EVALUATION OF DEWBEAN STRAW BASED COMPLETE FEED BLOCKS WITH AND WITHOUT SUPPLEMENTATION OF LIVE YEAST CULTURE IN RATION OF GOATS (*CAPRA HIRCUS*)

R. Nehra[1], T. Sharma, R.K. Dhuria, S.S. Dangi[2] and Sujata Bedwal[3]
Department of Animal Nutrition, College of Veterinary and Animal Science
Rajasthan University of Veterinary and Animal Sciences, Bikaner - 334 001, Rajasthan, India

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ABSTRACT

Dewbean straw based complete feed blocks (DS-CFB) were fed to kids to study the effect of live yeast (*Saccharomyces cerevisiae*) culture supplementation on nutrient utilization and daily gain by conducting a growth trial followed by metabolism trial on 12 Marwari kids divided in two equal groups, YS (yeast supplemented) and YU (yeast unsupplemented). The dry matter intake was 80.17 and 86.10 g/kg $W^{0.75}$ equivalent to 3.98 and 4.14 kg/100 kg BW, respectively in YU and YS groups. Effect on digestibility was highly significant (P<0.01) on OM, CP, EE CF NDF and ADF, significant (P<0.05) on DM and NFE, and non significant on hemicellulose due to supplementation of live yeast culture. Average daily gain was significantly higher in YS group (105.42 g) compared to YU group (85.97 g), whereas feed conversion ratio was similar. The DCP and TDN contents were 11.04 and 59.68 per cent in YU group and 11.78 and 63.36 per cent in YS group, respectively. Animals of both groups were in positive nitrogen, calcium and phosphorus balance. In conclusion, result showed that yeast supplementation with DS-CFB in ration of kids improved DM intake, digestibility of nutrients, average daily gain, with positive influence on balances of N, Ca and P.

Key words: Dewbean straw, live yeast, *Saccharomyces cerevisiae*, DS-CFB, digestibility, kids

Introduction

Dewbean (*Phaseolus aconitiolius*) is an annual legume of dry and warm habitats and appears to be a major pulse crop grown in hot and dry regions of India (Kumar, 2003) producing an appreciable amount of edible biomass for ruminants as waste or byproduct after screening of seeds popularly known as moth straw as the ratio of dewbean seed and straw is 30:70. Dewbean straw contains about 9.85% CP, 1.71% EE, 25.18% CF, 47.43% NFE and 15.60% total ash as nutrient availability (Saini and Purohit, 2007). The concept of completed feed with its densification i.e. compressed feed block permits incorporation of deficient nutrients, use of non conventional agro industrial by products (Samanta *et al.*, 2006), facilitates convenient low cost transportation to meet emergency. Over and above this, the processing have also been recorded to improve the feed consumption, growth rate and efficiency of feed utilization (Jakhmola, 2003 and Sharma *et al.,* 2004). The digestion process in the rumen can be manipulated by the addition of direct feed microbials to enhance feed digestion, to improve the performance of animals and to boost the health status of animals (Newbold *et al.*, 1996; Robinson and Erasmus, 2009; Desnoyers *et al.*, 2009). Yeast (*Saccharomyces cerevisiae*) supplementation have been reported to increase feed intake, weight gains, milk production and feed efficiency in meat producing animals (Mahender *et al.*, 2006), positive influence on nutrient utilization, productivity and health of ruminants (Garg *et al.,* 2009). Hence, the present study was planned to assess the effect of supplementation of live yeast (*Saccharomyces cerevisiae*) in dewbean straw based complete feed blocks (DS-CFB) on nutrient utilization and daily gain in the ration of goat.

