



Effect of feeding *Allium sativum* herb and Probiotic (*Saccharomyces cerevisiae*) Alone or in Combination with Ground Nut Straw on Nutrient Utilization Efficiency in Sonadi Sheep

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ABSTRACT

This experiment was conducted to assess the effect of feeding a herb (*Allium sativum*) and probiotic (*Saccharomyces cerevisiae*) alone or in combination with ground nut straw based complete feed on nutrient utilization efficiency in Sonadi sheep. A feeding trial was conducted for 90 days period followed by metabolism trial. Four complete diets were prepared as T₁ (roughage + concentrate mixture), T₂ (basal roughage + concentrate mixture + *Allium sativum*@ 3% of feed), T₃ (basal roughage + concentrate mixture + probiotic (*Saccharomyces cerevisiae* @3 g/head/d) and T₄ (basal roughage + concentrate mixture + *Allium sativum* @ 1.5% of feed + probiotic (*Saccharomyces cerevisiae* @1.5 g/head/d), using roughage and concentrate ratio 60:40. Sixteen Sonadi rams (10-12 month of age) were selected and randomly distributed in four groups of four rams each. In the study, highly significant (P<0.01) effect of groundnut straw based complete feed with garlic (*Allium sativum*) and probiotic (*Saccharomyces cerevisiae*) were found on average daily gain, digestibility of DM, OM, CP, EE, NFE, NDF and HC. Dry matter intake and organic matter intake were found non-significant in treatment groups. From present investigation, it can be concluded that using of herb (*Allium sativum*) and probiotic (*Saccharomyces cerevisiae*) alone or in combination with ground nut straw as feed additive had a beneficial effect on nutrient utilization efficiency in Sonadi rams.

HIGHLIGHTS

- Groundnut straw based complete feed could be efficiently utilized in sheep feeding.
- Supplementation of garlic at 3% and yeast 1.5% level of feed as feed additives is a viable proposition to improve productivity.

Keyword: *Allium sativum*, Digestibility, Ground nut straw, Probiotic, *Saccharomyces cerevisiae*

Sheep is an important livestock species of India. They contribute greatly to the agrarian economy, especially in the arid/semi-arid and mountainous areas where crop and dairy farming are not economical. They play an important role in the livelihood of a large percentage of small and marginal farmers and landless labourers engaged in sheep rearing. Several breeds of sheep are found in Rajasthan viz. Nali, Marwari, Malpura, Magra, Jaisalmeri, Chokla and Sonadi. Sonadi breed of sheep is found in Southern part of Rajasthan i.e. Udaipur, Dungarpur, Rajsamand and Chittorgarh districts.

Concept of complete feed with use of fibrous crop residue

is a noble way to increase the intake and improve the feed utilization in ruminants. The basic principle of this system is that all the feed ingredients inclusive of roughage and concentrates are mixed together to form a uniform mixture, ensuring a synchronous and proportionate supply of essential nutrients in the diet. Thus, it offers a means of controlling the ratio of concentrate and roughage intake.

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Garlic (*Allium sativum*) having active ingredient alicine, diallyl disulfide has been considered as a wonder drug in herbal world and used as growth promoter. It improves nutrient utilization and feed conversion efficiency, improves digestion and immunity. It has antibacterial, antifungal, anti-inflammatory and hepato-protective properties.

Probiotics are naturally occurring microbes, which upon administration improve the health status of the animal by competing with the pathogenic microbes and nutrient utilization by having a positive influence on gut microflora (Khalid *et al.*, 2011). Addition of probiotics in the lambs' diet has been reported to improve feed utilization and growth performance of the animals. The exact mechanism through which they affect the animal performance is not well known. However, it is stated that they work synergistically with ruminal microbes. Improvement in the colonization of cellulolytic bacteria may result in improved digestion process and nitrogen flow towards lower digestive tract.

The present investigation was planned to find out the possibilities of utilization of groundnut straw in the form of complete feed with feed additives *i.e.* supplementation of herb (*Allium sativum*) as well as yeast (*Saccharomyces cerevisiae*) alone or in combination in Sonadi sheep.

MATERIALS AND METHODS

A feeding trial of 90 days on 16 Sonadi rams were conducted to assess the effect of herb (*Allium sativum*) and probiotic (*Saccharomyces cerevisiae*) alone or in combination with complete feed on palatability, average daily gain, intake, digestibility and balance of nutrients.

