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Comparative Growth Performance of Weaner Lambs on Non-conventional Based Ration Under Intensive Production System

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ABSTRACT

Twenty four farms born weaner lambs, 12 each of Marwari and Patanwadi breed were randomly divided into two dietary treatments viz. T_1-conventional and T_2-nonconventional and fed individually on cemented manger for 180 days under feedlot system. The lambs grew at the rate of 63.38 ± 3.25 and 48.80 ± 2.50 g/d to attain 21.35 ± 1.26 and 18.51 ± 0.85 kg body weight at 11 months of age under conventional and non- conventional treatment groups, respectively. The breeds of lambs did not influence the body weight, body weight gain and body measurements However, body weight, body weight gain and body measurements significantly ($P<0.05$) influenced by treatment X period X breed, period X breed and treatment, period X breed and treatment X period interaction, respectively. Treatment groups only influenced significantly ($p<0.05$) to DM intake g/kg $M^{0.75}$ where as treatment X period and treatment X breed X period significantly ($P<0.05$) affected the DM intake as percent of body weight. The feed conversion efficiency in terms of DM, DCP and TDN per kg gain was significantly influenced by dietary treatment in Patanwadi breed group only. Where as FCE in terms of DM, DCP and TDN kg per kg dressed weight significantly ($P<0.01$) affect by breed group. The interaction of treatment X period and treatment X breed X period influenced significantly ($P<0.05$) to water intake. Carcass traits did not differ significantly either due to treatment or treatment X breed interaction. The Lower feed cost, feed cost Rs./kg gain and feed cost Rs./kg dressed weight have been recorded in non conventional treatment group due to use of cheaper non conventional ingredients. Non significant dietary influence on DM, OM, CP, CF, EE and NFE digestibility but nitrogen, calcium and phosphorus balanced positively as g/d and percent of intake.

Key Words: Mango seed kernel; Babul pods chuni; *Prosopis juliflora* pods; Weaner lambs; Intensive production system

INTRODUCTION

The productivity of Indian sheep is lower than those in agriculturally developed countries. The major factors contributing to low productivity of sheep are low/less available nutrients from pasture and lack in adopting scientific practice of feeding, increasing intensified agriculture with good irrigation facilities and industrialization hence more and more land slicing is lost from permanent pasture and waste ranges. This resulted in shrinkage of grazing land and making stall feeding of sheep is a necessity in coming era. In Gujarat state, the non-conventional feeds such as kuvadia seeds (*Cassia tora*), Mango seed kernels (*Mangifera indica*), *Prosopis juliflora* pods and Babul pods (*Acacia nilotica*) chuni are available to the tune of 2.00, 20.00, 400.00 and 200 thousand tones/annum, respectively (Shukla *et al*., 1988). These non conventional feeds and their by products are being tested for their palatability, digestibility, toxic effects, maximum level of incorporation in the concentrate mixture of different categories of sheep affecting their health and production (Anon. 1993). This will lead to need of designing and developing economic feeding system by way of using the available cheaper non-conventional feeds In the past under feedlot system of sheep rearing number of research workers utilized one or two non conventional feed ingredients for feed formulation hence present experiment was under taken to study the feasibility of rearing indigenous lambs on ration completely based on non conventional ingredients.

MATERIALS AND METHODS

Twenty four farm born weaner lambs, twelve each of Marwari and Patanwadi breeds, with six animals in each treatment group of 5 months of age and 10.25 kg body weight were randomly divided on body weight basis into two dietary treatment viz. T_1 (Conventional: Maize-38%,G N Cake-25%, Rice Polish-24%, Jaggery sol-10% & Mineral mixture-3% & T_2 (Non-conventional :P J Pods- 25%, Mango seed kernel-25%, Babul pods chuni-15%, *Cassia tora* seeds -6% ,Corn steep liquor-15%,Urea-1% Jaggery-10% & mineral mixture-3%) under middle Gujarat agro climatic condition. In addition to concentrate mixture the animals were individually fed *ad lib* on dried mature pasture grass (*Dicanthium annulatum*) and limited green NB-21(*Napier Hybrid*) @ 200 g/h/d. The jaggery solution was prepared by mixing 6.5 kg jaggery and 3.5 kg water .The experimental period was lasted for 180 days at Instructional Farm, Veterinary College, Anand. ICAR (1985) feeding standard was fallowed to meet the energy and protein