Materials and Methods

A growth trial of 120 days was conducted followed by metabolism trial of 7 days on 12 growing Marwari kids of almost same age (4-6 months) and of uniform conformation were divided into two groups of six in each. Kids were housed in well ventilated, hygienic and protected sheds and were allowed to acclimatize for a period of 10 days prior to experimental feeding. The animals were given prophylactic doses of Panacur as anthelmintic. Faecal and blood smears were examined periodically for parasitic infestation. Kids were offered DS-CFB; the complete feed blocks contained dewbean straw 60, groundnut cake 22, wheat bran 10, barley 02, de oiled rice bran 03, mineral mixture 02 and salt 01 per cent. The complete feed blocks were prepared by complete feed block making machine at 3500 psi and fed *ad libitum* to experimental kids without (yeast un-supplemented group: YU) and with (yeast supplemented group: YS) yeast (*Saccharomyces cerevisiae*, strain SC-47, containing $5x10^9$ cfu/d per animal) in the form of fermented wheat bran to study the effect of yeast supplementation on nutrient intake, digestibility, growth and on nitrogen and mineral balances. The same quantity of wheat bran (unfermented) was given to the kids of YU group to keep all animals on same nutritional status. Samples of complete diet, left over feed, faeces and urine were analyzed for proximate principles (AOAC, 1999), cell wall constituents (Goering and Van Soest, 1970), calcium and phosphorus content (Talpatra *et al.*, 1940). Samples of fresh faeces and urine were analyzed for nitrogen content (AOAC, 1999). Body weight of kids was taken at fortnight interval. The data were analysed statistically (Snedecor and Cochran, 1994).

Results and Discussion

The chemical composition of complete feed blocks contained on % DM basis: organic matter 87.07, crude protein 15.86, ether extract 3.82, crude fibre 17.08, nitrogen free extract

[1]Corresponding author: Email: drrajnehra@gmail.com; [2]Ph.D. Scholar, P & C Division, IVRI, Izatnagar, Bareilly, [3]Sr. Teacher, Govt. Sec. School, Khudia, Jhunjhunu, Rajasthan.

49.91, total ash 12.93, NDF 29.64, ADF 20.07, hemicellulose 9.57, calcium 1.40 and phosphorus 0.65 per cent. The average dry matter intake during the metabolism trial was 80.17 and 86.10 g/kg $W^{0.75}$ equivalent to 3.98 and 4.14 kg/100 kg BW, respectively, in YU and YS groups (Table 2). The dry matter and organic matter intake recorded for YS group was found to be significantly higher in comparison to YU group in terms of g/d, % of b.wt and g/kg $W^{0.75}$ which might be due to improvement in the taste of feed stuffs and pleasant odour by yeast produced glutamic acid (Kamra and Pathak, 2005), partly by an improved rate of fibre breakdown (Wallace and Newbold, 1992; Wholt *et al.* 1998) and partly by improved duodenal flow of absorbable amino nitrogen (Williams *et al.* 1990; Erasmus *et al.* 1992). However, earlier studies have reported mixed responses to yeast supplementation. Erasmus *et al.* (1992) in cow, Putnam *et al.* (1997) in Holstein cows, Stella *et al.* (2007) in Sannen dairy goats, Robinson and Erasmus (2009) recorded increase in dry matter intake by live yeast culture supplementation whereas, Titi *et al.* (2008) observed that supplementation of yeast culture in the diets of lambs and kids had no effect on DMI. Only marginal improvement or no effects on dry matter intake have been reported by Haddad and Goussous (2005). Regarding digestibility of dry matter, gross nutrients and fibre fractions for YU and YS groups, a highly significant (P<0.01) effect on digestibility of OM, CP, EE CF NDF and ADF, and significant (P<0.05) effect on DM and NFE and non significant effect on hemicellulose were observed due to supplementation of live yeast culture. Nutrient digestibility increases due to yeast supplementation which might be attributed to the stimulation of growth of rumen microbial populations (Harrison *et al.*, 1988), increasing OM digestibility by 12.1% when fed 2.5 g/day to Nubian kids (Fadel El-seed *et al.*, 2004) and increasing fibre digestibility (Harris *et al.*, 1992 and Kholif and khorshed, 2006). Improvement in digestibility of nutrients in animals on feeding of *Saccharomyces cerevisiae* have been observed by many workers *viz.,* Kumar and Reddy (2004), Sauvant *et al.* (2004), Mahender *et al.* (2006) and Garg *et al.* (2009) whereas Kawas *et al.* (2007) observed no effect of yeast supplementation on DM, NDF or non-fibrous carbohydrate digestibility in the finishing diets for lambs. Feed conversion ratio (FCR) values between two groups did not reach to statistical significance level but Marwari kids utilized experimental feeds with comparatively better efficiency in YS group. A better FCR have also been reported earlier as a result of live yeast culture supplementation by Pandey and Agrawal (2001), Isik *et al.* (2004), Kumar and Reddy (2004), Mahender *et al.* (2006) and no effect on FCR has also been reported by Quigley *et al.* (1992) and Wallis *et al.* (1992). However, the responses of yeasts are not consistent on the nutrient utilization, rumen fermentation and production on account of depending on several factors (Patra, 2012). The DCP (%), TDN (%) content and nutritive ratio (NR) were observed to be 11.04, 59.68 and 1: 4.41 and 11.78, 63.36 and 1: 3.38 in YU and YS groups, respectively. The DCP intake in terms of g/kg $W^{0.75}$ and kg/100 kg BW was found to be 8.61 and 0.42 and 9.75 and 0.46 in YU and YS groups, respectively. The TDN intake in terms of g/kg $W^{0.75}$ and kg/100 kg BW was found to be 46.54 and 2.28 and 52.43 and 2.48 in YU and YS groups, respectively.

