EFFECT OF HYDROLYSABLE TANNIN BASED PRODUCT ON FEED INTAKE, PROTEIN DIGESTIBILITY, RUMINAL CHARACTERISTICS AND BLOOD UREA NITROGEN IN BUFFALO BULLS

Muhammad Imran, Muhammad Aziz ur Rahman and Muhammad Sharif*

ABSTRACT

This trial was conducted to check the effect of commercially available hydrolysable tannin (Silvafeed Bypro) on feed intake, protein digestibility, rumen pH, ammonia nitrogen and blood urea nitrogen in *Nili Ravi* buffalo bulls. Four cannulated buffalo bulls were alloted in 4x4 Latin Square Design. The diet consisted of 50% seasonal fodder and 50% concentrate. Four iso-caloric (ME: 2800 kcal/kg) and iso-nitrogenous (CP: 18%) concentrate rations T1, T2, T3 and T4 were formulated and supplemented with 0, 10, 20 and 30 g hydrolysable tannin respectively per animal on daily basis. Diets as a total mixed ration were given to the bulls *ad libitum* twice a day. The results showed that adding tannin in diet had unaltered effect (P>0.05) on feed intake, digestibility of crude protein, ruminal pH, ammonia nitrogen and blood urea nitrogen. However, slightly increased numerical values were found for feed intake, crude protein digestibility and ruminal pH while slightly decreased numerical values were found for ruminal ammonia nitrogen and blood urea nitrogen at different inclusion levels of hydrolysable tannin in diet. It is concluded that numerical values for feed intake, crude protein digestibility, ruminal pH, ammonia nitrogen and blood urea nitrogen are slightly better but non-significant than control when buffalo bull were fed diets supplemented with hydrolysable tannin.

Keywords: *Bubalus bubalis*, buffaloes, hydrolysable tannin, feed intake, crude protein digestibility, ruminal characteristics, buffalo bulls

INTRODUCTION

Inadequate availability of protein in Pakistan is the main reason of low productivity in ruminants. Efficient utilization of dietary protein is very necessary because inefficient utilization of protein demands over feeding of protein which is not economical. Therefore, ruminant nutritionists are much interested to control protein degradation to ensure the supply of balanced protein from microbial synthesis (Broderick *et al*., 1991). Plant secondary compounds like tannins are able to prevent protein from breakdown in the rumen and they can be used for this purpose (El-Waziry *et al*., 2005). Tannin belongs to subcategory of plant polyphenols which is differentiated from other types of polyphenols because they are able to make linkages with proteins and precipitate them (Hagerman and Butler, 1978; Hagerman, 2012). These polyphenolic compounds are water soluble and categorized into two categories: hydrolysable

Institute of Animal and Dairy Science, University of Agriculture, Faisalabad, Pakistan, *E-mail: drsharifuaf@yahoo.com

tannin and condensed tannin (Haslam, 1988; Fickel *et al*., 1997; Frutos *et al*., 2004).

Dry matter intake (DMI) was found more in animals fed diet supplemented with hydrolysable tannin (Soleiman and Kheiri, 2018). Digestibility of protein is improved by tannins which make the complexes with protein and prevent unnecessary microbial breakdown in rumen (pH 5.5 to 7). Protein is released for digestion and absorption when these complexes are broken down in abomasum and lower small intestine (Jones and Mangan, 1977; Mueller-Harvey, 2006). Ability of tannin to make reversible and irreversible complexes with protein can reduce production of ammonia nitrogen (NH_3-N) in the rumen as well as excretion from the animal which leads to better efficiency of N-utilization (Lorenz *et al*., 2013). Ammonia nitrogen is reduced due to less protein break down in the rumen which is responsible for decreased urinary nitrogen and slightly increased fecal nitrogen (Mueller-Harvey, 2006). Tannins bind with salivary mucoproteins and produce astringent taste which can increase saliva production and salivary flow to rumen to improve pH control in rumen (Van Soest, 1994).

So, keeping in view all aspects of supplementation of hydrolysable tannin based product in ruminant diets, this trial was designed to observe the effect of Silvafeed Bypro on feed intake, protein digestibility, ruminal characteristics and blood urea nitrogen in buffalo bulls.

