

EFFECT OF ADDITION OF HERBS ON *IN VITRO* RUMEN FERMENTATION AND DIGESTIBILITY OF FEED

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ABSTRACT

Five herbs namely *Trigonella foenum-graecum* (Methi), *Acacia concina* (Shikakai), *Trachyspermum ammi* (Ajwain), *Cinnamomum tamla* (Tejpatta) and *Aloe barbadanis* (Aloe vera) were added at the rate of 1.5%, 2.5% and 4.0% of ration. The rumen fermentation parameters and digestibility of feed was studied with buffalo rumen liquor using *in vitro* gas production test. The addition of these herbs had no adverse effect on rumen pH. There was significant ($P < 0.05$) improvement in IVDMD and IVOMD (%) of feed after addition of *Trigonella foenum-graecum* (66.22, 69.63) as compared to control (56.33, 61.37) respectively. Similarly addition of aloe vera also tended to improve the IVDMD and IVOMD of feed in respect to control. Addition of other herbs *Acacia concina* (Shikakai), *Trachyspermum ammi* (Ajwain), *Cinnamomum tamla* (Tejpatta) did not show any improvement in the feed digestibility. From present study it can be concluded that *Trigonella foenum-graecum* (Methi) and *Aloe barbadanis* (Aloe vera) had the potential to improve the feed digestibility however *in vivo* trials are essential before its recommendation to dairy farmers.

Key words: Digestibility, Herbs, IVGPT.

The growing public concerns over chemical residues in animal-derived foods and threats of antibiotic-resistant bacteria have renewed interest in exploring safer alternatives to chemical feed additives in ruminant livestock. Natural products with high concentration of secondary metabolites appear to be good candidates for achieving these objectives (Teferedegne, 2000). These secondary metabolites may be tannins, saponins, essential oils, alkaloids, flavonoides, glucosides, amines and non-protein amino acids which are produced in nature as a defense mechanism for plants. Herbs a store house of these metabolites, are ecofriendly and non hazardous to both human handlers and animals. They have no side effects and have minimum problem of drug resistance. In view of this, some herbs were evaluated using *in vitro* gas production test for their effect on rumen fermentation and digestibility.

Spices like *Trigonella foenum-graecum* (Methi), *Acacia concina* (Shikakai), *Trachyspermum ammi* (Ajwain), and *Cinnamomum tamla* (Tejpatta)

were purchased from local market. For collection of extract from *Aloe barbadanis* (Aloe vera), leaves were procured from the garden of medicinal plants of DUVASU, Mathura. Aloe Vera extract was collected by removing the peel of fleshy leaves of aloe vera. These herbs were mixed individually with control ration containing wheat straw and concentrate in 60:40 ratio at the rate of 1.5%, 2.5% and 4% of dry matter and different type of ration having herbs were formed. The conc. mixture was having maize, 30, mustard oil cake, 23, wheat bran, 45 and Type II mineral mixture 2 percent. For *in vitro* gas production test, 0.2 g feed was incubated for 24 h with 30 ml medium in 100 ml capacity Hohenheim gas syringe (Menke and Steingass, 1988). Total gas production was calculated as displacement of piston in 24hr. After incubation, pH of *in vitro* rumen liquor was measured immediately using electronic pH meter calibrated against standard buffer solution. After that the contents of syringes were transferred to spout less beaker by repeated washing with 100 ml neutral detergent solution. The flask contents were

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refluxed for 1h and filtered through pre-weighed Gooch crucibles (Grade G1). The dry matter content of the residue was weighed and *in vitro* dry matter digestibility of feed was calculated as follows.

$$\text{In vitro dry matter digestibility (\%)} = \frac{(\text{DM of feed taken for incubation} - \text{residue})}{(\text{DM of feed taken for incubation})} \times 100$$

The crucibles containing residue were ashed in muffle furnace at 500°C and organic matter present in residue was calculated. The organic matter digestibility was calculated as follows.

$$\text{In vitro OM digestibility (\%)} = \frac{(\text{OM of feed taken for incubation} - \text{OM in residue})}{(\text{OM of feed taken for incubation})} \times 100$$

The feed samples were analysed for total ash, crude protein, ether extract (AOAC, 1995) and for fiber fraction (Van Soest *et al.*, 1991). All the data were analyzed by one-way ANOVA and difference between the means was compared by Duncan's Multiple Range Test as per Snedecor and Cochran (1994).