The higher periodical live weights and average daily gain in YS group is supported by the reports of Fallon and Harte (1987), Bhoi and Sharma (1993), Kumar and Reddy (2004), Mahender *et al.* (2006) and Garg *et al.* (2009).

Table 1: Effect of yeast supplementation on nutrient digestibility and growth in kids fed DS-CFB

Attributes	Dietary Treatments		SEM
	YU	YS	
Digestibility (%)			
Dry matter†	63.60	66.95	0.87
Organic matter‡	64.87	68.85	0.90
Crude protein‡	69.60	74.28	1.35
Ether extract‡	72.42	77.23	1.55
Crude fiber‡	53.81	59.87	1.59
Nitrogen free extract†	66.57	69.56	1.62
Neutral detergent fibre‡	50.20	55.29	1.24
Acid detergent fibre‡	44.16	50.86	1.83
Hemicellulose	63.1	64.58	1.36
Body weight changes (kg)			
Initial	11.97	16.12	-
Final	22.28	25.05	-
Total gain			-
Average daily gain† (g)	85.97	105.42	2.06
Feed conversion ration	7.81	7.72	0.13

† P<0.05; ‡P<0.01; YU=Yeast unsupplemented group; YS=Yeast supplemented group.

Table 2. Effect of yeast supplementation on plane of nutrition, nitrogen calcium and phosphorus balances in kids fed DS-CFB

Attributes	Dietary Treatments		SEM
	YU	YS	
Nutritive Value			
DCP %	11.04	11.78	0.12
TDN %	59.68	63.36	0.98
Nutritive ratio	1:4.41	1:3.38	0.36
Plane of Nutrition			
DM Intake			
g/d	666.87	786.47	8.04
Kg/100 kg. b. wt	3.98	4.14	0.032
g/kg $W^{0.75}$	80.17	86.10	0.66
OM Intake			
g/d	580.64	684.78	7.45
Kg/100 kg. b. wt	3.47	3.61	0.017
g/kg $W^{0.75}$	69.80	74.96	0.64
DCPI			
g/d	73.56	92.73	1.76
Kg/100 kg. b. wt	0.42	0.46	0.015
g/kg $W^{0.75}$	8.61	9.75	0.25
TDNI			
g/d	397.78	498.82	8.52
Kg/100 kg. b. wt	2.28	2.48	0.05
g/kg $W^{0.75}$	46.54	52.43	0.85
Nitrogen balance (g/d)			
Intake†	15.92	20.03	0.493
Faecal N	4.85	5.13	0.16
Urinary N	5.83	7.99	0.44
Balance (g/d)	5.24	6.91	0.436
Retention%	33.07	34.41	1.862
Calcium balance (g/d)			
Intake	8.78	11.05	0.17
Balance (g/d)	3.94	4.96	0.25
Retention%	45.17	45.19	1.98
Phosphorus balance (g/d)			
Intake	4.08	5.13	0.06
Balance (g/d)	1.45	1.76	0.15
Retention%	35.63	34.71	2.69

