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Growth and Feed Efficiency of Weaner Kids on a Non-conventional Ration Under Intensive Production System

L.H. SAIYED[1], S. PARNERKAR†, K. N. WADHWANI, P.R. PANDYA‡ AND A.M. PATEL[1]
Directorate of Research, Gujarat Agricultural University, Ahmedabad-380 004, India
†*Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, Gujarat Agricultural University, Sardar Krushinagar-385 506, India*
‡*Animal Nutrition Research Station, College of Veterinary Science and Animal Husbandry, Gujarat Agricultural University, Anand Campus, Anand- 388 110, Gujarat, India*
[1]Corresponding Authors: *Department of Livestock Production, College of Veterinary Science and Animal Husbandry, Gujarat Agricultural University, Anand Campus, Gujarat, India,* E-Mail: *amp@gau.guj.nic.in*

ABSTRACT

Twenty four kids (7.0 to 7.2 kg) eight each of Marwari, Surti kids were farm born and Zalawadi kids purchased from the local market and were randomly divided into two dietary treatments viz. T_1 (Conventional; Maize-38%, GN Cake-25%, Rice Polish-24%, Jaggery solution-10%, Mineral mixture-3%) and T_2 {Non-conventional; GN Cake-25%, Rice Polish-14%, Mango (*Mangifera indica*) seed Kernel-25%, Babul Pods chuni (*Acacia nilotica* seeds) -23%, Jaggery solution-10%, Mineral mixture-3%} on body weight basis and individually fed either on conventional or non-conventional concentrate mixture with ad lib mature pasture grass (*Dicanthium annulatum*), green NB-21 (Napier Hybrid) grass (200 g/h/d) for 210 days at Instructional farm, Veterinary College, Anand. The kids grew at the rate of 42.16±1.76 and 39.53±1.85 g/d to attain 16.10±0.60 and 15.26±0.63 kg body weight in conventional and non conventional treatment groups, respectively. The difference in body weight, body weight gain and body measurements due to diet, breed and periods were found to be non significant. The total dry matter intake was 72.82±1.60 and 73.25±1.68 kg/head with 55.25:44.75 and 53.33:46.67 concentrate to roughage ratio in conventional and non conventional treatment groups, respectively. The dry matter g per day and kg per day was not influenced by treatment and breed groups. The daily DCP and TDN intake per head, digestibility coefficients of DM, OM, CP, CF, EE , NFE and water intake per day and per kg DMI, feed efficiency in terms of per kg gain and per kg dressed weight in conventional and non -conventional treatment groups were found to be statistically similar. The total experimental feed cost (Rs/animal) worked out to be 216.89±6.01 and 182.41±5.63 in conventional and non-conventional group, respectively. The return as percentage of feed cost was 115.32±6.45 and 158.03±9.10 in conventional and non-conventional groups, respectively give reflection of significant treatment and breed effect. The non-conventional group recorded significantly ($P<0.01$) lower feed cost/kg dressed weight (28.32±1.25 kg) than conventional treatment group (34.88±1.36 kg). Kids fed non-conventional based diet had similar live weights as those fed conventional diets but costed less money to achieve those weights. The carcass traits did not differ except weight of heart, GI tract, rack and fore arms and legs.

Key Words: Mango seed kernel; Babul pods chuni; Weaner kids; Mutton; Intensive production system

INTRODUCTION

The productivity of Indian goats is lower than that in agricultural developed countries because of less available nutrients from about 80-90% of the poor to very poor Indian national rangeland (Sharma *et al*., 1992). Due to an increase in intensified agriculture, less irrigation facilities and increased industrialization, the permanent pastures and waste ranges are being reduced. This has resulted in shrinkage of grazing land, making stall feeding of sheep more a necessity in coming era. It is paradoxical that on one side there is large shortage of feed resources and on the other, India is endowed with an abundant variety of agro-industrial by products and non-conventional feed resources which are not being effectively utilized to the extent they can be.