requirements of experiment lambs. The animals were given their required quota of concentrate mixture at 8.00 a.m. and green NB-21 grass at 10.00 a.m. after mixing along with mature pastures grass. All animals were dewormed with Banminth forte-II and Diadin bolus was given to remove oocyst of coccidia. The animals were offered water thrice in a day in plastic tub. At the final stage of the feeding experiment, 5 lambs from each treatment group were shifted to metabolism cages and an adaptation period of 7 days in cage was fallowed by 7 days of collection period during which quantity of feed offered, feed residue, total faeces voided and total urine output of animals were recorded over 24 h. Then samples of feed offered, residue, faeces and urine were preserved. The chemical analysis of the collected samples was carried out using AOAC (1975) methods. At the end of growth trial all the lambs from both the treatment groups were slaughtered by traditional Halal method. The organs, head, cannon, empty GI tract and primal cuts were weighted on sensitive dial type balance with a capacity of 2 kg whereas pelt free carcass, hot carcass, skin and GI tract filled with ingesta were weighted on pan balance. The realizable receipts were computed based on the information from retailers in the local market. The mutton and liver were sold on weight basis but the skin, head, cannon, empty rumen, and the intestine were sold on fixed price irrespective of weight. The data were analyzed statistically as per Snedecor and Cochran (1987)

The observation on body weight, body weight gain , body measurements, feed intake, water intake, hematological studies etc were analyzed by Factorial completely Randomized-split plot design having two main factor i.e. treatments (T1 & T2) and breeds (B1 & B2) and one sub factor i.e. periods. The digestibility co efficient of proximate nutrients and balance of Nitrogen, Calcium and Phosphorous, carcass traits and feed cost/economics of rearing the lambs were analyzed by the Test of significance-'t' Test

RESULTS AND DISCUSSION

Ingredient/proximate composition of experimental diets. The proportion of different ingredients used in formulation of conventional and non-conventional concentrate mixtures and proximate composition of concentrate mixtures, dry and green fodders used in the experiment is presented in Table I.

Intake. The feed and feed efficiency data are presented in Table II and III, respectively. The experimental lambs consumed 3.14±0.04 and 3.25±0.04 kg dry matter per 100 kg body weight and 61.12±1.32 and 64.76±0.74 g/kg w $^{0.75}$ under conventional and non conventional treatment group, respectively. The lambs fed on non conventional concentrate mixture showed 3.82% higher DM intake per 100 kg body weight than those fed on conventional group. The dietary treatments significantly (P<0.05) affected the DM intake per kg metabolic body weight but not the DM intake per 100 kg body weight of the lambs .The breed and

Table I. Ingredients and chemical composition of experimental diets (%)

Particular	*Conventional*	*Non-conventional*
Maize	38.00	-
GN Cake	25.00	-
Rice Polish	24.00	-
Mango seed Kernel	-	25.00
Prosopis juliflora	-	25.00
Babul Pods chuni	-	15.00
Cassia tora seeds	-	06.00
Corn steep liquor	-	15.00
Urea	-	01.00
Jaggery solution	10.00	10.00
Mineral Mixture	03.00	03.00

Chemical Composition (% on DM basis)

Particular	*Conventional*	*Non-Conventional*	*NB-21 grass*	*Mature Pasture grass*
CP	17.22	17.19	12.12	02.01
CF	06.60	9.66	28.51	42.39
EE	04.62	5.02	04.01	02.08
Ash	10.70	9.51	11.78	07.82
NFE	60.85	58.62	43.58	45.79
Ca	00.78	1.16	0.90	00.80
P	00.99	0.99	0.41	00.30

Table II. Feed and water intake and feed cost of weaner lambs under feedlot

Particular	*Conventional*	*Non-onventional*	*Test*
A Dry matter intake g/kg w $^{0.75}$	61.12 ± 1.32^{a}	64.76 ± 0.74^{b}	**
Per 100 kg	3.14 ± 0.04	3.26 ± 0.04	NS
B. Water intake			
l Per 100 kg	11.69 ± 0.42	12.78 ± 0.79	NS
l per kg DMI	3.87 ± 0.08	3.62 ± 0.08	NS
C Feed cost (Rs)			
Concentrate	242.99 ± 11.45^{b}	150.11 ± 5.07^{a}	**
Roughage	48.07 ± 03.60^{b}	40.24 ± 3.12^{a}	**
D. Total feed cost	291.06 ± 13.76^{b}	190.35 ± 1.07^{a}	**
E. Feed cost/kg gain	30.01 ± 02.58^{b}	23.04 ± 1.07^{a}	**
F. Feed cost/kg dressed wt.	32.79 ± 01.40^{b}	23.95 ± 0.57^{a}	**