†P<0.05; YU= Yeast unsupplemented group; YS= Yeast supplemented group

Yeast culture has changed the rumen atmosphere resulted in higher digestibility of nutrients and thus increased weight gain (Isik *et al.*, 2004), Jayabal *et al.*, 2008), Garg *et al.*, 2009; Jinturkar *et al.*, 2009) on the other hand no improvement in live weight gain by live yeast culture supplementation have been observed (Cabrera *et al.,* 2000 and Titi *et al.,* 2008). The animals of both the groups had positive nitrogen, calcium and phosphorus balances (Table 2). The higher values of nitrogen balance and retention in YS group could possibly be due to comparatively higher dry matter intake and digestibility of protein as a result of stimulated proteolytic bacterial count on yeast supplementation (Yoon and Stern, 1996). The higher values for nitrogen intake, balance (g/d) and retention on live yeast culture supplementation have also been recorded earlier by Rao *et al.* (2001), Mahender *et al.* (2006) and in sheep (Garg *et al.,* 2009). The supplementation of live yeast culture resulted into significant improvement in intake and balances and non significant but comparatively higher retention (as % of intake) of calcium and phosphorus in YS group in comparison to YU group. This could possibly be due to improvement in dry mater intake on live yeast culture supplementation. Similar finding were observed in goats fed on groundnut haulm based complete diets supplemented with yeast (Rekha *et al.,* 2006), in sheep (Garg *et al.,* 2009) whereas Rao *et al.* (2001) noticed no influence on calcium and phosphorus balance due to probiotic supplementation but Singh *et al.*, (2012) reported that serum calcium and phosphorus concentration decreased ($P < 0.05$) significantly due to heat stress when buffaloes were not supplemented with yeast powder.

In conclusion, result showed that yeast supplementation of DS-CFB in ration of kids improved DM intake, digestibility of nutrients, average daily gain, with positive influence on balances of N, Ca and P.

References

AOAC (1999) Official method of analysis. 18th ed. Association of Official Analytical Chemists, Washington, D.C.

Bhoi G and Sharma DD (1993) Effect of different probiotics on growth and feed conversion efficiency in kids. Proceeding of the sixth A.N.R.W.C. held at Bhubaneswar from 13-16 Sept. 1993 (Abs.290).

Cabrera EJI, Mendoza MG.D, Aranda IE, Gareia-Bojalil C, Bareena GR and Ramos JJA (2000) *Saccharomyces cerevisiae* and nitrogen supplementation in growing steers grazing tropical pastures. *Anim. Feed Sci. Technol*. **83**: 49-55.

Desnoyers M, Giger-Reverdin S, Bertin G, Duvaux-Ponter C and Sauvant D (2009) Meta-analysis of the influence of *Saccharomyces cerevisiae* supplementation on ruminal parameters and milk production of ruminants. *J. Dairy Sci*. **92**: 1620-1632.

Erasmus LJ, Botha PM and Kistner A (1992) Effect of yeast culture supplement on production, rumen fermentation, and duodenal nitrogen flow in dairy cows. *J. Dairy Sci.* **75**: 3056-3065.

Fadel El-seed, ANMA, Sekine J, Kamel HEM and Hishinuma M (2004) Changes with time after feeding in ruminal pool sizes of cellular contents, crude protein, cellulose, hemicellusose and lignin. *Indian J. Anim. Sci*. **74**: 205-210.

Fallon RJ and Harte FJ (1987) The effect of yeast culture inclusion in the concentrate diet on calf performance. *J. Dairy Sci.* **70 (suppl. 1)**: 143.

Garg DD, Sharma T and Dhuria RK (2009) Effect of groundnut straw based complete feed alone and in combination with yeast in ration of sheep. *Anim. Nutr. feed Tech.* **9**: 137-144.

Goering HK and Van Soest PJ (1970) Forage Fibre Analysis, ARS, USDA. Agricultural Handbook No. 379, SDA, Washington, DC. pp. 1-12.