Mango seed kernel is one of the waste product of mango fruits canning industry which is available to the extent of one million tonnes per year in India (Kehar & Chanda, 1945) and about 20 thousand tones per annum in Gujarat state and about 200 thousand per annum tones of Acacia seeds are available in Gujarat state only (Shukla, 1988). National Commission on Agricultural (1976) has specifically recommended the use of non-conventional feedstuffs like mango seed kernel, Kuvadia seed, Salseed cake, Mahua cake, Rubber seed cake and many other by-products to improve the nutritional status of livestock. So, there is a need for designing and developing economic stall feeding system by way of using the available non-conventional feeds to the maximum possible extent without affecting health status and productive potential of the animals.

MATERIALS AND METHODS

Twenty four kids (7.0 to 7.2 kg), eight each of Marwari, Surti kids were farm born and Zalawadi kids were purchased from the local market and randomly divided into following two dietary treatments on body weight basis. Treatment I (T_1) conventional: Maize-38%, GN Cake-25%, Rice Polish-24%, Jaggery solution-10%, Mineral mixture-3%, and Treatment II (T_2) non-conventional: GN Cake-25%, Rice Polish-14%, Mango (*Mangifera indica*) seed Kernel-25%, Babul Pods chuni (*Acacia nilotica* seeds)-23%, Jaggery solution-10%, Mineral mixture-3%. The Jaggery solution was prepared by mixing 6.5 kg Jaggery and 3.5 kg water. Animals were fed in individual cement concrete manger either on conventional or non-conventional concentrate mixture in addition to mature pasture grass (*Dicanthium annulatum*) ad lib, green NB-21 (Napier Hybrid) grass (200 g/d) for 210 days at the Instructional Farm, Veterinary College, Anand. 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 pasture 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, four lambs from each treatment were shifted to metabolic cages. An adaptation period of seven days in cage was fallowed by seven 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. The chemical analysis of the collected samples was carried out following AOAC (1975) methods. At the end of growth trial, all the kids from both the treatment groups were slaughtered by traditional Halal method. The organs, head, cannon, empty GI tract and primal cuts were weighed 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 weighed 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 analysed under least squares analysis procedures as per Model - 1 of Harvey (1990).

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.

Growth performance. The animals on conventional and non-conventional ration attained statistically similar body weight during the experiment (Table II). The average body weight at the end of experiment was recorded to be 16.10±0.60 and 15.26±0.63 kg in conventional and non-conventional group, respectively and the same for kids of Zalawadi, Marwari and Surti breeds was recorded to be 15.19±0.79, 15.88±0.73 and 15.98±0.73 kg, respectively. The differences due to treatments, breeds and periods were non significant. Dhanger *et al*. (1992) reviewed the Indian goat breeds and reported that the average body weight varied between 12 and 17 kg at nine months of age in medium sized breeds. These weights are more or less in agreement with weights attained at 10 month of age by the experimental kids. The average daily weight gain was recorded to be 42.16±1.76 and 39.53±1.85 g/d in conventional and non-conventional groups, respectively. The difference due to treatments, breed groups and periods were found to be non-significant. A large number of experiments indicated that there is variation in daily gain under intensive, semi intensive and ranching system of management (Nagpal, 1993). The post weaning gain (g/d) ranged between 22 to 87 in Jamunapari (Johri & Talpatra, 1971), 42 to 57 in Beetal (Kanaujia *et al.*, 1985) breed of goats and 29 to 62 in meat types goats like Black Bengal and Assam Hill (Barua *et al.*, 1988).

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

Particular	Conventional	Non-Conventional	NB-21 grass	Mature Pasture grass
Ingredients (%)				
Maize	38.00	-		
GN Cake	25.00	25.00		
Rice Polish	24.00	14.00		
Mango seed Kernel	-	25.00		
Babul Pods chuni	-	23.00		
Jaggery solution	10.00	10.00		
Mineral Mixture	3.00	3.00		
Chemical Composition (%On DM basis)				
DM	90.21	88.12	91.43	91.12
CP	17.16	17.10	9.10	2.21
CF	7.21	11.11	38.58	42.16
EE	4.80	5.13	2.70	1.74
Ash	9.71	11.88	8.57	8.88
NFE	61.12	54.78	41.05	45.01

