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Productive performance, body condition score and carcass characteristics of Deccani lambs reared under different farming systems

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ABSTRACT

The present study was carried out to assess the effect of different farming systems on productive performance, body condition score and carcass characteristics of Deccani lambs. Thirty-six weaned lambs having 3 months of age were divided into three groups with twelve lambs in each group in under intensive (T_1), semi-intensive (T_2) and extensive (T_3) farming systems. The comparative mean dry matter intake (kg/day) and (kg/100kg BW) was significantly ($p<0.05$) higher in T_1 group when compared to other groups. T_2 group had significantly ($p<0.05$) higher DM intake (kg/day) than T_3 group. The mean values of Average daily gains in Deccani lambs were significantly ($p<0.05$) higher in T_1 group compared to T_2 and T_3 groups. The feed efficiency was significantly ($p < 0.05$) higher in T_1 compared to T_2, T_3 groups. Statistically significant difference was found in BCS at six months of age ($p<0.05$) between T_1 and T_3 groups. BCS at 9, 12 months and overall BCS, there was a significant ($p<0.05$) difference between T_1 and T_3 groups. T_1 group had higher pre-slaughter weight, hot carcass weight, meat %, fat% and meat: bone ratio thanT_2 and T_3. The dressing yields were comparable. The weights of other offals (heart, kidney, spleen, testicles, blood, head and lung and trachea) were comparable. The findings of this study indicated that the intensive and semi-intensive system of rearing could be useful for mutton production. In extensive system, which is predominant in India should change its facet by enriching the grazing land resources as well by the supplementation of required plane of nutrition during growth and special life stages *viz.,* gestation, puberty, post lambing and finisher stages for achieving optimum productivity.

Key words: Carcass characteristics, Deccani sheep, Dry matter intake, Farming system, Productive performance.

INTRODUCTION

Sheep is an important livestock species in dry land agriculture. Rain-fed agriculture occupy 67 percent of the cultivated area, which contributes to 44 per cent of the food grains production and supports 40 per cent of the human and 65 per cent of the livestock population in India (Venkareswarlu, 2005). Sheep farming significantly contributes to the productivity, stability and sustenance of dry land farming systems, which provides employment opportunities for landless labourers through sheep farming. Livestock farming creates opportunities for poor and landless farmers to earn income using common-property resources (Turner, 2004). In developed countries, sheep farming is carried out on a large scale with grazing facility within fenced area, whereas in India it is not so, due to the existing migratory flocks systems (Venkata Raju *et al*., 2015). Productivity is negatively affected by the climate factors such as temperature and humidity in sheep (Karabacak *et al*., 2015). Ruminants in India often grazed on low quality pastures, containing high cell wall carbohydrates and low in protein (Ramana Reddy *et al*., 2003). Deccani is one of the important sheep breeds of Deccan Plateau. Sheep is a socio-economically important livestock reared primarily as a source of mutton in rural areas (Yadav *et al*., 2013). Body condition scoring is done to monitor the progress of sheep in the various production stages round the year. Body condition score can be a potential management tool to improve the animal performance (Kenyon *et al*., 2014). The grazing resources are depleting at faster rate therefore sheep rearing is facing major problem of feed and fodder availability. The present study was carried out to assess the effect of different farming systems on production performance and carcass characteristics of Deccani lambs.

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MATERIALS AND METHODS

Experimental design: Thirty-six weaned lambs having 3 months of age were divided into three groups with twelve lambs in each group in a completely randomized (3x12) design. The lambs were maintained under Intensive (T_1), Semi-intensive (T_2) and Extensive (T_3) farming systems. The lambs in intensive system were fed with 300 g of concentrate mixture and *adlibitum* quantity of green fodder. Zero grazing practice was done for the group. The animals in semi-intensive system were fed with 150 g of concentrate + 4 hours of grazing and *adlibitum* quantity of green fodder. In extensive farming system lambs were sent for grazing from 8.00 AM to 4.00 PM every day for the entire experimental period. Green fodder was provided *adlibitum*. In extensive and semi-intensive groups, the numbers of bites per minute were recorded during grazing and weight of each bite of grass was taken to find out grass intake during grazing hour gulped/eaten while grazing as per the procedures of Sawal *et al.,* (2011). The feed efficiency (%) was calculated as feed or nutrient intake per unit gain. The samples of feed offered and residues from all the groups were collected separately and analysed every fortnightly for calculation of dry matter intake. Body condition score was recorded at different growth stages in different farming systems. The body condition score was done based on 1to 5 scale system with an interval range of 0.5 point as per the procedures suggested by (Russel *et al*.,1969). At the end of growth trail, three animals from each group were slaughtered and carcass and non-carcass components were recorded. The data obtained was subjected to analysis of variance (Snedecor and Cochran, 1989). Comparison of means of different farming was made by Duncans multiple range tests as described by Kramer (1957) using SPSS 15 statistical software.