Haddad SG and Goussous SN (2005) Effect of yeast culture supplementation on nutrient intake,digestibility and growth performance of Awassi lambs. *Anim. Feed Sci. Technol.* **118**: 343-48.

Harris B, Dorminey DE, Smith WA, von Horn HH and Wilcox Cj (1992) Effects of feather meal at two protein concentrations and yeast culture on production parameter in lactating dairy cows. *J. Dairy Sci*. **75**: 3524-3530.

Harrison GA, Hemken RW, Dawson KA, Harmon, RJ and Barker KB (1988) Influence of addition of yeast culture supplement to diets of lactating cows on ruminal fermentation and microbial populations. *J. Dairy Sci*. **71**: 2967–2975.

Isik M, Ekimler F, Ozen N and Firat MZ (2004) Effect of using probiotics on growth performance and health of dairy calves. *Turk Veterinerlik ve Hayvancilik Dergisi*. **28**: 63-69.

Jakhmola RC (2003) Principle and preparation of complete feed block: In Recent Advances in Animal Nutrition Research, CAS in Animal Nutrition, Indian Veterinary Research Institute, Izatanagar, India, pp. 139-143.

Jayabal T, Murallidharan Ra, Tensingh Gnanaraj, T and Murugan M (2008) Growth performance of stall-fed goats under probiotic supplementation. *Tamilnadu J. Vet. Anim. Sci.* **4** (5): 179-184.

Jinturkar AS, Gujar BV, Chauhan DS., and Patil, RA (2009) Effect of feeding probiotics on the growth performance and feed conversion efficiency in Goat. *Indian J. Anim. Res.* **43**(1): 49-52.

Kamra DN and Pathak NN (2005) Improvement in livestock productivity by use of probiotics: A review. *Indian J. Anim. Sci*. **75**(1): 128-134.

Kawas JR, Garcia-Castillo R, Fimbres-Durazo H, Garza-Cazares F, Hernandez-Vidal JFG, Olivares-Saenz E and Lu CD (2007) Effects of sodium bicarbonate and yeast on nutrient intake, digestibility, and ruminal fermentation of light-weight lambs fed finishing diets. *Small Rumin. Res*. **67**: 149–156.

Kholif SM and Korshed MM (2006) Effect of yeast or selenized yeast supplementation to rations on the productive performances of lactating buffaloes. *Egypt. J. Nutr. Feeds.* **9**: 193-205.

Kumar D (2003) Production technology for Moth bean in India. Central Arid Zone Research Institute, Jodhpur, ICAR.

Kumar MK and Reddy GVK (2004) Supplementation of yeast culture (*Saccharomyces cerevisiae*) to roughage based rations in crossbred heifers. *Indian J. Anim. Nutr.* **21**: 36-39.

Mahender M, Prasad VLK and Reddy GVN (2006) Effect of yeast culture on growth and nutrient utilization in Nellore lambs. *Indian J. Anim. Nutr*. **23**: 10-13.

Newbold CJ, Wallace RJ and McIntosh FM (1996) Mode of action of the yeast *Saccharomyces cerevisiae* as a feed additive for ruminants. *Brit. J. Nutr*. **76**: 249-261.

Pandey P and Agrawal IS (2001) Nutrient utilization and growth response in cross bred calves fed antibiotic and probiotic supplemented diets. *Indian J. Anim. Nutr.* **18**(1): 15-18.

Patra AK (2012) The use of live yeast products as microbial feed additives in ruminant nutrition. *Asian j. Anim. vet. adv.* **7**(5): 366-375.

Putnam DE, Schwab CG, Socha MT, Whitehouse NL, Kierstead NA and Garthwaite BD (1997) Effect of yeast culture in the diet of early lactation dairy cows on ruminal fermentation and passage of nitrogen fractions and amino acids to the small intestine. *J. Dairy Sci.* **80**: 374-84.

Quigley JD, Wallis LB, Dowlen HH and Heitmann RN (1992) Sodium bicarbonate and yeast culture effects on ruminal fermentation, growth and intake in dairy calves. *J. Dairy Sci.* **75**: 3531-3538.

Rao TN, Rao ZP and Prasad JR (2001) Effect of supplementation of probiotics in rumen environment of sheep. *Indian J. Anim. Nutr*. **18**: 133-137.