Table II. Body weight (kg) and Body weight gain (g) in weaner kids under intensive Production system

Particular	Zalawadi		Marwari		Patnwadi		Ration	
	Conv.	Non. conv.	Conv.	Non. conv.	Conv.	Non. conv.	Conv.	Non. conv.
Body weight								
Initial	6.84 ±0.75	6.98±0.84	7.06±0.73	6.86 ±0.73	7.85±0.73	7.03 ±0.73	7.25 ±0.42	6.96±0.44
Final	15.02±1.04	15.35±1.20	16.63±1.04	15.14±1.04	16.61±1.04	15.29±1.04	16.10±0.60	15.26±0.63
Body gain (g)	37.99±3.05	39.84±3.52	45.54±3.05	39.41±3.05	41.95±3.05	39.55±3.05	42.16±2.15	39.53±1.85
Body measurements	**Increment (cm)**							
HG	7.62±0.76	6.50±0.87	7.25±0.76	7.75±0.76	7.13±0.76	7.50±0.76	7.33±0.44	7.95 ±0.46
H.Wt	5.12±1.57	4.83±1.81	4.87±1.57	3.51±1.57	6.00 ±1.57	4.38±1.57	5.33±0.94	4.52±0.96
BL	9.63±1.17	8.33±1.35	8.38±1.17	9.13±1.17	7.63±1.17	6.63±1.17	8.54±0.60	8.03±0.71

Table III. Least Square means of feed and water intake and feed efficiency of weaner kids

Breed/Ration	Zalawadi		Marwari		Surti		Ration	
Particular	Conv.	Non-Conv.	Conv.	Non-Conv.	Conv.	Non-Conv.	Conv.	Non-Covn.
Drymatter Intake								
Daily (g)	369.72±14.0	374.00±16.2	371.42±10.0	392.96±14.0	394.07±14	358.86±14.0	378.42±8.1	371.94±8.5
Kg/100kg	3.66±0.22	3.34±0.25	3.35±0.22	3.70±0.22	3.03±0.22	3.35±0.12	3.35±0.12	3.46±0.13
g/kg $B^{0.75}$	64.58±2.29	60.61±3.22	60.23±2.79	65.89±2.79	56.34±2.79	60.20±2.79	60.38±1.61	62.25±1.70
Total (kg)	73.24±2.76	74.99±3.19	72.28±2.76	75.13±2.76	72.94±2.76	69.65±2.76	72.82±1.60	73.25±1.68
Nutrient intake (g)								
CP	40.76±1.54	42.00±1.77	40.30±1.54	42.07±1.54	40.60±1.54	39.00±1.54	40.55±0.89	41.19±0.94
DCP	34.06±1.87	31.42±1.77	30.14±1.87	31.47±1.97	30.36±1.87	29.18±1.87	31.52±1.08	30.69±1.14
TDN	234.54±9.81	243.92±11.33	213.03±9.91	238.43±9.81	235.18±9.8	226.56±9.81	233.85±5.6	236.30±5.9
Water intake								
Daily (l)	0.84±0.14	0.99±0.16	0.89±0.14	1.07±0.14	0.69±0.14	0.76±0.14	0.81±0.08	0.94±0.08
l / kg DM	2.25±0.34	2.62±0.39	2.34±0.34	2.78±0.34	11.72±0.3	2.21±0.34	2.10±0.20	2.54±0.21
l/100 kg	7.69±1.08	8.39±1.25	7.51±1.08	10.17±1.08	5.17±1.08	7.85±1.08	6.79±0.62	8.80±0.66
Ml/kg $w^{0.75}$	135.0±21.6	154.62±24.9	168.08±21.	182.07±21.6	141.86±21	140.75±21.6	14830±12	159.15±13
Intake /Kg gain								
DM (kg)	9.43±0.74	9.03±0.36	7.64±0.74	9.11±0.94	8.36±0.74	8.56±0.74	8.48±0.43	8.90±0.45
CP (g)	1101.50±86.8	1061.67±100.	893.25±86.8	1071.75±86.6	977.75±86.80	1006.25±86.8	990.83±50.	1046.56±52
DCP (g)	823.75±60.38	794.33±79.31	668.00±60.8	802.0±23.92	731.25±60.89	830.50±137.0	741.0±35.1	782.0±30.9
TDN (kg)	5.56±3.8	6.1±4.39	5.84±3.80	6.01±3.80	5.76±3.80	5.94±3.80	5.72±0.34	6.02±0.31
Intake/kg dressed wt.								
DM (kg)	11.57±0.70	11.53±0.70	11.07±0.70	11.16±0.70	12.05±0.70	13.08±0.81	11.56±0.41	11.93±0.43
CP (g)	1173.25±70.4	1137.00±70.4	1122.50±70.4	1099.50±70.4	1222.00±70.4	1287.67±81.3	1172.58±40	1174.73±42
DCP (g)	890.50±53.86	870.25±53.86	854.25±53.86	842.25±53.86	927.75±53.86	986.00±62.19	890.33±31	899.50±32
TDN (kg)	6.96±0.43	7.07±0.43	6.67±0.43	6.85±0.43	7.25±0.43	7.99±0.79	6.90±0.25	7.30±0.26