RESULTS AND DISCUSSION

Dry matter intake and Average daily gain: The comparative means dry matter (DM) intake (kg/day) and (kg/ 100kg BW) was significantly ($P < 0.05$) higher in T_1 group followed by T_2 group (Table 1). The mean average daily gain (g) observed were 43.53±0.19, 38.51±0.24 and 34.70±0.17 for T_1, T_2 and T_3 farming systems, respectively. Higher ADG was seen in T_1 group when compared to other two groups. Higher dry matter intake in T_1 and T_2 groups might be attributed to high quality feed supplementation and more resting time in shade. Karaca *et al*., (2016) reported that feeding system has a significant effect on feed intake, which resulted in animal comfort and improved production performance. In T_3 group, the lambs were allowed for grazing on the fields with scattered and scare grazing resources and high moisture content of the grasses resulted in low dry matter intake. The results are in concurrence with the findings of (Bharambe and Burte, 2012) and (Sari *et al.,* 2014) who reported higher dry matter intake by the sheep reared under intensive system followed by semi-intensive system than open grazing system. Higher ADG was observed for T_2 group than T_3, might be attributed to supplementation of concentrate feed along with limited hours of grazing which has a limited stress factors in comparison to extensive system. The conserved energy in T_1 andT_2 was utilized for the efficient growth of muscles. Similar findings were reported by (Porwal *et al.,* 2005) and (Sari *et al.,* 2014) who observed higher ADG for weaners reared under semi-intensive and intensive production systems when compared to extensive system.

Body weight gain: The total body weight gains (kg) of Deccani lambs in the experimental diets T_1, T_2 and T_3 were 11.75, 10.40 and 9.36 respectively. Significantly higher body weight gains at all fortnight intervals were observed in T_1 followed by T_2 and T_3 group, indicated the advantages of intensive system. The lambs had enough resting time for the regurgitation and rumination, which helped in efficient feed conversion into muscle development which reflected in body weight gains. T_3 group achieved comparatively lower weight gains than other treatment groups, indicated that extensive farming system has limited feeding resources and exposure to varied environmental conditions might have resulted in loss of body reserves for grazing activities which might have resulted in poor body weight gains. The results of the present study were in concurrence with the findings of (Zervas *et al.,* 1999; Porwal *et al.,* 2005 and Bharambe and Burte, 2012) who reported higher body weight gains for the lambs reared under semi-intensive and intensive system of feeding when compared to extensive system. Carvalho *et al.,* (2007) observed that increase in roughage with decrease in concentrate in the diets decreased the live weight gain of the lambs fed diets. Thakur *et al.,* (2017*)* reported that growth performance parameters did not differ statistically with higher space allowance. Venkata Raju *et al.,* (2015) reported that there was superior nutrient-growth dynamics, overall growth rate, increased resistance to parasitic diseases and improved profitability in Deccani sheep in intensive system of rearing compared to semi-intensive and extensive system.

