

Comparative economic analysis of Kenguri ram lamb rearing under intensive and semi-intensive systems

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Abstract

The present study was undertaken to evaluate the growth performance and economics of Kenguri ram lambs reared under semi-intensive (T1) and intensive (T2) systems at the Instructional Livestock Farm Complex, Veterinary College, Bidar. Twelve male Kenguri lambs of uniform age and body condition were randomly allocated to two treatment groups (n=6 per group). Lambs in T1 were reared under a semi-intensive system consisting of restricted suckling, limited grazing, and minimal concentrate supplementation, while lambs in T2 were maintained under an intensive stall-feeding system with *ad libitum* access to a formulated concentrate and roughage-based diet. Body weight, average daily gain (ADG), feed intake, and economic traits were recorded throughout the six-month trial. Birth weights did not differ significantly between the two groups. However, body weights from the first to sixth month of age were significantly ($P < 0.05$) higher in the intensive system. Lambs in T2 achieved markedly superior growth, with a higher ADG (163.59 ± 6.56 g) compared to T1 (108.79 ± 5.01 g). Total variable cost was higher in T2 (₹4,188) owing to increased feed and fodder inputs, while T1 incurred lower input costs (₹1,995). Despite higher expenditure, intensive rearing generated greater revenue (₹12,988.50) and higher net profit (₹8,800) than the semi-intensive system (₹7,025). Hot carcass weight was also superior in T2 (16.84 kg) compared to T1 (11.04 kg). The study demonstrates that intensive stall-fed rearing significantly enhances growth and economic returns in Kenguri ram lambs compared to semi-intensive management.

Keywords: economics; Kenguri; rearing system; profit

Introduction

Kenguri (also known as Tenguri) is a well-known indigenous mutton breed native to the Koppal and Raichur districts of the northeastern region of Karnataka. In recent years, it has gained considerable popularity as a preferred meat-type sheep breed in the state (Mahanthesh et al., 2019). With the progressive decline in grazing resources, stall-feeding and small flock rearing systems are increasingly being adopted for Kenguri sheep production (Kotresh Prasad and Abraham, 2017). Among these, short-term intensive feeding or ram lamb fattening systems have become particularly popular (Mahanthesh et al., 2019). Lambs reared on concentrate-based diets under intensive systems exhibit superior daily weight gains due to the consistent and balanced nutrient supply (Karthik et al., 2021). Studies comparing sheep reared under semi-intensive and intensive system of rearing have reported that lambs reared under intensive system had better average daily gain (ADG), higher body weights, better carcass yield (dressing %) and higher yield of primal cuts (Karaca *et al.*, 2016; da Silva *et al.*, 2020). Studies have also demonstrated that rearing system significantly influences growth performance and productivity of male sheep lambs, with intensive systems generally providing better body weight gain (Salahuddin et al., 2018; Karthik *et al.*, 2021; Rangamma *et al.*, 2023). Different feeds and feeding systems like soybean meal (AbdelHakeam, et al., 2024), probiotic (Raghebian et al., 2017) and early creep feeding (Martinez et al., 2015) were used for increased growth in lambs.

Intensive system involves stall feeding of animals without any grazing, whereas in semi-intensive system, animals are allowed to graze for a limited period and are provided with a small quantity of concentrate during the evening hours; in the extensive system, animals are allowed to graze for longer periods with little or no concentrate supplementation (Godde *et al.*, 2021). These production systems are particularly relevant to small and marginal farmers, as short-duration ram lamb fattening can provide an opportunity for faster growth and relatively quick economic returns. Ram lambs are commonly utilized for meat production and short-term fattening, and Kenguri ram lambs have previously been evaluated under different rearing systems for growth performance and economic returns (Mahanthesh *et al.*, 2019). Recent studies have also demonstrated that sex can influence growth, carcass and fat deposition characteristics in growing lambs, supporting the use of a defined sex group when evaluating meat-production performance (Zhang *et al.*, 2023). In practical production systems, ram lambs may be purchased at about two months of age, fattened through stall-feeding or limited grazing for 6–8 months, and marketed at around eight months of age. Therefore, ram lambs were selected in the present study to maintain a uniform meat-production-oriented experimental population and to evaluate the growth performance, carcass characteristics and economic efficiency of intensive and semi-intensive rearing systems. In this context, the present study was undertaken to compare the growth performance, production costs, carcass output and economic returns of Kenguri ram lambs reared under intensive and semi-intensive systems, and to evaluate the economic efficiency of these two rearing systems.

Materials and Methods

Location of the study

The study was conducted from October 2024 to February 2025 at the Sheep Unit, Instructional Livestock Farm Complex (ILFC), Veterinary College, Bidar under the Karnataka Veterinary, Animal and Fisheries Sciences University. Bidar is located at 17°54' N latitude and 77°32' E longitude, at an altitude of 710 m above Mean Sea Level. The region experiences a semi-arid climate, with average annual rainfall of approximately 850 mm, majorly received from the Southwest monsoon (June to September). The weather is generally hot and dry, with moderate winter during the study period, offering suitable conditions for sheep husbandry under both intensive and semi-intensive systems.