Feed intake and feed efficiency. The total dry matter intake during entire experiment was found to be 72.82±1.60 and 73.25±1.68 kg/head, respectively with 55.25:44.75 and 53.33:46.67 concentrate to roughage ratio in conventional and non-conventional groups, respectively. The average daily dry matter intake (g/d) under T_1 (378.42±8.11) and T_2 (371.94±8.55) was on par (Table III). The treatments and breed groups did not influence the total as well as daily dry matter intake indicated inclusion of Mango seed kernel and Babul pods in the non conventional concentrate mixture for weaner kids has no adverse effect on the voluntary feed intake. The figures of dry matter intake obtained in the present investigation are in agreement with respect to the results obtained using conventional feed (Wadhwani, 1990) and non-conventional feeds based ration (Anonymous, 1991). The feed efficiency in terms DM, CP, DCP and TDN per kg gain for conventional based ration 8.48±0.43, 990.83±50.11, 741.00±35.15 and 5.72±0.34 and corresponding values on non-conventional based ration were 8.90±0.45, 1046.56±52.82, 782.00±30.98 and 6.02±0.31 also have been worked out which were not influenced by treatment and breeds. The corresponding intake values per kg dressed weight for DM (11.47±0.41 and 11.40±0.43), CP (1337.83±47.70 and 1340.83±50.28), DCP (1000.75±35.73 and 1003.76±37.67) and TDN (7.72±0.28 and 7.79±0.29) for conventional and non-conventional treatment groups , respectively.

Digestibility of proximate nutrients and digestible nutrients intake. During metabolism trail the daily dry matter intake through concentrate was 266.71±20.66 and 267.90±19.68 g in $T_1$and T_2 groups, respectively. The treatments did not differ from each other. The total dry matter intake (g/d) was recorded to be 458.92±37.05 and 464.27±33.18 where as DMI per g/kg $w^{0.75}$ and as percent of body weight was 62.30±4.16 and 63.49±3.38 and 3.19±0.23 and 3.34±0.15 conventional and non-conventional groups of kids respectively. The difference between the two groups were non significant. The figures of total dry matter intake obtained in the present investigation are in agreement with respect to results obtained using

Table IV. Feed intake, digestibility co-efficient and nitrogen balance experimental lambs during metabolosim trial

Particulars	Conventional	Non-Conventional	T test
No.of animals	5	5	
Body weight (kg)	14.37±0.82	14.12±0.51	NS
Dry matter intake			
Concentrate (g/d)	266.71±20.66	267.90±19.68	NS
Roughage (g/d)	192.21±18.79	196.37±24.19	NS
Total (g/d)	458.92±37.05	464.27±33.18	NS
g/kg w $^{0.75}$	62.30±4.16	63.49±3.38	NS
Kg/100kg	3.19±00.23	3.34±00.15	NS
Nutrient digestibility (%)			
DM	65.59±0.73	68.36±0.97	NS
OM	69.20±0.52	71.11±1.57	NS
CP	74.66±1.26	74.68±1.95	NS
CF	59.58±2.02	63.12±2.27	NS
EE	73.34±1.10	71.87±0.85	NS
NFE	79.66±0.59	80.91±1.27	NS
Nutritive value (%)			
DCP	8.74±0.37	8.80±0.53	NS
TDN	67.25±1.30	68.13±1.23	NS
Nutritive intake (g/h/d)			
DCP	39.97±3.17	41.15±3.00	NS
TDN	308.93±26.76	316.66±19.69	NS
Nitrogen balance (g/h/d)			
Intake	8.54±0.61	8.63±0.50	NS
Balance	3.68±0.28	3.75±0.22	NS
g/kg w $^{0.75}$	0.50±0.04	0.51±0.02	NS

