



Research Article

NUTRIENTS INTAKE AND NUTRIENTS DIGESTIBILITY OF WEANER LAMBS AS AFFECTED BY INCORPORATION OF NON-CONVENTIONAL INGREDIENTS IN TOTAL MIXED RATION

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Abstract: A study of 112 days on 18 weaned Patanwadi and Merino× Patanwadi healthy lambs of about 180 days of age were randomly distributed into three dietary treatments on body weight basis viz. T1: Total mixed ration (TMR-I) -Conventional group (65% concentrate and 35% urea treated wheat straw), T2 : TMR-II (Azolla-10%, P J Pods -25 %, Corn steep liquor -7 %, G N Cake-10 %, molasses- 10%, mineral mixture- 3% and urea treated wheat straw- 35 %) and T3:TMR-III (Azolla-20%, P J Pods -14 %, Corn steep liquor -15 %, molasses- 10%, vegetable oil- 3%, mineral mixture- 3% and urea treated wheat straw- 35 %). The TMRs were iso-nitrogenous. The daily gains in body weight were significant ($P<0.05$) amongst treatments and were in descending order of TMR I, II and III. The result indicated that the incorporation of Azolla 10% and more in the weaner ration significantly ($P<0.05$) reduced the growth rate. An increase in body length (cm) followed the same trend. An improvement in heart girth was similar in all treatments while gain in height at wither (cm) was found to be highest ($P<0.05$) in TMR-I (7.83 ± 0.83) followed by TMR-II (5.72 ± 0.43) and the lowest ($P<0.05$) height at wither (cm) in TMR-III (5.08 ± 0.46). Nutrient intakes were to satisfy the requirement, whereas, digestibility (%) of dry matter (DM), organic matter (OM), crude protein (CP) and ether extract (EE) were declined significantly ($P<0.05$) in lambs fed non conventional feed stuff containing total mixed rations except crude fibre (CF) digestibility which was statistically similar. Moreover, the lambs of all treatments showed positive nitrogen balance.

Keywords: Non- conventional, TMR, growth, digestibility, nutrient balance, Weaner lambs

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Introduction

The sheep husbandry generates income from mutton (main) and others like wool, hide, milk, manure and bone for farmers [1]. The sheep husbandry is considered as most suited livestock enterprise to weaker section of the society owing to little input need. Even though nutrition is central to economic sheep production, in India feeding primary based on herbage from natural range land and crop residues. These situation hampers mutton and wool yield [2]. Two extreme situations of huge shortages of the feed resources and abundant availability of non-conventional as well as agro-industrial by products as feed; can be effectively utilize for designing and developing economic stall-feeding system for sheep production. Non-conventional feed resources like *Prosopis juliflora* (P J) pods (12.00 and 4.00 million tons in India and Gujarat, respectively) and corn steep liquor (10.00 and 4.00 thousand tons) are abundantly available to utilize effectively for livestock feed [3]. An Azolla is a water plant which can be used as feed for livestock and as a bio-fertilizer with huge potential to cultivate in new business model [4]. Keeping above facts in mind the experiment was designed to study the effect of incorporation of Azolla, *Prosopis juliflora* pods and corn steep liquor in total mixed ration of weaner lamb on nutrients intake and nutrients digestibility.

Materials and Methods

Study of 112 days on eighteen weaned Patanwadi and Merino× Patanwadi healthy lambs of about 180 days of age (13.83 to 14.43 kg) was conducted at Instructional Farm, College of Veterinary Science & Animal Husbandry, Anand Agricultural University, Anand (erstwhile Gujarat Agricultural University).

On the basis of body weight the weaner lambs were randomly divided into three dietary treatments viz. T1: TMR-I Conventional group (Maize- 20%, Ground nut cake- 20%, Rice polish- 12%, molasses- 10%, mineral mixture- 3% and urea treated wheat straw 35 %), T2 : TMR-II supplemented non conventional group I (Azolla-10%, P J Pods -25 %, Corn steep liquor -7 %, G N Cake-10 %, molasses-10%, mineral mixture- 3% and urea treated wheat straw- 35 %) and T3:TMR-III supplemented non conventional group II (Azolla-20%, P J Pods -14 %, Corn steep liquor -15 %, molasses- 10%, vegetable oil – 3%, mineral mixture- 3% and urea treated wheat straw- 35 %). Lambs were individually fed in cement concrete manger either conventional or non-conventional total mixed ration. All lambs were dewormed with broad spectrum dewormer before initiation of the experiment. Lambs were offered clean and wholesome water twice in a day in plastic bowl and intake was measured at weekly interval. They were given total mixed ration two times in a day at 9.00 am and 15.00 pm. Lambs were allowed to exercise in the shed during the afternoon hours. Lambs were weighed at weekly intervals before feeding and watering in morning. At the final stage of the feeding experiment, 4 lambs from each treatment were shifted to metabolism cages which are specially designed for collection of urine and faeces separately. An adaptation period of 7 days in cage was given followed by 7 days of collection period during which quantity of feed offered, feed residue, total faeces and urine voided were recorded over 24 h. The samples of feed offered, left over, faeces and urine were preserved for further analysis. An analysis of the collected samples was carried out using AOAC (1995) methods [5].