The per cent organic matter, crude protein, crude fibre, ether extract, total ash and nitrogen free extract in ration was 92.91, 13.02, 17.85, 2.98, 7.08 and 54.05 respectively. The per cent neutral detergent fibre, acid detergent fibre and hemicellulose content of ration were 48.07, 26.15 and 21.92 respectively. The calcium and phosphorus content (%) of ration was 0.15 and 0.80 respectively. The pH of *in vitro* rumen fluid was within normal range (6.5-7.0) after addition of these herbs, showed no adverse effect. Kumar *et al.* (2011) also reported that feeding of essential oil and plant part mixture in the fistulated buffalo had no adverse effect on ruminal pH. The addition of various herbs had no significant effect on IVDMD and IVOMD of feed except *Trigonella foenum-graecum* (Table 2 and 3).

Total gas production (ml) in 24 hr incubation of control ration was 19.53± 0.86. Upon addition of *Trigonella foenum-graecum* @ 1.5%, 2.5% and 4.0% of ration it was 28.53± 0.86, 30.83± 1.64 and 32.83± 0.44 respectively. There was significant (P < 0.05) increase in gas production along with increase in concentration of methi. This might be due to increase in rumen bacterial activity. Since saponins contained in fenugreek seeds (*Trigonella foenum-graecum*) have antimicrobial properties, and suppressed the growth of ciliate protozoa in the rumen (Francis *et al.*, 2002), thereby increasing the bacterial population and activity. Addition of *Trigonella foenum-graecum* @ 1.5%, 2.5% and 4.0% of ration significantly (P < 0.05) improved the *In vitro* dry matter digestibility (%) from 56.33± 2.38 to 63.21± 1.74, 66.57± 0.61 and 66.22± 2.78 respectively. Similarly organic matter digestibility (%) increased to 66.51± 1.36, 69.97± 6.55 and 69.63± 2.25 respectively upon addition of *Trigonella foenum-graecum* @ 1.5%, 2.5% and 4.0% of ration as compared to control group (61.37± 2.07). El-Foly *et al.* (2005) reported that addition of fenugreek seeds or vegetable oil in the ration of sheep significantly increased organic matter and nitrogen free extract digestibility. Total Digestible Nutrient (TDN %) and starch equivalent (SE %) significantly (P < 0.05) increased in rams fed diet supplemented with fenugreek seeds. Mir *et al.* (2010) also reported an improvement in the *in vitro* dry matter and organic matter digestibility after addition of *Trigonella foenum-graecum* in the ration. Total gas production was increased in dose dependent manner after addition of *Aloe barbadensis* (Table 1). Increase in gas production might be due to presence of active principles in *Aloe barbadensis* which had increased the microbial activity and hence gas production. There was also improvement in digestibility of feed in dose dependent manner after addition of *Aloe*

TABLE 1: Effect of addition of different levels of herbs on total gas production (ml/24 hr).

Herbs	Level of herbs			
	0%	1.5%	2.5%	4.0%
<i>Aloe barbadensis</i> (Aloe-vera)	28.6 ± 0.9 ^a	31.6 ± 1.3 ^{ab}	33.9 ± 0.6 ^{bc}	34.9 ± 0.7 ^c
<i>Trigonella foenum-graecum</i> (Methi)	19.5 ± 0.9	28.5 ± 0.9	30.8 ± 1.6	32.8 ± 0.4
<i>Acacia concina</i> (Shikakai)	21.8 ± 0.4 ^a	23.3 ± 1.5 ^{ab}	28.7 ± 1.5 ^c	26.7 ± 1.2 ^{bc}
<i>Trachyspermum ammi</i> (Ajwain)	23.7 ± 1.7 ^a	28.3 ± 1.0 ^b	27.8 ± 0.7 ^b	32.3 ± 1.5 ^c
<i>Cinnamomum tamala</i> (Tejpatta)	21.5 ± 3.0 ^a	27.3 ± 1.5 ^{ab}	28.7 ± 0.9 ^b	30.3 ± 0.9 ^b

^{ab}Means with different superscript in a row differ significantly at 5% level of significance

TABLE 2: Effect of addition of different levels of herbs on *in vitro* dry matter digestibility(%).

