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The effects of some essential oils on ruminal fermentation in Baloochi lambs

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***Abstract*—**Ruminal fermentation characteristics of lambs fed diets with garlic oil (*Allium sativa*), turmeric powder (*Curcuma longa*) and Monensin were compared. The experiment was designed as a 4 × 4 Latin square using 4 ruminally baloochi lambs with 4 treatments: basal diet (as control) and basal diet+0.4 g of garlic oil, basal diet+20 g turmeric powder and basal diet+0.2 g monensin (day/lamb). The animals were housed in individual metabolically cages (0.5×1.2×1m) and were fed a TMR diet (2.48 Mcal kg^{-1} DM and CP 155 g kg^{-1}DM) containing of Lucerne hay and concentrate (45:55 based on DM, respectively). The maximum PH values were differing among treatments and minimum PH values were similar among treatments. The concentration of NH3-N and Peptide-N were affected by different additives. No differences between time and treatment were found for NH_3-N, Soluble protein-N, Peptide-N and Amino acid-N concentrations.

***Keywords*—** ruminal pH, NH_3-N, peptide-N

I. INTRODUCTION

In order to manipulate ruminal microbial ecosystem to reduce methane emission and ammonia nitrogen concentration, ruminant nutritionists have suggested optimizing diet formulation and using feed additives [1]. Supplementation diets with antibiotics growth promoters such as monensin and lasalocid diminish losses of energy and nitrogen. Recently, some studies have done to evaluate the potential of garlic oil as alternative to these antibiotics because of the risk of appearance of antibiotic residues in milk and meat and development of multi-drug bacteria [2]-[3]. However most of these researches have accomplished under in vitro condition and there is limited information about the effects of garlic oil on rumianl fermentation using in vivo experiments [4], [5]. The aim of this study was to assess the effects of diets containing monensin, garlic oil (*Allium sativa*) or turmeric powder (*Curcuma longa)* on ruminal fermentation in Baloochi lambs.

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II. MATERIALS AND METHODS

The Four ruminaly fistulated Baloochi lambs (38±1.5 kg body weight) were used in a 4×4 Latin square design with 4 periods. Each period included 28 days. The animals were housed in individual metabolically cages (0.5×1.2×1m) and had free access to salt and fresh water throughout the experiment. The animals were fed essential oil mixture (EOM) diet (2.48 Mcal kg^{-1} DM and CP 155 g kg^{-1}DM) containing of Lucerne hay and concentrate (45:55 based on DM, respectively). The treatments were basal diet alone (as control) or plus 0.4 g of garlic oil, 20 g turmeric powder and 0.2 g monensin (day/lamb). Experimental period consisted of 28 days; the first 21 days were designated to adaptation of animals to diets and 7 days of sampling. The rumen liquor samples were taken via rumen fistula using a flexible stomach tube and a manual vacuum pump at every10 minutes until to 3 hours and every 15 minutes until to 6 hours and every 20 minutes to 8 hours post feeding. The PH value was measured immediately in fresh liquor using a portable digital PH-meter with a combination electrode (Metrohm 744, Switzerland). For NH3-N determination, a 10ml sample of filtered rumen fluid was acidified with 10ml of 0. 2 N HCl and then was stored in the freezer at −20°C. The NH3-N concentration in the rumen liquor samples was determined by using the macro Kjeldahl technique [6]. At day 23^{th} of the each experimental period, ruminal fluid samples of before the morning feeding and 2, 4 and 6 h post feeding were prepared for peptide-N analysis using sulphate-tungstate method described by Chen et al., 1987 [7]. The percholoric and tungsten acid-precipitates nitrogen (reflecting the soluble protein and peptide nitrogen, respectively) were assayed by using the macro Kjeldahl technique [7].

Data were analyzed using the same mixed model procedure of SAS [8] as a Latin square design with treatment, period,

and their interaction as fixed effects and lambs within treatment as random effects.

III. RESULTS AND DISCUSSION

Ruminal PH data were summarized for each lamb as mean, minimum, and maximum PH. There was an interaction between time and treatment for ruminal PH ($p< 0.01$) (table 1).

TABLE 1

RUMINAL pH, NH3-N AND PEPTIDE-N CONCENTRATION IN BALOOCHI LAMBS FED DIFFERENT ADDETIVES

Factor	Treatments				SEM [1]	P-value	
	Control	Garlic oil	Monensin	Turmeric		Treat	Treat*Time
pH							
Mean	6.23[a]	6.01[d]	6.18[b]	6.1[c]	0.01	0.011	0.001
Min	5.81	5.54	5.69	5.71	0.08	NS	0.001
Max	7.48[a]	7.02[b]	6.97[b]	7.11[b]	0.08	0.013	0.001
NH_3-N[2]	18.28[b]	22.58[a]	20.83[c]	19.25[c]	0.43	0.011	0.29
SPN[3]	6.33	7.94	9.67	8.61	1.34	NS	0.38
PN[4]	4.13[b]	7.47[a]	6.16[ab]	5.99[ab]	0.79	0.011	0.81
AAN[5]	7.81	7.48	8.00	9.51	1.4	NS	0.61

1:SEM: Standard Error of Mean; 2:NH_3-N:Ammonia Nitrogen (mg/ml); 3:Soluble protein-N (mg/ml), 4: Peptide-N (mg/ml); 5: Amino acid-N (mg/ml); NS: non-significant; Means within a row with different superscripts differ ($P < 0.05$).

