The experiment was divided in 2 periods according to the composition of the concentrate mixture. The concentrate mixture fed during the second period (44-75 day) had lower protein content compared to that in the first period (1-43 day). Plasma concentration of urea, cholesterol, indol and complement activity were determined at the end of each period.

Yucca treatment caused a decline ($p<0.05$) in plasma urea level during the second period, but had no effect during the first period. Plasma cholesterol level in experimental group was higher than that in control group during the first period, but there were no significant differences between the two groups during the second period. Yucca treatment resulted in insignificant decline in plasma indol level during the second period, and had no effect on plasma complement activity.

Taken as a whole our findings suggest that *yucca schidigera* treatment contributes to better protein utilization, and possibly has an inhibitory effect on some pathogenic bacteria during the second period.

Key words: urea, cholesterol, indol, complement activity

Introduction

Yucca saponins have been reported to have strong antiprotozoa activity (*Wallace et al*., 1994). Yucca supplemented diets modulate plasma urea concentration. However, the published data dealing with the effect of Yucca are controversial. There are evidence that Yucca saponins reduce blood urea in rat (*Preston et. al*., 1987) and poultry (*Baloh et al.*, 1994), elevate blood urea in sheep (*Ryan et al., 2001*) and have stimulatory (*Wilson et al.,* 1998) or no effect (*Wu et al*., 1994) in cows. Furthermore, the desert plant yucca has been reported to have hypocholesterolemic properties both in quail (*Kaya et al*., 2003) and man (*Kim et al*., 2003).

This experiment was undertaken to investigate the effect of supplemental yucca on plasma urea, cholesterol, complement and indol in lams.

Material and methods

Thirty Karakachanska and Balkan mountainous lambs at the age of 60 days were allocated into two analogous groups. The lambs were fed concentrate mixture and meadow hay at a ratio 57:43. The composition of the concentrate mixture is shown in table 1. The concentrate mixture of the experimental group was supplemented with 2 g. of *Yucca schidigera* per lamb/daily. Blood samples were taken *via venipuncture* of the jugular vein at the end of 1st (1-43) and 2nd (44-75) day period. All samples were collected in the morning before feeding. The only difference between the two periods being the changed ratio between the concentrate ingredients.

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[2] D. Gudev, Simona Popova-Ralcheva, Penka Moneva, L. Kozelov, F. Iliev, Institute of Animal Science, Kostinbrod, Bulgaria

Table 1. Composition of concentrate mix

Ingredient, %	Period	
	I/1st 1-43 day	II/2nd 44-75 day
Barley	36.0	81.0
Wheat	36.5	9.0
Sunflwer meal	25.0	8.0
Limeestone	1.7	1.2
Vitamin premix	0.8	0.8
Total:	100.0	100.0
Concentrate mix contain in 1 kg:		
- FUG	1.20	1.24
- CP, g	181	123
- PDI, g	103	88
- BPR, g	+18	-7.6
- Ca, g	7.5	5.3
- P, g	5.3	4.0

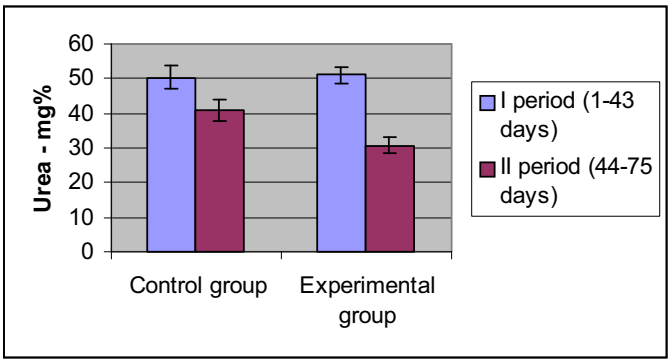
Plasma urea was measured by the method of *Rerat et al*. (1979); plasma cholesterol level - by the method of *Mrskos and Tovarek* as described by *Ibrishimov and Lalov* (1987); complement activity - by the methods of *Grislova et al.* (1978); plasma indol level - by the method of *Balahovski and Balahovski* (1959).

Values are expressed as means ± S.E.M. Statistical analyses was performed by *Student`s t-test*.

Results and discussion

There were no significant differences in plasma urea levels between control and experimental group during the 1st period of the experiment (Fig. 1). However yucca resulted in significant ($p<0.05$) decline in plasma urea level during the second period. According to the generally held view the effect of yucca on plasma urea level is related with the antiprotozoal activity of its saponin fraction (*Hristov and Broderick,* 1996; *Hristov et al*., 1999) which results in increased flow of microbial protein to the intestine and therefore amino acids for absorption. Ammonia binding capacity of yucca`s glycofractions is considered as extremely limited compared with normal ruminal ammonia concentration (*Wallace et al., 1994*). The decrease in plasma urea level in lambs receiving yucca supplemented diet during the second period is consistent with the view of *Hristov et al*. (1999) that the effect of yucca results from decreased bacterial lysis rather than from diminished deaminative activity and direct binding of ammonia in the rumen.

