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Effect of selected tanniniferous leaves on *in vivo* enteric methane emission in sheep

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Introduction

Concentration of methane is continuously increasing in atmosphere and now almost 155% (IPCC, 2007) more than that recorded during pre-industrial era. Livestock production is a major sector accountable for high methane emission into atmospheric pool. World's livestock is contributing around 15% of total atmospheric methane on annual basis feeds (Moss *et al.,* 2000). Additionally, methane emission from ruminants leads to a loss of 2 to 15% of the dietary energy (Holter and Young, 1992). Due to these two crucial issues, researchers are working tirelessly to find a suitable and effective way for enteric methane amelioration accompanied with minimal inputs. So far numerous interventions have been tried with variable results, but due to one or another reason the search for effective strategy is on the priority of animal scientist. One of the possible approaches for enteric methane amelioration may be the use of plant secondary metabolites which are being traditionally used by the people since ages.

Under the ICAR sponsored outreach project on *Estimation of methane emission under different feeding systems and development of mitigation strategies* more than 1700 feed, herbs and grasses samples were screened through *in vitro* gas production technique at different participating centres and finally selected few plant & herbs for evaluating the secondary metabolites on *in vivo* enteric methane emission. Three selected tanniniferous leaves were evaluated for their effect on enteric methane emission and feed fermentability in adult sheep.

Materials and Methods

20 adult male *Mandya* sheep (BW 32.01±0.25kg) were divided into four groups of five animals each. The animals were kept in a well ventilated shed having provision for individual feeding. Animals were fed as per ICAR standard feeding standard and requirement was fulfilled by the feeding of complete feed block (CFB) comprising ragi straw and concentrate in the ratio of 70:30. Concentrate mixture had fixed quantity of maize grain, mineral mixture and salt for all the treatments including control, while the quantity of wheat bran and soybean meal varied among the test groups depending on the crude protein of selected tanniniferous leaves. The selected tanniniferous plant leaves A, B & C was incorporated at 10% level in treatment T_1, T_2 and T_3, respectively. Initially the animals were fed on respective diets for 25 days before conducting the SF_6 trial. Five successful gas collections was done from each animal kept under different treatment and the concentration of SF_6 and CH_4 in collected samples was analyzed in the laboratory using separate gas chromatograph for each gas. Gas chromatograph used for methane analysis was fitted with FID and capillary column, while for SF_6 analysis the gas chromatograph was fitted with ECD and capillary column. Further, a digestibility trial of 7 days was also carried out to examine the effect of selected tanniniferous leaves A, B & C on feed intake and nutrients digestibility.

Results and Discussion

Data pertaining to the effect of the incorporation of three selected tanniniferous leaves *viz.* A, B & C on dry matter intake (DMI) and digestibility are presented in Table 1. Result indicated no adverse effect of the inclusion of selected tanniniferous leaves on DM intake (g/d) in *Mandya* adult sheep. Higher ($p<0.05$) DMI was recorded in treatment T_1 and T_3 than the control treatment T_0. However, the DMI in treatment T_2 was at par with control group. DMI (g/d) in T_1 and T_3 test groups was also significantly ($p<0.05$) higher than the test treatment T_2. Among the groups, the maximum DMI (g/d) was recorded in treatment T_3 where tanniniferous leaves C were incorporated at 10% level. The DMI in different groups was also compared on g/kg BW basis and found that the intake among the groups did not vary significantly except group T_2 where significantly lower intake was reported than the treatment T_1 & T_3. These results indicated that the inclusion of selected tanniniferous leaves do not have any adverse impact on DMI in adult sheep (Table 1). Similarly, the dry matter digestibility (DDM) also did not affect significantly by the inclusion. However, among the test treatments, the highest DDM availability was recorded in treatment T_1 (632 g/d) followed by T_3 (626 g/d) and T_2 (605 g/d). The DDM in group

T_1 and T_3 was significantly higher ($p<0.05$) than that in group T_2. The variation among the groups for digestible dry matter availability was not significant (Table 1) except T_1 and T_2 where significant ($p<0.05$) variation was reported. It is envisaged from the results that the incorporation of selected three tanniniferous leaves at 10% level did not have any adverse effect on dry matter intake and availability of digestible dry matter in sheep as compared to control.