Mean ruminal PH ranged from 6.01 to 6.23 and was different among treatments. Similarly, the maximum PH values were differing among treatments but minimum PH values were similar among treatments. The concentration of NH3-N and Peptide-N (mg/100ml) were affected by treatments ($P< 0.05$) and the concentration of soluble protein-N and Amino acid-N were not affected by different additives ($P> 0.05$). No differences between interaction time and treatment were found for NH_3-N, Soluble protein-N, Peptide-N and Amino acid-N. The NH3-N is considered to be the most important nitrogen source for microbial protein synthesis in the rumen and Peptides are intermediates in the conversion of ingested protein to ammonia in the rumen and their accumulation depends upon the nature of diet [9]. The results of this study were consistent with those of Yang and Russell., (1993) [10], They reported that addition of 350 mg/daily per cow of monensin not affect on soluble protein or amino acids in ruminal fluid. Based on our results, it seemed that the rate and extent of protein degradation exceeded the rate of carbohydrate fermentation and microbial growth. The results of this study were consistent with those of Busquet et al., (2005), They reported that garlic oil could increase ruminal NH3-N [2]. In contrast, Castillejos, et al., (2007) who reported that essential oil has no influence on NH3-N concentration in continuous-culture fermenters [11]. However, in this study higher NH3-N and peptide–N concentrations were found when garlic oil added to basal diet. Results from this expriment showed that Ammonia absorption from the rumen is decreased. This result was consistent with literature of Chalmers et al., (1971) who reported that Ammonia absorption is proportional to concentration [12].

IV. CONCLUSION

Present results indicate that both garlic oil and turmeric powder have a potential to change some of the rumen responses. However, it is a need to evaluate the effects under in vivo experiment using higher concentration of these additives.

REFERENCES

[1] Calsamiglia, S., L. Castillejos, and M. Busquet. 2006. Alternatives to antimicrobial growth promoters in cattle. Pages 129–167 in Recent Advances in Animal Nutrition. P. C. Garnsworthy, and J. Wiseman, ed. Nottingham University Press, Nottingham, UK.

[2] Busquet, M., S. Calsamiglia, A. Ferret, M. D. Carro, and C. Kamel. 2005. Effect of garlic oil and four of its compounds on rumen microbial fermentation. J. Dairy Sci. **88**:4393–4404.

[3] Calsamiglia, S., et al., Invited Review: Essential Oils as Modifiers of Rumen Microbial Fermentation. Journal of Dairy Science, 2007. **90**(6): p. 2580- 2595.

[4] Yang, W. Z., C. Benchaar, B. N. Ametaj, A. V. Chaves, M. L. He, and T. A. McAllister. 2007. Effects of Garlic and Juniper Berry Essential Oils on Ruminal Fermentation and on the Site and Extent of Digestion in Lactating Cows. J. Dairy Sci. **90**:5671–5681.

[5] Chaves, A.V., K. Stanford, M. E. R. Dugan, L. L. Gibson, T.A. McAllister, F. Van Herk, and C. Benchaar. 2008b. Effects of cinnamaldehyde, garlic and juniper berry essential oils on rumen fermentation, blood metabolites, growth performance, and carcass characteristics of growing lambs. Livestock Science. **117**:215–224.

[6] AOAC International. 2003. Official methods of analysis of AOAC International. 17th edition. 2nd revision. Gaithersburg, MD, USA, Association of Analytical Communities.

[7] Chen, G., J.B. Russell, and C.J. Sniffen, a procedure for measuring peptides in rumen fluid and evidence that peptide ubtake can be a rate limiting step in ruminal protein degridation. Journal of Dairy Science, 1987. **70**(6): p. 1211-1219.

[8] SAS 1999. Users Guide: Statistics. 1999. Version 8.2. SAS Institute, Inc., Cary, NC, USA.

[9] Mesgaran, M.D. and D.S. Parker, The effect of dietary protein and energy sources on ruminal accumulation of low molecular weight peptides in sheep. animal Science, 1995. **60**(535A).

[10] Yang, C.M.J. and J.B. Russell, The effect of monensin supplementation on ruminal ammonia accumulation in vivo and

the numbers of amino acid-fermenting bacteria. Journal of Animal Science, 1993. **71**(12): p. 3470-3476.

[11] Castillejos, L., S. Calsamiglia, and A. Ferret, Effect of essential oil active compounds on rumen microbial fermentation and nutrient flow in in vitro systems. Journal of Dairy Science, 2006. **89**(7): p. 2649-2658.

[12] Chalmers, M.I., A.E. Jaffray, and F. White, Movements of ammonia following intraruminal administration of urea or casein. Proceedings of the Nutrition Society, 1971. **30**: p. 7.