Experimental feed

The ground nut straw based complete feed was used for *ad lib* feeding of experimental rams with or without feed additives, *viz.* *Allium sativum* (3% of feed), probiotic (*Saccharomyces cerevisiae*) supplementation (3g/head/d). Garlic was purchased from the local market and was dried under the shade for a period of ten days. After drying, the outer husk was removed and the bulbs were ground to powder by electrical mixer. Probiotic (*Saccharomyces cerevisiae*) in dried powder form was also purchased from the local market. Along with garlic (*Allium sativum*) and

Probiotic (*Saccharomyces cerevisiae*) powder, roughage and concentrate ingredients were dried and grinded with grinder. These were mixed in certain proportion as per design in the experiment (Table 1).

Table 1: Experimental feed (Parts composition of ingredients)

Feed ingredients	Parts composition of ingredients
Groundnut Straw	60
Barley	5
Deoiled rice bran	15
Guar korma	12
Groundnut cake	5
Mineral mixture	2
Salt	1
% CP	13.54

Experimental animals

Sixteen Sonadi rams of same age group (10-12 months) and of uniform confirmation were procured from livestock farm at College of Veterinary & Animal Science, Navania, Vallabh Nagar, Udaipur and divided into four treatment groups having four animals each. Animals were housed in well ventilated, hygienic and protected sheds and were allowed to acclimatize for a period of 7 days prior to experimental feeding. The deworming was done with an anthelmintic drug. Microscopic examination of faeces and blood smears was also conducted. The animals were given measured quantity of experimental feed and *ad lib* water.

The treatment groups were designated as T₁ – Basal Roughage + Concentrate mixture (Control), T₂ – Basal Roughage + Concentrate mixture + *Allium sativum* @ 3% of feed, T₃ – Basal Roughage + Concentrate mixture + Probiotic (*Saccharomyces cerevisiae*) (@3g/head/d) and T₄ – Basal Roughage + Concentrate mixture + *Allium sativum* (@ 1.5 % of feed + Probiotic (*Saccharomyces cerevisiae*) (@1.5 g/head/d).

Metabolic studies

A metabolic trial conducted at end of feeding trial to assess nutrient digestibility, balance of nitrogen, calcium and phosphorus, digestible nutrient content and intake of digestible nutrients. The animals were harnessed with faecal bags and urine collection bags seven days prior to actual collection for acclimatization.

Chemical analysis

Samples of feed stuff offered and their residues left of each animal were collected for chemical analysis. Samples of feed offered residues left and faeces were analysed for proximate constituents as per AOAC (2016).

Statistical Procedure

The data obtained in the experiment were analyzed using statistical procedures as suggested by Snedecor and Cochran (1994) and significance of mean difference was tested by Duncan's New Multiple Range Test (DNMRT) as modified by Kramer (1957).

RESULTS AND DISCUSSION

Chemical composition

Proximate analysis of complete feed contained 13.54% crude protein, 3.18% ether extract, 23.85% crude fibre, 45.74% NFE, 13.69% total ash, 35.50% NDF, 18.30% ADF and 17.20% hemicellulose, whereas the calcium and phosphorus contents were observed to be 1.10% and 0.40% respectively.

Dry matter intake

The mean dry matter intake was found highest in group T₄, followed by T₃, T₂ and T₁. The dry matter intake was

increased in sheep with the addition of herbal feed additive garlic and / or probiotic (*S. cerevisiae*) in the groundnut straw based complete feed but statistical analysis of data revealed that there was no significant difference in the mean dry matter intake in different treatment groups (Table 3).

Similar findings were reported by Wanapat *et al.* (2013) and Zhu *et al.* (2016) in dairy cattle, Bampidis *et al.* (2005), Yang *et al.* (2007), Chaves *et al.* (2008), Wanapat *et al.* (2008) and Moharrery *et al.* (2009) in sheep; and Kongmun *et al.* (2011) in buffalo bulls fed herbal feed additives and/or *Saccharomyces cerevisiae*. This contrast to the present study may be due to the addition of herbal feed additive garlic and / or probiotic (*S. cerevisiae*).

Average daily gain

The average daily gain (g/d) in animals under different treatment groups were found 62.43, 73.30, 84.81 and 85.73 for T₁, T₂, T₃ and T₄ groups, respectively. Higher (P<0.01) average daily gain (ADG) found in group T₄, followed by T₃, T₂ and T₁ (Table 3).