** P<0.01 NS Non significant

Table III. Comparative growth performance and feed efficiency of weaner lambs under Intensive production system

Particular	*Marwari*		*Patanwadi*		*Test value*
	T1	**T2**	**T1**	**T2**	
A. Body weight (kg)					
Initial	10.96± .30	11.82± .98	11.23± 1.01	9.59 ± 0.23	NS
Final	19.51± .82	19.77± .08	23.20± 1.53	17.25±1.14	NS
B. Body weight gain (g/d)	52.05± 27^{A}	49.89± 97^{A}	74.52± .63^{B}	47.72± .48^{A}	**
C Body measurement (cm)					
A. Heart girth					
Initial	48.42± .31	51.25± .17	49.62± 1.52	49.42± 1.52	NS
Final	59.92± .46	60.42± .45	62.00±1.18	66.00± 1.80	NS
B. Body length					
Initial	49.08± .29	49.50±1.94	46.83±1.62	45.67±1.47	NS
Final	60.67±2.03	60.83±0.99	60.92±2.50	57.42±1.54	NS
C. Height at wither					
Initial	46.83±2.16	48.00±1.53	45.83±1.20	43.92±1.50	NS
Final	56.33±1.99	56.50±1.68	57.75±1.32	52.00±1.57	NS
D. Intake (kg/kg gain)					
DM	10.25±1.59	11.59±0.96	7.88±0.39^{A}	10.91±0.66^{B}	**
DCP	0.94±0.14	1.05±0.08	0.73±0.03^{A}	0.98±0.06^{B}	**
TDN	6.74±0.99	7.55±0.59	5.23±0.26^{A}	7.11±0.43^{B}	**
E. Intake (kg/kg dressed weight)					
DM	9.45±0.65^{a}	9.46±0.31^{a}	10.79±0.46^{b}	11.11± 0.38	**
DCP	0.88±0.06^{a}	0.88±0.02^{a}	0.98±0.04^{b}	1.04± 0.04^{b}	**
TDN	6.28±0.43^{a}	6.28±0.21^{a}	7.06±0.26^{b}	7.12± 0.15^{b}	**

** P<0.0NS Non significant Means with A and B superscript show treatment effect Means with a and b superscript show breeds effect

treatment X breed interaction were non significantly affected the feed intake of the lambs. However, the interaction of treatment X period and treatment X breed X period significantly (P<0.05) affected the feed intakes. Thus, either conventional or non-conventional concentrate mixture was equally better in palatability. Ravikala *et al* (1993) also reported non-significant effect of treatment on DM intake per 100 kg body weight by incorporating *Prosopis juliflora* pods in complete ration for growing lambs up to 30%.

The feed conversion efficiency under T_1 and T_2 groups, in terms of DM (9.06±0.85 & 11.25±0.54 kg), DCP (0.84±0.07 & 1.02±0.50kg) and TDN (5.99±0.54 & 7.33±0.35) kg/kg gain has been observed under present study. Patanwadi lambs reared on conventional group showed significantly (P<0.05) better growth and feed efficiency over lambs reared on non-conventional group where as Marwari lambs showed non significant FCE reared either on conventional or non conventional concentrate mixture based ration. The values for FCE in terms of DM, DCP and TDN intake kg per kg gain and per kg dressed weight for Patanwadi and Marwari lambs obtained in the present study were similar to those reported by Anon. (1993) when fed conventional and non- conventional concentrate mixture based ration under feedlot system. The breed effect was significant (P<0.05) indicated that the Marwari lambs utilize protein and energy better from the ration for production of each kg of dressed weight when fed on either conventional of non conventional concentrate mixture based ration than those of Patanwadi lambs. It can be concluded that lambs of Marwari breeds performed similarly when fed either conventional or non conventional concentrate mixture under intensive production system where as Patanwadi lambs showed better growth and feed efficiency on conventional concentrate mixture rather than on non-conventional concentrate mixture based ration. However, Marwari breeds excel over Patanwadi breed when FCE is expressed in terms of kg per kg dressed weight

Water intake. The average daily water intake per 100 kg body weight (Table II) was 9.32% higher by the lambs in T_2 (12.78±0.79 L) than those in T_1 (11.69±0.4 L) treatment group. However, the difference was non significant indicating that the water intake by the lambs as per cent of their body weight did not increase even though a completely non-conventional concentrate mixture was used in their ration. The interaction between treatment X breed was also significant (P<0.05) indicating that average water intake of the lambs was not influenced by either treatment or breeds of lambs. The interaction of treatments X Periods and treatment X breed X Periods was highly significant (p<0.01) imply that the response of the treatments was not similar on water intake over the periods. Anonymous (1993) reported non significant average daily water intake per 100 kg body weight by Marwari, Patanwadi and Merino X Patanwadi lambs fattened on either conventional concentrate mixture (11.44±0.64 L) or non-conventional concentrate mixture (12.75±0.67 L).