Figure 1. Plasma levels of urea



However this view is in contrast with the lack of any effect on urea level in lambs, fed with yucca supplemented diet during the 1st period.

One of the reasons for the observed discordance could be the fact that the ratio of forestomach compartments in lambs reaches that of the full grown sheep at about 6 month of age (*Petkov,* 1982).

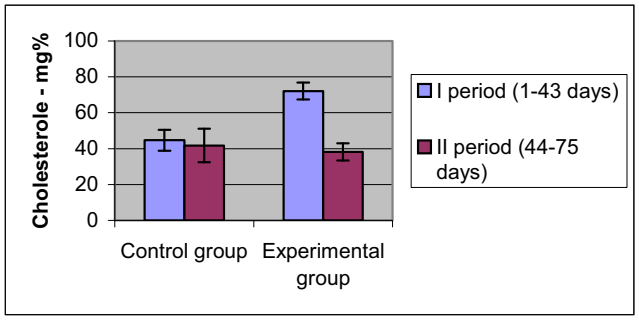
Thus it could be expected that the digestive tract of the lambs during the 1st period had not reached the ability of the full grown sheep to digest food.

The decline of plasma urea level in control lambs during the second period was probably due to the lower protein content of the diet during the second period since it has been shown that the lower level of diet protein decreases urea N production (*Marini et al*., 2004). An alternative explanation of the observed, lowering effect of yucca on plasma urea during the second period could be related to the higher catecholamines levels in animals fed low protein diets (*Pissaia et al*., 1980). Catecholamines are known to stimulate adrenal glucocorticoids which in turn stimulate gluconeogenesis (*Lapdau et al.*, 1962). Most of glucose available to the ruminants has to be supplied by gluconeogenesis, since little glucose is normally absorbed from the gut (Ballard et al., 1969). Therefore the provision of glucose is energetically expensive process especially for growing animals. The higher glucose demand in lambs could be met by the use of gluconeogenetic precursors from exogenous or endogenous sources, the latter being energetically more expensive. Numerous studies have shown that defaunating effect of saponins is often related with increased molar proportions of propionic acid in the rumen (*Hristov et al.,* 1999). Propionic acid is the main gluconeogenic precursor in ruminants (*Danfer et al.,* 1995) and might provide les expensive energy needed for better use of ammonia originating both from the rumen and from protein catabolism, which take place during the normal tissue turnover in the body. It is also worth mentioning that the lowering effect of Yucca on urea level is more consistent in nonruminant animals than in ruminants (*Ryan et al.*, 2001; *Wilson et al*., 1998; *Balog et al*., 1994). The downregulatory effect of yucca on urea level in the current study confirms our argument, since yucca extract has been found to cause opposite effect (significant increase) of blood urea in full grown sheep (*Ryan et al*., 2001). The very fact that the effect of yucca on plasma urea is more consistent in nonruminants suggests that yucca might exert its effect by modulation of the intestinal digestion.

Lu and Jorgenen (1987) have reported increased degradability of fiber fractions in the hind gut of sheep when saponins were added to the diet. Yucca saponins pass through the digestive tract unabsorbed and according to *Hristov et al*. (1999) could affect post ruminal digestibility of the nutrients. However it should be taken into account that the controversial effort of yucca on plasma urea level in ruminants might also be due to differences in the diet ingredients, the time of sampling and the experimental design, used by the investigators. In summary our results dealing with the effect of yucca on plasma urea showed that while supplemental yucca had no effect on plasma urea level during the first (60-103 day) period it caused a significant increase in urea level during the second (103-134 day) period.

The lower plasma urea level during the second period is indicative of better protein utilization, since urea has been proposed to be an indicator of N losses and a valuable management tool (*Harris et al*., 1995).

Figure 2. Plasma levels of cholesterol

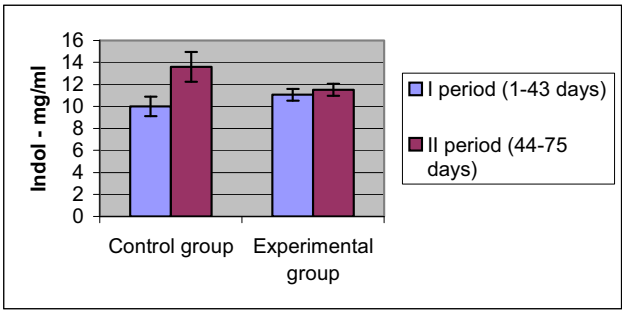


Plasma level of cholesterol was increased in yucca treated lambs, during the 1st period ($p<0.01$) but declined to levels similar to those in control group during the second period (Fig. 2). Yucca has been shown to

reduce plasma cholesterol in man (*Kim et al*., 2003) and quail (*Kaya et al*., 2003). Saponins - induced depletion of body cholesterol is achieved by the binding of bile acids and cholesterol thus preventing cholesterol reabsorption and increasing its excretion. However we did not find any data dealing with the effect of yucca on cholesterol level in ruminants. It seems that yucca stimulates or has no effect on plasma cholesterol level in lambs. The fact that the effect of yucca schidigera on plasma cholesterol level in lambs was opposite to that found in man and quail suggests that the effect of yucca on rumen microflora might have influenced intestinal reabsorption of cholesterol. Our findings come to show once more that the effect of yucca is probably exerted at the intestinal level. The observed enhancement of plasma cholesterol level in yucca treated lambs during the 1st period remains to be elucidated.