Similar findings were reported by Omotosho *et al.* (2015) and Maria *et al.* (2016). Showed significant effect supplementation of garlic powder and garlic oil as feed additives in rams. The results of present study also showed agreement with Kishan *et al.* (2008), Ahmed *et al.* (2009), Temim *et al.* (2009) and Zhu *et al.* (2016) in cattle fed herbal feed additives and/or yeast i.e. *S. cerevisiae*. These

Table 2: Chemical composition of different experimental feed (%DM basis)

Attributes	DM	OM	CP	EE	CF	NFE	TA	NDF	ADF	HC	Ca	P
Experimental Complete feed	92.17	86.31	13.54	3.18	23.85	45.74	13.69	35.50	18.30	17.20	1.10	0.40
Feed ingredients												
Groundnut straw	95.63	90.30	7.84	1.70	39.68	41.08	9.70	52.40	44.20	8.20	1.10	0.15
Groundnut cake	92.19	91.28	41.63	7.85	9.65	32.15	8.72	34.80	19.90	14.9	1.30	0.70
Barley	90.15	94.31	11.85	2.93	4.25	75.28	5.69	52.10	8.30	43.8	0.42	0.33
Guar korma	91.35	89.35	42.35	4.0	6.90	36.10	10.65	25.15	17.12	8.03	1.20	0.12
Deoiled rice bran	93.35	89.78	13.85	2.03	17.15	56.75	10.22	30.35	11.6	18.75	0.70	1.20
Mineral mixture	96.75	—	—	—	—	—	100	—	—	—	30	9.0
Common salt	97.45	—	—	—	—	—	100	—	—	—	—	—
Feed additives												
Garlic	93.23	95.31	19.13	6.68	2.30	67.20	4.69	21.15	16.35	4.80	0.05	0.06
Saccharomyces cerevisiae	91.38	92.66	44.3	3.19	2.50	42.67	7.34	—	—	—	0.12	1.42

Table 3: Effect of herb (*Allium sativum*) and probiotic (*Saccharomyces cerevisiae*) on dry matter intake and nutrient utilization efficiency in Sonadi sheep

Parameter	Treatment Groups				SEM ±
	T ₁	T ₂	T ₃	T ₄	
Dry matter intake					
g/d	949.25	1020.75	1050.75	1087.5	58.61
kg/100 kg b.wt	2.71	2.87	2.86	2.93	0.09
g/kgW ^{0.75}	66.14	70.11	70.34	72.52	2.65
Average daily gain (g/d)**	62.43 ^a	73.30 ^b	84.81 ^c	85.73 ^c	0.9064
Digestibility coefficient					
DM**	58.23 ^a	61.89 ^b	65.33 ^c	68.43 ^c	1.02
OM**	61.66 ^a	65.34 ^{ab}	68.39 ^{bc}	71.68 ^c	1.18
CP**	62.65 ^a	68.89 ^b	72.59 ^c	74.88 ^c	0.90
EE**	64.24 ^a	70.59 ^b	72.81 ^b	71.03 ^b	1.14
CF*	54.62 ^a	58.88 ^{bc}	57.69 ^{ab}	60.36 ^c	0.93
NFE*	60.23 ^{ab}	65.17 ^{bc}	63.05 ^{ab}	67.35 ^c	1.49
NDF**	41.33 ^a	48.91 ^b	51.36 ^c	53.88 ^d	0.52
ADF**	45.88 ^a	49.25 ^b	51.63 ^{bc}	54.71 ^d	0.91
HC**	55.15 ^a	61.67 ^b	64.81 ^{bc}	64.99 ^c	0.92

a, b, c values bearing different superscripts in a row differ significantly (**P < 0.01; *P < 0.05).

results might be due to the effective to improve immunity and decrease debility incidence, which agree with the findings of Ahmed *et al.* (2009), they reported that nutrition plays important role in diminishing growth rate.

Digestibility of nutrients

Digestibility of dry matter (DM), crude protein (CP) was higher (P<0.01) in T₄ followed by T₃, T₂ and T₁ and the values of percent digestibility of dry matter in group T₄ and T₃ were comparable. Digestibility of ether extract (EE) was lowest in T₁ group as compared to T₂, T₃ and T₄ groups. Digestibility of crude fibre (CF), nitrogen free extract (NFE) (P<0.05), neutral detergent fibre (NDF) and acid detergent fibre (ADF) (P<0.01) was highest in T₄ group and lowest in T₁ group (Table 3).

Similar findings were reported by Tripathi *et al.* (2009) in cattle, Nehra *et al.* (2009) in goat and Hari Krishna *et al.* (2013) in rams fed with yeast. Improvement in digestibility of nutrients in cattle with supplementation of *Saccharomyces cerevisiae* have also been demonstrated by Prahalada *et al.* (2001); and Kumar and Reddy (2004). Probiotic supplementation (*Saccharomyces cerevisiae*) and olive cake feeding resulted in significant increases in

digestibility of ether extract (EE) in lambs (Obeidat *et al.*, 2017). The results indicated that, yeast inclusion might have exerted selective stimulatory effect on specific rumen bacteria responsible for fibre degradation and microbial protein synthesis in rams (Rossi *et al.*, 1995).