Feed conversion ratio: The feed conversion ratio was recorded as 14.43, 14.87and 15.12for T_1, T_2 and T_3 rearing systems respectively. The feed conversion efficiency was

Table 1: Comparison of DM intake (Kg) of the Deccani lambs in different farming systems

Treatment	Body weight (kg)	DMI (kg/day)	DMI (kg/100 kgbody wt.)
T_1	21.95±0.17^a	0.724±0.04^a	3.30±0.07^a
T_2	20.53±0.13^b	0.659±0.04^b	3.21±0.06^b
T_3	19.52±0.19^c	0.617±0.04^c	3.16±0.01^c

Means with different superscripts in column differ significantly ($P< 0.05$)

significantly ($p< 0.05$) higher in T_1 compared to T_2 and T_3 farming systems (Table 2). The feed conversion efficiency was significantly higher in T_1 followed by T_2 and T_3 indicated higher plane of nutrition and quality of feed from their digestibility, when compared to extensive feeding system. Poor nutritive value, scare biomass availability, poor soil conditions coupled with energy losses while grazing might have interrupted the natural feeding habitat in extensive system. Hence the feed conversion efficiency was inferior in T_3 when compared to T_1 and T_2. Hence it could be interpreted that predominantly existing extensive feeding system can be detrimental factor for the loss of small ruminant production in the country. The results of present studies were in agreement with the findings of (Sari *et al.,* 2014).

Body condition scores of Deccani lambs at different growth stages: There was a statistically significant ($P<0.05$) difference between T_1 and T_3 groups in which T_1 has achieved 2.05 BCS score at six months of age. The BCS at 9, 12 months and overall BCS, there was a significant ($p<0.05$) difference between T_1 and T_3 groups. Means of BCS of T_1 and T_2 and means of T_2 and T_3 groups were comparable with each other (2.43 Vs2.19 Vs2.07, respectively) (Table 3). T_1 group showed significantly higher BCS whereas; BCS of T_2 group was comparable with T_1 and T_3 group. The mean BCS gain values were 0.46, 0.40 and 0.36 for T_1, T_2 and T_3 groups, respectively. From the results, it is evident that all the groups have achieved the overall BCS range of 2.07 to 2.34 indicated the ideal body fat reserves and muscle thickness. The findings of the present study on the lamb growth rate in relation to BCS was in agreement with Molina *et al*., (1991) who observed significant correlation among live weights, total internal fat and body condition score. The lower BCS gain in extensive system (T_3) group in the present study might be attributed to feeding system under natural grazing conditions. Sheep mobilizes their body fat reserves to overcome feed shortage, hence resulted in the reduction or draining out body fat reserves, hence observed lower range in BCS. Ozder *et al*., (1995) supported the results of present study who opined that the amount of stored nutrition that the organism can use by the process of break down to overcome insufficiencies due to production systems.

Carcass characteristics of lambs reared in different farming systems: T_1 group was having statistically significant ($p<0.05$) higher pre-slaughter weight, hot carcass weight, meat %, fat% and meat: bone ratio thanT_2 and T_3 (Table 4). There was a non-significant difference in dressing percentage on pre-slaughter live weight and empty live weight basis in all the treatment groups. Non-significant difference among treatment groups for weights of heart, kidney, spleen, testicles, blood, head and lung and trachea was observed. The weight of skin was significantly ($P<0.05$) higher in T_3 group over T_2 and T_1. However, T_1, T_2 and T_3 exhibited similar per cent of organ weights for the remaining edible and non-edible organs (Table 5). Higher plane of nutrition and efficient conversion into edible meat is the resultant effect of intensive system. Zervas *et al.,* (1999) reported that, the carcass weight of lambs kept on pasture was lower, but omental and perinephric fat were significantly heavier in animals fed concentrate feed indoor. The meat: bone ratio was in the range of 1.89:1(T_3), 1.92:1(T_2) and 2.22:1 (T_1) indicated that significantly ($p<0.05$) higher percentage of meat weight obtained in intensive system. Higher fat % in intensive farming system was observed by Garcia *et al.,* (2010). Significantly higher fat depots were found in animals fed concentrate feed in intensive group (Ripoll *et al.,* 2014). Carcass fat content exceeding the limits will lower feed conversion efficiency rendering the production system uneconomical (Santra and Karim, 2009).