Rekha NA, Prasad JR, Ramana JV and Ravi A (2006) Evaluation of groundnut haulms based complete rations with or without yeast culture in sheep. *Indian J. Anim. Nutr.* **23**(1): 1-4.

Robinson PH and Erasmus LJ (2009) Effects of analyzable diet components on responses of lactating dairy cows to *Saccharomyces cerevisiae* based yeast products: A systemic review of the literature. *Anim. Feed Sci. Technol.* **149**: 185-198.

Saini N and Purohit GR (2007) Feeding value of straws of semi arid zone in goat. *Indian J. Anim. Nutr.* **24**(1)*:* 36-39*.*

Sauvant D, Giger-Reverdin S and Schmidely P (2004) Rumen acidosis: Modeling ruminant. Proceedings of the Alltech's 20th Annual Symposium: Re-Imaging the feed industry, May 23-26, 2004, Nottingham University Press, pp. 221-229.

Samanta AK, Singh KK, Das MM and Kundu SS (2006) Rumen fermentation pattern in cross bred cattle maintained on complete feed block. *Indian J. Anim. Nutr.* **23**: 50-52.

Sharma T, Arya RS, Dhuria RK, Garg DD, Harsh M and Purohit GR (2004) Comparative utilization of wheat straw and groundnut fodder based complete feed in loose and block form in calves. *Proc. XI Anim. Nutr. Conf.* Jabalpur. pp. 79.

Singh SP, Hooda OK, Kundu SS and Singh S (2012) Biochemical changes in heat exposed buffalo heifers supplemented with yeast. *Trop. Anim. Health Prod*. **44**(7): 1383-7.

Snedecor GW and Cochran WG (1994) Statistical Methods, 8th ed. Oxford and IBH Publishing Co. New Delhi, India.

Stella AV, R Paratte, L Valnegri, G Cigalino, G Soncini, E Chevaux, V Dell'Orto, and G Savoini. (2007) Effect of administration of live *Saccharomyces cerevisiae* on milk production, milk composition, blood metabolites, and faecal flora in early lactating dairy goats. *Small Ruminant Res.* **67**:7-13.

Talpatra SK, Ray SC and Sen KC (1940) The analysis of mineral constituents in biological material. Estimation of phosphorus, chloride, calcium, magnesium, sodium and potassium in feeds stuff. *J. Vet. Sci. Anim. Husb*. **10**: 243-246.

Titi HH, Dmour RO, Abdullah AY (2008) Growth performance and carcass characteristics of Awassi lambs and Shami goat kids fed yeast culture in their finishing diet. *Anim. feed Sci. Technol.* **142**: 33-43.

Wallace RJ and Newbold CJ (1992) Probiotics for ruminants. In: Probiotics: The Scientific Basis. R. Fuller, ed. Chapman, p. 317.

Wallis LB, Quigley (III), JD and Dowien HH (1992) Effects of sodium bicarbonate and yeast culture on growth and intake in Jersey calves. *J. Dairy Sci.* **75** (Suppl.1): 268.

Williams PE, Walker A and MacRae JC (1990) Rumen probiosis: The effects of addition of yeast culture [viable yeast (*Saccharomyces cerevisiae*) plus growth medium] on duodenal protein flow in wether sheep. *Proceedings Nutrition Society*. **49**: 128A.

Williams PEV and Newbold CJ (1990) Rumen probiosis. The effect of the inclusion of yeast culture (*Saccharomyces cerevisiae* plus growth medium) in the diet of cows on milk yield and forage degradation and fermentation patterns in the rumen of sheep and steers. *J. Anim. Sci.* **69**: 3016-3026.

Wholt JE, Corcine TT, Zajac PK (1998) Effect of yeast on feed intake and performance of cows fed diets based on corn silage during early lactation. *J. Dairy Sci*. **81**: 1345-1352.

Yoon IK and Stern MD (1996) Effect of *Saccharomyces cerevisiae* and *Aspergillus oryzaecultures* on rumen fermentation in dairy cows. *J. Dairy Sci*. **79**: 411-417.