NS= Non significant

Table V. Least squares means of economic traits

Breed	Character	TFC (Rs./animal)	ROFC (Rs./animal)	ROFC (%)	Total realizable receipt (Rs./ani.)
Zalawadi	Conv.	220.0^{a}9.74	226.121±20.34	102.76±9.01	446.13±25.86
	Non-conv.	191.22±11.25	264.22±23.46	142.05±10.40	455.43±29.86
	Average	205.61±7.44	245.17±15.53	122.41±6.08^{a}	450.78±19.75
Marwari	Conv.	226.98±9.74	241.05±20.34	105.95±9.01	467.78±25.86
	Non-conv.	187.76±9.74	268.84±20.34	143.66±9.01	456.55±25.86
	Average	207.37±6.89	254.94±14.38	124.81±6.37^{a}	462.16±18.29
Surti	Conv.	203.69±9.74	276.81±20.34	137.25±9.01	480.05±25.86
	Non-conv.	170.49±9.74	313.26±20.34	184.33±9.01	483.75±25.86
	Average	187.09±6.89	295.03±14.38	160.79±6.37^{b}	482.13±18.29
Ration	Conv.	216.89±6.01^{b}	247.99±15.04^{a}	115.32±6.45^{a}	464.80±12.78^{b}
	Non-conv.	182.41±5.63^{a}	282.11±15.63^{a}	158.03±9.10^{b}	466.14±8.18^{a}

Means with different superscript in column differ significantly

conventional feeds (Wadhwani, 1990) and non conventional feeds based rations (Anonymous, 1990). However, figures of higher dry matter intake were also reported on Mahua seed cake based rations (Chahal & Sharama, 1992) and when sundried Azolla replaced 10 or 20% of the conventional ration (Tamang & Samanta, 1993). The digestibility coefficients of DM, OM, CP, CF, EE and NFE obtained for kids on conventional and non-conventional ration are in accordance with Wadhwani, 1990 and statistically similar. The ICAR recommendation in the live weight category of 10 and 15 kg are 425 and 600, 25and 30 and 275 and 350 g daily intakes of DM, DCP and TDN for supporting a growth rate of 50 g/d. The average of above figures works out to be 5.44% DCP and 61.25% TDN in the ration on dry matter basis. In the present study, the conventional and non-conventional rations provided 8.74 and 67.25 and 8.80 and 68.31% DCP and TDN, respectively indicated that both the conventional and non conventional ration adequate to supply required nutrients for growth observed in present study. The daily DCP and TDN intake per head in conventional (31.52±1.08 and 233.85±5.66 g) and non-conventional (30.69±1.14 and 236.30±5.97 g) treatment groups were found to be statistically similar indicated similar nutrients utilization by weaner kids either on conventional or non-conventional groups. The nitrogen balance (g/d) in the kids of conventional and non-conventional groups was found to be 8.54±0.61 and 8.63±0.50 g/h/d, respectively. All the animals showed positive nitrogen balance. The daily nitrogen balance g/kg w $^{0.75}$ was worked out to be 3.68±0.28 and 3.75±0.22 in conventional and non-conventional groups, respectively. Srivastava *et al.* (1990) reported positive N balance of 3.25 g daily on 40% karanj cake, which support the present observed values.