CONCLUSION

Higher production features including DMI, ADG, total body weight gain and feed conversion efficency were observed in T_1 compared to T_2 and T_3 indicated superiority of the intensive farming system over semi-intensive and extensive farming systems. The plane of nutrition and farming systems helps in achieving the body condition scores at a desirable level. In intensive farming system, care of life stages through provision of concentrate feed, with minimal body energy loss while grazing can be assured. But in case of extensive farming system, proper care and management

Table 2: Comparison of Productive performance in Deccani lambs in different farming systems

Treatment	Initial weight (kg)	Final weight (kg)	Total weight gain (kg)	Average daily gain (g/day)	FCR (DMI/kg weight gain)
T_1	10.21±0.18^a	21.95±0.17^a	11.75±0.50^a	43.53±0.19^a	14.43±0.18^b
T_2	10.14±0.10^a	20.53±0.13^b	10.30±0.60^b	38.51±0.24^b	14.87±0.11^a
T_3	10.17±0.17^a	19.52±0.19^c	9.35±0.49^c	34.70±0.17^c	15.12±0.16^a

Means with different superscripts in column differ significantly ($P<0.05$)

Table 3: Comparative body condition scores of Deccani lambs at different growth stages

Treatment	BCS at 3 months	BCS at 6 months	BCS at 9 months	BCS at 12 months	Overall BCS
T_1	1.88±.06^a	2.05±.04^b	2.45±.01^b	3.0±.05^b	2.43±.11^b
T_2	1.79±.07^a	1.83±.07^a	2.5±.07^{ab}	2.79±.08^{ab}	2.19±.23^{ab}
T_3	1.71±.07^a	1.71±.07^a	2.21±.07^a	2.63±.08^a	2.07±.26^a

Means with different superscripts in column differ significantly ($P< 0.05$)

Table 4: Carcass characteristics of lambs reared under different farming systems.

Treatment	Pre-slaughter live weight	Empty live weight(Kg)	Hot carcass weight(Kg)	Dressing %PSW	Dressing%ELW	Meat %	Bone %	Fat %	Meat :bone ratio
T_1	23.46±.55^a	19.86±.29^a	10.13±.20^a	43.21±.76^a	51.02±.75^a	63.43±.39^a	28.56±.30^b	8.00±.10^a	2.22±.03^a
T_2	20.86±.90^b	18.30±.77^{ab}	8.72±.46^b	41.78±1.05^a	47.64±1.31^a	61.36±.60^b	31.86±.70^a	6.76±.14^b	1.92±.06^b
T_3	19.66±.70^b	16.83±.81^b	8.19±.22^b	41.70±.37^a	48.79±1.08^a	61.16±.29^b	32.26±.28^a	6.56±.18^b	1.89±0.02^b

Means with different superscripts in column differ significantly at (P<0.05)

Table 5: Weights (%) of organs on pre-slaughter weight basis of lambs in different farming systems

Treatment	Edible offal (%)					Non-Edible offal (%)				Edible: Non-edible
	Liver	Heart	Kidney	Spleen	Testicles	Blood	Head	Skin	Lungs with trachea	
T_1	2.37±.04^a	0.596±0.33^a	0.536±.04^a	0.470±.025^a	1.13±.05^a	3.53±.11^a	7.76±.08^a	9.42±.20^b	1.58±.13^a	4.58±.04^a
T_2	2.31±.10^{ab}	0.606±.01^a	0.626±.12^a	0.627±.051^a	1.17±.01^a	3.08±.17^a	7.59±.25^a	9.69±.56^b	1.70±.09^a	4.14±.22^a
T_3	2.11±.04^b	0.633±0.5^a	0.600±.08^a	0.573±.09^a	1.13±.02^a	3.15±.28^a	7.31±.38^a	11.37±.33^a	1.74±.07^a	4.51±.12^a

Means with different superscripts in column differ significantly at (P<0.05)

is not possible for the different physiological life stages of sheep. Hence, Intensive farming system under the prevailing conditions of urbanization, shrinkage of grazing lands can be recommended as commercial viable farming system. However, wherever, the provision of grazing lands exists, 4 hours of grazing along with supplementation of concentrate mixture to the special life stages can reduce the cost of meat production as well maintain the animal welfare conditions and natural habitat of small ruminants. In extensive system, which is predominant in India should change its facet by enriching the grazing land resources as well by the supplementation of required plane of nutrition during growth.

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