MATERIALS AND METHODS

The research trial was performed at Raja Muhammad Akram Animal Nutrition Research Centre, University of Agriculture, Faisalabad. Four rumen cannulated *Nili Ravi* buffalo bulls were used in this trial. These animals were weighed before the start of experiment to calculate the feed requirements. Before the start of experiment, animals were given bath with clean water and shifted to their individual pens in the shed. Disinfectant was used weekly on the fistula of the animal to prevent any kind of infection.

The diet consisted of 50% seasonal fodder and 50% concentrate. Four iso-caloric (ME: 2800 kcal/kg) and iso-nitrogenous (CP: 18%) concentrate rations T1, T2, T3 and T4 were formulated and supplemented with 0, 10, 20 and 30 g hydrolysable tannin respectively per animal on daily basis. Diets were fed to the bulls *ad libitum* twice a day as a total mixed ration in 4x4 Latin Square Design. Buffalo bulls were given free access to fresh and clean water. The overall experiment was lasted for 40 days. Experiment was divided into 4 periods. Each experimental period was of 10 days. First 7 days of each experimental period were used for adaptation period while remaining 3 days were used for collection period.

Data on feed offered and feed ort were collected on daily basis to calculate feed intake during each collection period. For determination of crude protein (CP) digestibility, CP of feed intake and fecal outgo was determined daily throughout each collection phase. The fecal samples of every animal were taken, weighed, thoroughly mixed on daily basis and 20% of it was taken and dried up at 55°C. At the last of every collection phase, these dried samples were mixed and 10% of the mixed sample was used for analysis of crude protein.

For analysis of rumen pH and ammonia nitrogen, samples of rumen liquor were taken at 3, 6, 9 and 12 h from rumen after morning feeding for first two days during each collection duration. Portable pH meter was used to measure rumen pH immediately after sample collection. These samples

were filtered through 4 layers of cheesecloth and 50 mL of the fluid was acidified with 3 mL of 6 N HCl to seize fermentation and these samples were stored for lab analysis by freezing in refrigerator. Then these samples were used to check ruminal NH_3-N after thawing. Samples of feed, feces and rumen liquor were analyzed for determination of nitrogen content. Nitrogen was determined by Kjeldhal's method and titration against sulphuric acid (AOAC, 2000). Crude protein of feed and feces was calculated as N × 6.25. For determination of blood urea nitrogen, samples of blood were taken from jugular vein in serum separating tubes by using sterile syringe.

Statistical analysis

The data were subjected to analysis of variance and treatment means were compared by using Tukey's test.

RESULTS AND DISCUSSION

Feed intake

Results had shown non-significant change (P>0.05) between all the treatments (Table 3). However, numerical readings were slightly higher for 10, 20 and 30 g of hydrolysable tannin as compared to control. Results were in line with the observations of Bengaly *et al*. (2007) who noticed non-significant increases in total DMI. Similarly, Pineiro-Vazquez *et al*. (2018) found no effect on feed intake when *L. leucocephala* (tannin containing plant) was included in diet at the levels of 0, 20, 40, 60 and 80% of DM. Similarly, Moreover, Gunun *et al.* (2016) reported that DMI was not affected when mao seed meal (tannin containing plant) was added in the diet at the levels of 0, 0.8, 1.6 and 2.4% of DMI. Parallel results were found by Sedighi-Vesagh *et al*. (2015) when tannin was used in the ration of dairy goats. The lack of significant effect on feed intake may be due to the little concentration of tannin (Mokhtarpour *et al*., 2017).

However, Barajas *et al.* (2011) noticed that supplementation of tannin improves DMI in relation to control group. Similarly, Rivera-Mendeza *et al.* (2017) stated that supplementation of tannin resulted in increased feed intake in ruminants. Higher feed intake in ruminants fed tannin supplemented diet might be due to the constructive outcome of secondary metabolites on ruminal fermentation (Naserian *et al*., 2015).