Water intake. The water intake liter per day, liter per kg DMI, per 100 kg and mL per kg w $^{0.75}$ were (Table III) in

conventional and non-conventional group were 0.81±0.08, 2.10±0.20, 6.79±0.62 and 8.80±0.66 and 0.94±0.08, 2.54±0.21, 148.30±12.49 and 159.15±13.17. The treatment and breed group did not differ from each other and Kurar and Singh (1981) supported with the present findings of water intake.

Economics of feeding. The total experimental feed cost (Rs/animal) worked out to be 216.89±6.01 and 182.41±5.63 in conventional and non-conventional groups, respectively. The treatments differed significantly from each other. This is due to the higher cost of conventional concentrates mixture. The total realizable receipt (Rs. /animal) worked out to be Rs. 464.80±12.78 and 466.14±8.18 in $T_1$and T_2 which were statistically similar. The receipts from sale of chevon and liver was also similar with respect to breeds and treatments. The return as percentage of feed cost was found to be115.32±6.45and 158.03±9.10 in conventional and non-conventional groups, respectively. The difference due to treatments and breeds were found to be statistically significant ($P<0.05$) might be due to lowered feed cost observed on inclusion of non-conventional feedstuffs in formulation of ration. The cheaper non conventional ration comprising of Nahar seed meal (Anomymous, 1990) and deoiled karanj cake + Kosum cake +Niger cake+ Urea (Thakur *et al*., 1993) resulted in lower feed cost of rearing the weaner kids. The surti kids recorded (160.79±6.37%) significantly higher ($P<0.01$) values than Marwari (124.81±6.37%) and Zalawadi (122.41±6.88%) kids, respectively. The feed cost per kg dreesed weight (Rs) was found to be 34.88±1.36 and 28.32±1.25 in conventional and non-conventional group, respectively. The non-conventional group recorded significantly ($P<0.01$) lower feed cost per kg dressed weight. However, the difference due to breeds were non significant.

Carcass traits. The average value of hot carcass weight was 7.93±0.39 and 8.13±0.42 kg in conventional and non-conventional groups, respectively. The breed effect was found to be significant for weight of kidney fat, Breast Rack, loin and hind legs might be due to individual variation. The major constraints in comparing the performance of different native breeds is the lack of uniformity in slaughter age and feeding and management conditions in which they are maintained before slaughter. The dressing percentage on the basis of live weight varied from 38 to 56% (Prasad *et al.,* 1991) and on the basis of empty body weight range from 49.66 to 56.82% (Mali & Chougoule, 1985). The contribution of different primal cuts in hot carcass weight was recorded to be highest by hind legs (36.50%) followed by neck and shoulder (27.12%), forearm and leg (10.28%), rack (9.30%), breast (9.01%) and loin (8.62%). It revealed that 63.62% meat production is contributed by the hind leg and neck and shoulder. The treatment differences were non significant expect weight of heart, GI tract, Rack and forearm + legs.

Haematological studies. The average values of hemoglobin, packed cell volume, total erythrocyte and total differential counts were statistically not different in conventional and non-conventional groups. Our data were similar to those complied by Bhaumik *et al*. (1992).

Table VI. Least square means of carcass traits of weaner lambs

Particular	Conventional	Non-Conventional	T test
Pre fasting weight (kg)	15.37±0.60	15.28±0.63	NS
Post fasting weight (kg)	14.82±0.56	14.50±0.59	NS
Carcass weight (Kg)	6.48±0.24	6.50±0.25	NS
Dressing (%) on			
Live weight	43.68±0.60	44.81±0.63	NS
Empty weight	63.96±1.27	64.15±1.34	NS
Empty weight (kg)	10.15±0.46	9.99±0.49	NS
Weight of edible organs (g)			
Liver	232.50±7.70	237.77±8.11	NS
Heart	69.17±3.00 [b]	57.78±3.17 [a]	*
Kidney	60.00±2.69	54.17±2.83	NS
Kidney fat	136.67±6.38	150.28±6.72	NS

It can be inferred that incorporation of Mango seed kernel (25%) and Babul Pods chuni (23%) in non-conventional concentrate mixture reduce the feed cost significantly and can be incorporated safely in the ration of the weaner lambs without affecting, feed intake, nutrient utilization, growth rate, carcass traits and blood profile.

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