Digestibility of proximate nutrients and digestible nutrients intake. The digestibility coefficient (%) of DM (dry matter), OM (organic matter), CP (crude protein), CF (crude fiber), NFE (nitrogen free extract) and EE (ether extract) was 66.37±1.44, 68.32±0.91, 74.34±0.50, 58.87±2.59, 72.40±1.26 and 75.56±1.48 and 64.1±2.38, 67.65±2.36, 74.67±0.61, 63.86±1.88, 67.19±2.89 and 76.88±1.55 (Table IV) in conventional and non-conventional treatments groups, respectively. The digestibility coefficient did not influence by diet indicated nutrients of non conventional ration utilize with similar efficiency as conventional ration by weaner lambs. Ravikala *et al.* (1993) supported this report by observing non significant effect on DM, OM, CP, CF, NFE and EE digestibility when 30% incorporation of *Prosopis juliflora* pods in complete ration for Marwari, Patanwadi and Patanwadi X Merino crossbred weaner lambs under feedlot system of rearing. However, lower values of DM, OM, CP, CF, NFE and EE digestibility (54.80 to 63.20%) were reported by Jaikishan *et al.* (1984) when poultry dropping was used in complete rations of sheep.

The average DCP (digestible crude protein) and TDN (total digestible nutrient) contents for conventional (9.35±0.18 & 66.52±2.45%) and non-conventional ration (9.07±3.06 & 65.11±1.52%). reflected non significant difference indicating either conventional or non-conventional ration supplied equal amount of DCP and TDN to the growing lambs. The rations used in the present feeding trial were higher or at least comparable with the complete rations used by Sehgal (1992) and Ravikala *et al.* (1993).

The nitrogen, calcium and phosphorus balanced positively in the body of growing weaner lambs fed either on conventional or non conventional concentrate based ration under feedlot system. Krishna Mohan and Charyulu (1985) reported comparable values of nitrogen balance (5.47 to 6.63 g/d) to the present study when lambs fed complete rations containing groundnut straw in different ratios with concentrate. However, low daily calcium (1.74 g) and phosphorous (2.20 g) balance was reported by Ravikala *et al.* (1993) when fed 0, 15 and 30% levels of *Prosopis juliflora* pods in complete ration to growing hogget. The average phosphorus balance observed in the present study was higher than the values reported by Reddy and Reddy (1985) for lambs given complete feeds based on mixed forest grass hay or sorghum straw (1.42 to 1.79 g) with concentrate mixture. It can be concluded that feeding of non-conventional concentrate mixture based ration had no any adverse effect on the digestibility of proximate nutrients and showed positive daily balances of nitrogen, calcium and phosphorus in weaner lambs.

Growth performance. The average body weight and body weight gain of experimental lambs are presented in Table III. At the end, the experimental lambs attained 21.35±1.26

and 18.51±0.85 kg body weight under treatment group I and II, respectively. The lambs raised on T_1 maintained higher (10.99%) body weight than those lambs rose on T_2. However, the influence of the treatments on body weights of the lambs was non significant indicated that both the rations have similar nutritive value or nutrients utilization to attain similar body weight by the lambs (Saiyed, 1994; Wadhwani, 1999). The body weight attained by Marwari and Patanwadi lambs under T_1 (19.51±1.82 & 23.20±1.53 kg) and T_2 (19.77±1.08 & 17.25±1.14 kg) was on par indicated that both the breeds have similar effect on body weight. The body weight recorded for Marwari and Patanwadi lambs under present study are well in accordance with the values reported (Wadhwani *et al.,* 1994) under intensive production system .The interaction effect of treatment X period X breed was highly significantly ($P<0.05$) on body weight gain. The average daily body weight gain was recorded to be 63.28±3.25 and 48.80±2.54 g in conventional and non-conventional treatment groups, respectively. The lambs in T_1 group had 29.67% ($P<0.01$) higher daily body weight gain than the lambs reared under T_2 group. Patanwadi lambs showed 22.47g (43.17%) higher body weight gain (74.52±4.63 g) over Marwari lambs (52.05±4.27g) under conventional treatment group where as lambs of both the breeds performed equally under non conventional group indicated that non conventional concentrate mixture had similar effect on average daily weight gain of Marwari and Patanwadi lambs resulted into significant treatment X breed ($P<0.05$) interaction but non significant breed effect. The period X breed interaction effect was highly significant ($P<0.01$) but interaction between treatments X periods was non significant. The similar body weight gain has been reported when Marwari and Patanwadi lambs fed on non conventional concentrate mixture (Saiyed, 1994) and on 20% Azolla based non conventional total mixed ration (Wadhwani, 1999). The effect of treatment and breed was non significant on all three body measurements recorded under present study. However, period and treatment X period effect was significant (Saiyed, 1994).