Digestibility of crude protein

Results had shown non-significant variation (P>0.05) between all the treatments (Table 3). However, numerical readins were slightly higher for 10, 20 and 30 g of hydrolysable tannin as compared to control. Our data were in close resemblance with Cieslak *et al*. (2005) who noticed that animals fed tannin supplemented feed had non-significant result on CP digestibility. Moreover, Gunun *et al.* (2016) studied that animals fed tannin supplemented diet had non-significant effect on CP digestibility. Values were also in agreement with the observations of Pathak *et al*. (2017) who noticed lacked of effect among all treatments for CP digestibility.

In contrast, Soleiman and Kheiri (2018) reported that hydrolysable tannin at the inclusion level of 6 mg/L of milk improved the digestibility of CP as compared to control group. Cabral Filho *et al*. (2013) stated that digestibility of CP was improved (P<0.05) for the low tannin cultivar diet.

Blood urea nitrogen

Results had shown non-significant

Table1. Ingredients used in concentrate ration.

Ingredients	Percentage
Maize	15
Canola meal	3
Maize oil cake	15
Wheat bran	30
Maize gluten 30 %	20
Molasses	14
urea	1
Dicalcium phospahte	1
Sodium chloride	1
Total weight	100

Table 2. Chemical composition of experimental diet.

Ingredients	Dry matter %	Crude protein %
Concentrate	90	18.02
berseem	18	16.01

*Standard error of mean

Table 3. Effect of different levels of hydrolysable tannin on feed intake and blood urea nitrogen.

Parameters	Treatments[1]					
	T1	T2	T3	T4	*SEM	P-value
Dry matter intake (kg/day)	9.59	10.21	9.85	10.34	0.50	0.71
Crude protein intake (kg/day)	1.63	1.74	1.68	1.76	0.08	0.71
Crude protein digestibility (%)	72.15	74.31	77.01	78.82	3.18	0.49
Blood urea nitrogen (mg/dL)	30.0	27.0	26.5	20.0	4.78	0.57

[1]T1, T2, T3 and T4 represent supplementation of 0, 10, 20 and 30 g hydrolysable tannin, respectively

change (P>0.05) between all the treatments (Table 3). However, slightly decreased numerical values were observed for blood urea nitrogen along increasing levels of hydrolysable tannin as compared to control. Similarly, Gunun *et al.* (2016) observed non-significant reduction in blood urea nitrogen when tannin based diet was fed to animals. This might be due to reduced availability of digestible protein in rumen due to tannin protein complex resulting in a decline in blood urea nitrogen concentrations. In contrary, Dey *et al.* (2008) described that blood urea nitrogen was decreased significantly by tannin present in diet. Similarly, Zhang *et al.* (2019) reported that dietary supplementaion of tannin significantly reduce the concentration of blood urea nitrogen in cows.

Ruminal characteristics

Results had shown non-significant alteration (P>0.05) among the treatments. However, numerical values for rumen pH were slightly higher for 10, 20 and 30 g of hydrolysable tannin as compared to control (Table 4). However, numerical values for NH3-N were found lowest for 10g hydrolysable tannin at 3 and 12 h while for 20 and 30 g hydrolysable tannin at 6 and 9 h respectively.

Results followed the same trend as conveyed by Krueger *et al.* (2010) that addition of tannin in the diet of animals had non-significant influence on rumen pH and NH3-N. Similarly Supapong *et al.* (2017) concluded that tannin supplementation in diet had unaltered effect on ruminal pH and NH3-N. Hervas *et al.* (2003) also stated that adding tannin in diet had lacked of effect on ruminal pH and ammonia nitrogen but slightly decreased ruminal pH and NH_3-N.

However, Carulla *et al.* (2005) found that ruminal pH and ammonia nitrogen were decreased by tannin present in diet. Similrly, Jolazadeh and Mohammadabadi (2017) investigated that inclusion of pistachio tannin extracts linearly decreased NH3-N and pH at all incubation times. Capacity of tannins to form irreversible and reversible compounds with proteins can decrease production of ammonia in the rumen as well as excretion from the animal which leads to better efficiency of nitrogen utilization (Lorenz *et al*., 2013).

CONCLUSION

It is concluded that numerical values for feed intake, CP digestibility, ruminal pH, ammonia nitrogen and blood urea nitrogen are slightly better but comparatively non-significant than control when buffalo bull diet is supplemented with hydrolysable tannin.

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