Table 1: Effect of selected tanniniferous leaves inclusion on DMI

Particulars	**Treatment**					
	T_0	**T_1**	**T_2**	**T_3**	**SEM**	**Sig.**
BW (kg)	31.36	32.21	32.20	32.37	0.15	NS
DMI (g/d)	739^{a}	764^{b}	745^{ac}	774^{bd}	2.48	0.001
DMI (g/kg BW)	23.5^{abc}	23.7^{b}	23.1^{a}	23.9^{bc}	0.07	0.002
DDM (g/d)	620^{abc}	632^{b}	605^{a}	626^{ab}	3.24	0.017

Mean values bearing different superscripts in a row differ significantly

Data presented in Table 2 revealed a significant ($p<0.05$) reduction in enteric CH_4 emission in adult *mandya* sheep on the feeding of complete feed block containing selected tanniniferous leaves. The enteric CH_4 emission (g/d) was recorded highest in control group (T_0), while lowest in T_3. The emission for rest of groups lies in between these two groups. The variation in enteric CH_4 production (g/d) among the three test group was not significant. The inclusion of tanniniferous leaves in CFB lead 20.5 to 26.2% reduction in enteric CH_4 emission (g/d) as compared to T_0. The maximum reduction was recorded in group T_3 (26.2%) followed by T_2 (20.7%) and T_1 (20.5%). The trend of reduction remained same when emission was expressed on g/kg BW basis. Enteric CH_4 emission ranged from 2.34 to 3.32 g/100 g DMI among the groups. Among the treatments, T_4 emits minimum, while animals under control produced maximum methane per day. Enteric CH_4 emission between test treatments (T_1, T_2 and T_3) and control differed significantly ($p<0.05$), however, the variation among the test treatments was not significant. Likewise, the enteric CH4 emission (g/100 g DDM) in control was significantly higher ($P>0.05$) than the test treatments. However, there was no significant change between the test treatments was observed in the study. It may be inferred from the study that the incorporation of selected three tanniniferous leaves (A, B & C) at 10% level in ragi straw and concentrate based CFB reduced The enteric CH_4 emission significantly without affecting the intake and digestibility.

Table 2: Effect of tanniniferous leaves inclusion on *in vivo* enteric methane emission in sheep.

	Treatment					
Attributes	**T_0**	**T_1**	**T_2**	**T_3**	**SEM**	**Sig.**
BW (kg)	31.36	32.21	32.20	32.37	0.15	NS
CH_4 (g/d)	24.58^{b}	19.54^{a}	19.49^{a}	18.13^{a}	0.53	0.001
CH_4 (g/kg BW)	0.78^{b}	0.60^{a}	0.60^{a}	0.56^{a}	0.01	0.001
CH_4 (g/100 g DMI)	3.32^{b}	2.55^{a}	2.61^{a}	2.34^{a}	0.07	0.001
CH_4 (g/100 g DDM)	3.96^{b}	3.09^{a}	3.22^{a}	2.89^{a}	0.08	0.001

Mean values bearing different superscripts in a row differ significantly

Conclusion

It may be concluded from the study that the selected tanniniferous leaves A, B & C can be incorporated at 10% level for the amelioration of enteric CH_4 emission in the tune of 20-25% in adult sheep without affecting the intake, palatability, dry matter digestibility etc. The effect of these tanniniferous leaves on microbial diversity and rumen methanogens needs to be investigated.

References

Holter, J. B. and A. J. Young. 1992. Methane production in dry and lactating Holstein cows. *J. Dairy Sci.* 75: 2165-2175.

IPCC, 2007. Intergovernmental Panel on Climate Change. *The scientific basis. Contribution of working group I to the fourth assessment report of the Intergovernmental Panel on Climate Change*, edited by S. Solomon *et al.*, Cambridge Univ. Press., New York.

Moss, A. R. J. P. Jouany and C. J. Newbold. 2000. Methane production by ruminants: its contribution to global warming. *Ann. Zootechnol*. 49: 231-235.

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