The data were analyzed following two factorial completely randomized design described in Snedecor and Cochran, 1994 [6].

Results and Discussion

Nutrients composition and growth

Ingredients and proximate compositions of total mixed rations and ingredients used were given in [Table-1]. An analysis indicated that total mixed ration was iso-nitrogen. The average daily gain of lambs in TMR-I, TMR-II and TMR-III was found to be 119.40 ± 5.40 , 79.46 ± 3.50 and 54.86 ± 3.34 g. The daily gains in body weight were significant ($P < 0.05$) amongst treatments and were descending order of TMR I, II and III [Table-2]. The result indicated that the incorporation of Azolla 10% and more in the weaner ration reduces the growth rate significantly ($P < 0.05$). Similar trend in growth parameters observed in Marwari, Patanwadi and Merino x Patanwadi lambs by Wadhawani, *et al.*, (2010) on feeding conventional and non-conventional TMR [7]. The four (TMR-I) and two & half (TMR-II) times higher daily gain were observed in comparison to semi-intensive feeding experiment in lamb [8]. This indicates superiority of total mixed ration over semi-intensive system. Thus, the findings of this study make a strong case for feeding of total mixed ration. An improvement in heart girth was similar in all treatments while gain in height at wither (cm) was significantly higher ($P < 0.05$) in lambs fed TMR-I (7.83 ± 0.83) than lambs fed TMR-II (5.72 ± 0.43) and TMR III (5.08 ± 0.46) with numerical differ between T2 and T3. An increase in body length (cm) under followed same trend as that of body weight gain. These results agree with the observations of earlier workers. Saiyed, 2003; Patel, 1995 and Savsani, 1998; showing more or less same heart girth, height at withers and body length for animals of same breed and similar age which were reared either on conventional or non-conventional feedlot rations [9-11].

Table-1 Ingredients and proximate composition of total mixed rations (% on DM basis)

Ingredients/rations	CP	CF	EE	NFE	Ash
TMR-I	13.87	20.04	2.96	53.47	9.66
TMR-II	13.64	22.20	2.87	50.90	10.39
TMR-III	13.30	20.50	4.58	49.19	12.43
Azolla	15.63	13.01	2.84	52.70	15.82
<i>Prosopis juliflora</i> pods	12.48	25.59	3.59	53.28	5.08
Corn steep liquor	48.0	0.50	0.20	22.60	28.70
Urea treated wheat straw	7.32	42.01	1.85	39.75	9.07

Note: DM= dry matter, CP= Crude protein, CF= Crude fibre, EE= Ether extract, NFE= Nitrogen free extract

Table-2 Gain in growth parameters of weaner lambs under feedlot system

Particular	TMR-I	TMR-II	TMR-III
Gain			
Body weight (g/day)	119.40 ± 5.40	79.46 ± 3.50	54.86 ± 3.34
Height at Wither (cm)	7.83 ± 0.83	5.72 ± 0.43	5.08 ± 0.46
Heart Girth (cm)	17.14 ± 1.70	14.39 ± 2.26	10.8 ± 1.01
Body Length (cm)	12.70 ± 0.87	8.46 ± 0.78	5.72 ± 0.28

a, b, c Means with different superscripts in row differed significantly ($P < 0.05$)

Note: TMR= Total mixed ration

Nutrient intake and digestibility

During metabolism trial, daily percent dry matter intake (kg) was reported significantly ($P < 0.05$) lower (2.58 ± 0.40) TMR-I in comparison to TMR-II (3.93 ± 0.18) and TMR-III (3.64 ± 0.20) but difference between TMR-II & III was non-significant [Table-3]. However, DM intake on total and metabolic body weight basis followed same trend with non-significant difference between treatments. The digestibility (%) of CF for lambs fed either conventional or non-conventional total mixed ration was statistically similar. However, digestibility (%) of DM, OM, CP and NFE was significantly ($P < 0.05$) reduced in lambs fed non-conventional total mixed rations. The digestibility (%) of DM, CP and EE was significantly ($P < 0.05$) reduced in lambs fed TMR-III than TMR-II and TMR-I. The values are similar to those reported on feeding conventional and non-conventional TMR [7,9], Whereas lower digestibility was reported by Singh, *et al.*, (1992) and Ravikala, (1992) [12,

13]. The average DCP and TDN intake (g/head/day) of the lambs of TMR-I, TMR-II and TMR-III were 78.27 ± 10.03 , 427.01 ; 77.17 ± 5.74 , 449.44 ± 40.72 and 55.56 ± 3.46 , 329.56 ± 30.04 , respectively which did not differ from each other. Similar value was reported on feeding conventional and non-conventional TMR [7].