Carcass traits. The results on carcass traits are presented in Table V. There was non significant difference between the two treatments in the dressing percent, weight of primal cuts, edible and non edible offal indicated non significant effects of the dietary treatments on all the parameters as reported by other research workers (Anon.1993, Saiyed, 1994; Wadhwani *et al.,* 1999). Thus, feeding of non conventional concentrate mixture had no adverse effect on the carcass and non carcass traits.

Economics of feeding. The average total feed cost (Rs/h) for rearing lambs was Rs 291.06 and 190.35 (Table II) under conventional and non- conventional treatment groups, respectively. The total feed cost was significantly ($P<0.01$) reduce to the tune of 47.84% under non conventional group over conventional group due to higher cost of conventional concentrate ingredients. The feed cost per kg gain and per kg dressed weight was 30.01±2.58 and 32.79±1.40 and 23.04±1.07 and 23.95±0.57 under T_1 and T_2 treatment groups, respectively. The lower feed cost per kg gain and per kg dressed weight under non-conventional treatment group over conventional treatment group has been reported (Anon., 1993; Ravikala *et al*, 1993; Saiyed, 1994; Wadhwani, 1999) for Marwari, Patanwadi and Merino X Patanwadi breeds under feedlot system of rearing due to cheaper non conventional concentrate ingredients.

The results of present study indicated that the conventional concentrate based ration can be replaced by the cheaper non conventional concentrate mixture based ration completely for economic feedlot rearing of weaner indigenous lambs for mutton production.

Table IV. Nutrients utilization and balance study in weaner lambs on non conventional concentrate based rations

Particular	*T1*	*T2*	*Test*
Animals	5	5	
Digestibility (%)			
DM	66.37 ± 1.44	64.01 ± 2.38	NS
OM	68.32 ± 0.91	67.65 ± 2.36	NS
CP	74.34 ± 0.50	74.67 ± 0.61	NS
CF	58.87 ± 2.59	63.86 ± 1.88	NS
NFE	72.40 ± 1.26	67.19 ± 2.89	NS
EE	75.56 ± 1.48	76.88 ±1.55	NS
Nutritive value (%)			
DCP	9.35 ± 0.18	9.07 ± 3.06	NS
TDN	66.52 ± 2.45	65.11 ± 1.52	NS
Balance (g/d)			
N	7.06 ± 0.42	7.55 ± 0.55	NS
Ca	1.80 ± 0.11	1.97 ± 0.07	NS
P	2.19 ± 0.04	2.13 ± 0.10	NS
Balance as % of intake			
N	66.35	66.29	NS
Ca	48.78	41.21	NS
P	58.40	51.45	NS

Table V. Carcass traits of weaner lambs on feedlot

Particular	*Conventional*	*Non-conventional*	*Test*
Pre fasting body wt.(kg)	21.52 ± 2.06	21.60 ± 1.13	NS
Post fasting body wt. (kg)	20.62 ± 1.93	19.90 ± 1.26	NS
Shrinkage (%)	4.17 ± 0.57	7.66 ± 1.66	NS
Hot carcass Wt.(kg)	8.80 ± 1.19	8.25 ± 0.51	NS
Dressing (%)			
Live weight	42.19 ± 2.03	41.52 ± 1.16	NS
Empty weight	49.95 ± 1.16	50.88 ± 1.48	NS
Weights of primal cuts (g)			
Neck & shoulder	2395.0 ± 575.29	2535.0 ±248.78	NS
Breast	557.5 ± 27.70	567.50 ±39.45	NS
Rib chops	767.5 ± 170.95	870.50 ±95.95	NS
Loin	690.0 ± 179.63	537.50± 23.94	NS
Hind leg	3350.0 ± 350.99	3120.00 ±223.12	NS
Edible offal (g)	1054.0 ± 30.10	1061.25 ± 28.59	NS
Non edible offal (g)	1520.0 ± 143.70	1462.50 ± 98.01	NS

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