Herbs	Level of herbs			
	0%	1.5%	2.5%	4.0%
<i>Aloe barbadanis</i> (Aloe-vera)	58.3± 0.7	59.8± 1.8	63.3 ± 1.0	62.4± 5.5
<i>Trigonella foenum-graecum</i> (Methi)	56.3± 2.4 ^a	63.2± 1.7 ^{ab}	66.6± 0.6 ^b	66.2± 2.8 ^b
<i>Acacia concina</i> (Shikakai)	61.2 ± 2.0	58.6± 0.7	58.4± 0.8	59.5± 0.8
<i>Trachyspermum ammi</i> (Ajwain)	60.0± 2.1	57.2± 1.2	57.7± 3.7	51.7± 2.2
<i>Cinnamomum tamala</i> (Tejpatta)	61.7± 0.8	64.3± 1.3	65.0± 1.0	64.7± 0.3

^{ab}Means with different superscript in a row differ significantly at 5% level of significance

TABLE 3: Effect of addition of different levels of herbs on *in vitro* organic matter digestibility (%).

Herbs	Level of herbs			
	0%	1.5%	2.5%	4.0%
<i>Aloe barbadanis</i> (Aloe-vera)	62.6± 0.6	63.9± 3.3	68.4± 1.6	70.7± 3.0
<i>Trigonella foenum-graecum</i> (Methi)	61.4± 2.1 ^a	66.5± 1.4 ^{ab}	69.9± 6.5 ^b	69.6± 2.2 ^b
<i>Acacia concina</i> (Shikakai)	61.7± 1.6	60.5± 0.2	60.5± 0.6	61.6± 0.9
<i>Trachyspermum ammi</i> (Ajwain)	61.9± 1.5	60.2± 0.5	59.5± 3.3	53.7± 3.4
<i>Cinnamomum tamala</i> (Tejpatta)	63.4± 4.3	65.2± 2.4	67.7± 1.6	65.7± 1.7

^{ab}Means with different superscript in a row differ significantly at 5% level of significance

barbadanis (Table 2 and 3). Sirohi *et al* (2009) also reported that among the different extracts tested, IVDM (%) increased by 15.42% after addition of *Aloe-barbadanis*. Addition of other herbs *Acacia concina* (Shikakai), *Trachyspermum ammi* (Ajwain),

Cinnamomum tamla (Tejpatta) did not show any improvement in the digestibility of feed.

From present study it can be concluded that *Trigonella foenum-graecum*, and *Aloe barbadanis* are the potential fermentation modifier.

REFERENCES

- AOAC. (1995) Official Method of Analysis, Association of Official Analytical Chemists, Washington, DC. 16th edition.
- El-Foly A H , Abd El-Baki S M , Nowar M E, Shehata S A and Ibrahim M K. (2005). Effect of fenugreek seeds and vegetable oil addition on digestibility and nitrogen and energy utilization of sheep, *Egypt Zagazig J Agri Res* **10** (32): 1271-1289.
- Francis G, Kerem Z, Makkar HPS, Becker K (2002). The biological action of saponins in animal systems: A review. *British J Nutri.* **88**: 587-605.
- Kumar, Ravindra., Kamra, D.N., Agarwal, N. and Chaudhary, L. C. (2011). Effect of feeding a mixture of plants containing secondary metabolites and peppermint oil on rumen fermentation, microbial profile and nutrient utilization in buffaloes. *Indian J. Anim. Sci.* **81** (5): 488-92.
- Menke, K.H. and Steingass, H. (1988). Estimation of the energetic feed value obtained by chemical analysis and *in vitro* gas production using rumen fluid. *Anim. Res. Develop.* **28**: 7-55.
- Mir, I. A., Kumar, Ravindra, Sharma, R. K. and Barman, K. (2010). Effect of addition of herbs on *in vitro* digestibility of feed with rumen liquor of goat. *Indian J Vet. Res.* **19**:13-18.
- Sirohi, S. K., Pandey, N. Goel, N., Singh., B., Mohini., M., Pandey, P and Chaudhary, P.P. (2009). Microbial activity and ruminal methanogenesis as affected by plant secondary metabolites in different plant extracts. *Intern. J Environ. Sci. and Engg.* **1**:1.
- Snedecor, G.W. and Cochran, W.G. (1994). Statistical Methods. 7th edition The Iowa State University Press, Iowa, USA.
- Teferedegne, B. (2000). New perspective on the use of tropical plants to improve ruminant nutrition. *Proc. Nutrition Soci.* **59**: 209-214.
- Van Soest, P.J., Robertson, J.B., Lewis, B.A. (1991). Methods for dietary fiber, neutral detergent fiber and non starch polysaccharides in relation to animal nutrition. *J. Dairy Sci.* **74**: 3583-3597