Table-3 Feed Nutrient intake, digestibility coefficients and nitrogen balance of experimental lambs during metabolism trial

Particular	TMR-I	TMR-II	TMR-III
No of animals	4	4	4
Body weight(kg)	25.85 ± 1.32	$20.24^a \pm 1.62$	$19.20^a \pm 1.78$
Dry matter intake			
g/d	670.10 ± 118.14	798.00 ± 79.08	611.30 ± 67.00
g /kg $w^{0.75}$	58.28 ± 9.24	83.39 ± 4.55	73.62 ± 4.81
Kg/100 kg	$2.58^a \pm 0.40$	$3.93^b \pm 0.18$	$3.64^b \pm 0.20$
Nutrient Digestibility (%)			
DM	$56.39^c \pm 0.46$	$51.68^b \pm 0.70$	$45.94^a \pm 1.06$
OM	$64.48^b \pm 1.06$	$58.86^a \pm 0.76$	$56.06^a \pm 1.14$
CP	$72.16^c \pm 1.36$	$66.34^b \pm 1.77$	$60.90^a \pm 1.22$
CF	60.38 ± 2.06	57.71 ± 1.46	55.50 ± 1.34
NFE	$63.02^b \pm 1.41$	$56.61^a \pm 1.34$	$55.18^a \pm 1.96$
EE	$71.97^b \pm 1.60$	$68.07^b \pm 1.82$	$58.56^a \pm 2.96$
Nutritive value (%)			
DCP	$12.08^b \pm 0.86$	$9.76^a \pm 0.37$	$9.26^a \pm 0.66$
TDN	$64.74^b \pm 2.62$	$54.46^a \pm 0.82$	$54.22^a \pm 1.32$
Nutritive intake (g)			
DCP/head/day	78.27 ± 10.03	77.17 ± 5.74	55.56 ± 3.46
DCP/kg $w^{0.75}$ /day	6.80 ± 0.72	8.25 ± 0.19	6.72 ± 0.10
TDN/ head /day	427.01 ± 64.06	449.44 ± 40.72	329.56 ± 30.04
TDN/ kg /day	37.13 ± 4.82	46.98 ± 1.92	40.01 ± 1.67
Nitrogen balance(g/h/d)			
Intake	17.35 ± 2.18	18.68 ± 1.58	14.87 ± 1.06
Balance	$9.10^b \pm 0.74$	$8.38^b \pm 0.94$	$5.53^a \pm 0.30$
g/kg $w^{0.75}$	0.79 ± 0.06	0.88 ± 0.06	0.67 ± 0.01

Means with different superscripts (a, b and c) in row differed significantly ($P < 0.05$)

Note: g=gram, d=day, $w^{0.75}$ = metabolic body weight, kg= kilogram, DM= Dry matter, OM= Organic matter, CP= Crude protein, CF= Crude fibre, NFE= Nitrogen free extract, EE= Ether extract, DCP= digestible crude protein, TDN= total digestible nutrients

Table-4 Water intake efficiency of weaner lambs ()

Particular	TMR-I	TMR-II	TMR-III
Water intake			
ml/d	2.43 ± 0.11	2.20 ± 0.10	2.16 ± 0.06
l/100 kg B.wt	11.96 ± 0.81	12.09 ± 0.78	13.22 ± 0.70
g/kg W 0.75	253.62 ± 14.00	250.46 ± 14.27	264.76 ± 11.96

However, DCP and TDN content of conventional total mixed ration (12.08 ± 0.86 , 64.74 ± 2.62) was significantly ($P < 0.05$) higher than non-conventional total mixed ration (9.76 ± 0.37 , 56.46 ± 0.82 and 9.26 ± 0.66 , 54.22 ± 1.32). In present study the DM, DCP and TDN intake in T1, T2 and T3, were higher than ICAR (1985) recommendation [14] indicating that non-conventional based total mixed ration provides nutrients for growth as efficiently as the conventional ration. The mean retention of nitrogen (g/head/day) in lambs was positive in all the treatments and statistically at par in conventional (TMR-I; 9.10 ± 0.74) or non-conventional total mixed ration (TMR-II; 8.38 ± 0.94).

It can be inferred that Azolla, P J Pods and corn steep liquor can be incorporated in the ration of lambs without affecting nutrient utilization and N balance.

Conclusion

The inclusion of *Prosopis juliflora* pods and Azolla as non-conventional feeds had times higher weight gain as compared semi-intensive rearing system of Patanwadi and Merino × Patanwadi lambs. The digestibility of DM, OM, CP and NFE of non-conventional TMRs were lower than conventional TMR, whereas digestibility of DM, CP and EE were further lower in TMR-III than TMR-II but nutrient intake (DCP and TDN) and nitrogen balance was positive in all the treatments.

Application of research: Applicable to the sheep rearing farmers

Research Category: Animal Nutrition

Abbreviations:

TMR: Total Mix Ration

DCP: Digestible Crude Protein

TDN: Total Digestible Protein

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