Supplemental yucca had no effect on plasma indol level during the 1st period, but caused insignificant decline in plasma indol level during the 2nd period (Fig. 3).

Figure 3. Plasma levels of indol



The lower protein content of the diet during the 2nd period induced higher ($p<0.05$) indol level in control group in comparison with the indol level in control lambs during the 1st period. The observed enhancement of plasma indol level in control lambs during the 2nd period could be due to the physiological adaptation to the lower protein content of the diet, which comprises increased reabsorption and salvage of urea by the kidney and increase in the clearance of urea into the gastrointestinal tract (*Marini et al*., 2004).

Yucca-induced decline in plasma indol level suggests that yucca might have inhibitory effect on some pathogenic and less desirable bacteria, which are responsible for the production of indol.

Yucca had no effect on serum complement activity (Fig. 4, 5). The alternative pathway of complement activation, used in our study, showed that yucca did not influence the antibody independent route for complement activation.

Figure 4. Plasma levels of serum complement activity

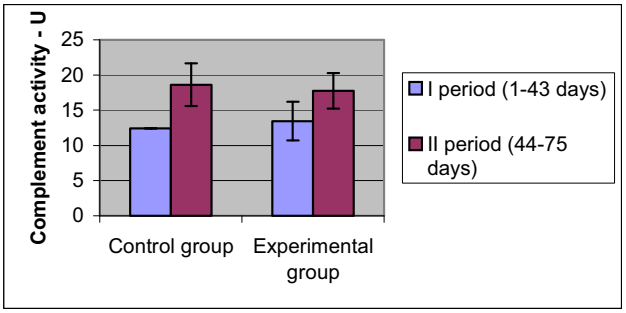
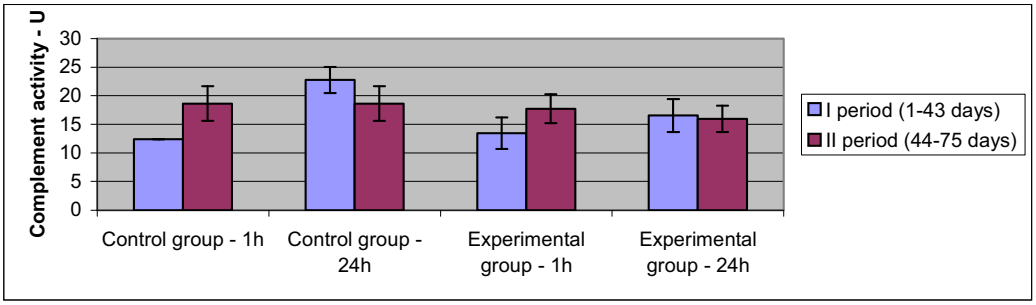


Figure 5. Plasma levels of serum complement activity



Conclusion

In conclusion, supplemental yucca caused a decline of plasma urea level in lambs older than 103 days of age, fed lower protein diet. Yucca resulted in an increase of plasma cholesterol levels in lambs up to 103 days of age. Plasma indol level and serum complement activity were not significantly influenced by yucca treatment.

UTICAJ *YUCCA SCHIDIGERA* NA NEKE BIOHEMIJSKE PARAMETRE KOD JAGNJADI

D. Gudev, Simona Popova-Ralcheva, Penka Moneva, L. Kozelov, F. Iliev

Rezime

Jagnjad u uzrastu od 60 dana (n=30) i hranjena koncentratnom smešom i livadskim senom u odnosu 57:43 je podeljena u dve grupe. Ogledna jagnjad je u obroku dobijala 2 g *yucca schidigera* po jagnjetu dnevno. Ogled je podeljen u 2 perioda prema sastavu koncentratne smeše. Koncentratna smeša korišćena u drugom periodu (44.-75. dana) je imala niži sadržaj proteina u poređenju sa prvim periodom (1.-43. dana). Koncentracija uree u plazmi, kao i holesterola, indola i komplementarna aktivnost su određivani na kraju svakog perioda.

Yucca tretman je uticao na pad ($p<0.05$) nivoa uree u plazmi tokom drugog perioda, ali nije imao uticaj tokom prvog. Nivo holesterola u plazmi u oglednoj grupi je bio viši nego u kontrolnoj tokom prvog perioda, ali nije bilo signifikantnih razlika između grupa tokom drugog perioda. Yucca tretman je rezultirao u neznatnom padu u nivou indola u plazmi tokom drugog perioda, ali nije imao uticaj na komplementarnu aktivnost plazme.

U celini, naši rezultati sugerišu da tretman sa *yucca schidigera* doprinosi boljem korišćenju proteina i verovatno ima inhibitorni efekat/dejstvo na neke patogene bakterije tokom drugog perioda.

Ključne reči: urea, holesterol, indol, komplementarna aktivnost

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