Balances of nitrogen and minerals

Non-significant effect of supplementation of garlic (*Allium sativum*) and yeast alone and in combination along with groundnut straw based complete feed recorded on nitrogen, calcium and phosphorus intake. Highest (P<0.01) balance for nitrogen and calcium was observed in group T₄, followed by T₃, T₂ and T₁, whereas higher (P<0.01) phosphorus balance was found in T₃ group and it was comparable with T₄ group. Phosphorus balance was lowest in group T₁. Non-significant differences were observed for nitrogen, calcium and phosphorus retention in different treatment groups (Table 4).

The results of present study are in agreement with that of Wanapat *et al.* (2013) they observed that nitrogen balance was higher in cattle fed with herbal feed additive and yeast. Likewise, EL-Waziry *et al.* (2007) revealed significant effect of *Saccharomyces cerevisiae* on nitrogen balance in

rams. However, Kowalik *et al.* (2016) observed no effect of live yeast (*Saccharomyces cerevisiae*) supplementation on nitrogen balance in rams. The results of present study are in accordance with the findings of Kowalik *et al.* (2016) who recorded improvement in macro elements (calcium and phosphorus) status in rams fed diet supplemented with yeast (*Saccharomyces cerevisiae*).

Table 4: Effect of herb (*Allium sativum*) and probiotic (*Saccharomyces cerevisiae*) on balances of nitrogen and minerals

Parameter	Treatment groups				SEM ±
	T ₁	T ₂	T ₃	T ₄	
Nitrogen intake (g/d)	20.56	22.11	22.76	23.55	1.0276
Excretion					
Faeces (g/d)	8.23	6.93	7.07	6.61	
Urine (g/d)	5.95	7.58	6.57	6.63	
Total (g/d)	14.18	14.51	13.64	13.24	
Balance (g/d)**	6.38 ^a	7.60 ^b	9.12 ^c	10.31 ^d	0.1480
Retention (%)	31.08	34.37	40.07	43.77	3.5742
Calcium intake (g/d)	10.44	11.22	11.55	11.96	0.50
Excretion					
Faeces (g/d)	6.46	6.22	6.06	5.78	
Urine (g/d)	1.09	1.32	1.38	1.30	
Total (g/d)	7.55	7.54	7.44	7.08	
Balance (g/d)**	2.89 ^a	3.68 ^b	4.11 ^c	4.88 ^d	0.07
Retention (%)	27.68	32.79	35.58	40.80	3.43
Phosphorus intake (g/d)	3.79	4.08	4.20	4.35	0.1500
Excretion					
Faeces (g/d)	2.281	2.138	1.866	2.069	
Urine (g/d)	0.269	0.272	0.254	0.261	
Total	2.55	2.41	2.12	2.33	
Balance(g/d)**	1.24 ^a	1.67 ^a	2.08 ^b	2.02 ^b	0.0270
Retention	32.71	40.93	49.52	46.36	4.5869

a, b, c values bearing different superscripts in a row differ significantly (**P < 0.01; *P < 0.05).

Table 5: Effect of herb (*Allium sativum*) and probiotic (*Saccharomyces cerevisiae*) on average daily gain

Average Daily Gain gm/day				
T ₁	T ₂	T ₃	T ₄	
63.32	68.43	86.62	87.69	
62.53	76.34	84.90	86.16	
61.44	75.14	82.91	83.36	

Table 6: Effect of herb (*Allium sativum*) and probiotic (*Saccharomyces cerevisiae*) on periodized body weight gain kg/month

	Periodized Body Weight Gain kg/month			
	T ₁	T ₂	T ₃	T ₄
Initial	30.20	30.32	30.65	30.75
7/12/2017	32.09	32.37	33.24	33.01
8/12/2017	33.96	34.66	35.78	35.59
9/12/2017	35.80	36.91	38.26	38.09

CONCLUSION

At the end, on the basis of the performance of animals subjected to feeding of groundnut straw based complete feed with feed additives i.e. garlic and yeast alone and in combination in respect to feed intake and nutrient utilization efficiency, it appears that groundnut straw based complete feed could be efficiently utilized in sheep feeding and supplementation of garlic at 3 per cent level and yeast at 1.5 per cent level of feed as feed additives is a viable proposition to improve productivity of sheep in arid and semi-arid region and to have lucrative sheep farming.

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