Experimental animals and treatments

The experiment involved twelve pre-weaned Kenguri male lambs of uniform body size and conformation characteristics along with their dams. Immediately after lambing, the birth weight of each lamb was recorded and colostrum was administered at the rate of 10 per cent of body weight within the first 12 hours. The lambs were randomly allotted to two treatment groups (T1 and T2), each consisting of six lambs, as per the experimental design (Table 3). Animals were housed under similar environmental conditions, and standard farm management practices were uniformly followed throughout the study.

Treatment-I (T1) – Semi-intensive system of rearing

Lambs in T1 (control group) remained with their dams for the first seven days post-birth. From the 8th day onward, they were allowed to suckle thrice daily for the next four weeks and twice daily thereafter until the 12th week of age. From the 15th day, lambs had access to green fodder *ad libitum*. The dams were maintained under a semi-intensive system, grazed for 4–5 hours daily and supplemented with a concentrate mixture containing 14% DCP and 70% TDN, formulated according to the nutrient requirements prescribed by ICAR (2013). The lambs were allowed to graze from the third month onwards. The total concentrate consumption in T1 was 16.50 kg per lamb during the six-month experimental period. Since the lambs had access to grazing and green fodder *ad libitum*, their actual roughage intake was not quantified.

Treatment-II (T2) – Intensive system of rearing

In this group, Kenguri lambs were intensively reared under controlled housing conditions. Lambs were allowed natural suckling up to three months of age. In addition to mother's milk, they were offered a formulated concentrate diet supplemented with dry red gram husk and soya husk from the second week up to six months of age. The total concentrate consumption was 32.60 kg per lamb during the six-month experimental period, along with 342 kg of fodder per lamb.

The concentrate feed was formulated as per ICAR (2013) feeding standards using locally available ingredients to meet the protein and energy requirements for early growth. Feeding was done thrice daily, and weighed quantities of feed were offered individually. Leftover feed was measured to calculate average daily feed intake (ADFI). Clean drinking water was made available at all times. The lambs remained housed indoors throughout the rearing period, and no grazing was permitted.

Housing management

All lambs were housed in a well-ventilated, slatted floor shed equipped with individual feeding arrangements. The housing area provided 1.14 m² per lamb, with a total pen area of 6.86 m² per group. Clean potable water was made available round the clock, and strict sanitation protocols were followed to maintain hygiene.

Health management

The first 24 hours post-lambing were managed with utmost care. Newborn lambs were dried using clean towels, and the umbilical cord was disinfected with 7 per cent tincture of iodine after being tied and cut with sterilized scissors. The udder of the dam was checked for abnormalities. Lamb pens were cleaned and disinfected daily using 10% phenyl and 10% CuSO₄ solution. External parasites were managed using Butox® spray (0.5%) and lambs were regularly dewormed using Fentas Plus®.

Body Weight

The birth weight of lambs was recorded using an electronic platform balance within one hour of birth to establish the baseline weight for subsequent growth monitoring.

Economic analysis

The cost of feeding was calculated separately for concentrate and roughage for each lamb over the entire rearing period. The quantity of concentrate and roughage consumed by each lamb was recorded, and the feeding cost was calculated by multiplying the quantity consumed by the respective cost per kilogram of feed. For T2, the cost of both concentrates and fodder was calculated based on the measured quantity offered and consumed, whereas for T1, the cost of supplementary concentrate was calculated based on the quantity consumed. Since T1 lambs had access to grazing and green fodder *ad libitum*, their actual grazing and green fodder intake was not quantified and, therefore, no separate fodder cost was assigned to grazing.

The total feeding cost was calculated as the sum of concentrate and roughage costs. Total variable cost was calculated by adding feeding cost, labour cost, treatment and other miscellaneous expenses. The cost per kilogram of live-weight gain was calculated by dividing the total variable cost by the total live-weight gain during the rearing period. Gross returns were estimated based on the prevailing live-weight price, and net returns were calculated by subtracting the total variable cost from the gross returns.

Statistical Analysis

The recorded data on body weight, average daily gain, and feed intake were summarised using descriptive statistics. Economic parameters such as total cost, revenue, and net returns were analysed by computing means, standard deviations, and percentage contributions of major cost components. Growth and economic performance were compared using one-way analysis of variance (ANOVA), wherever applicable, to evaluate differences among groups. Statistical significance was considered at $P < 0.05$. Data analysis was carried out using standard statistical software such as SPSS 20 to ensure accuracy and reliability.

Results and Discussion

Growth performance

The growth performance of ram lambs reared under semi-intensive (T1) and intensive (T2) systems is presented in Table 1. No significant difference was observed in birth weight between the two groups. However, body weight differed significantly between the treatments from the first month onwards, with highly significant differences observed from the second to sixth months ($P < 0.01$). Overall average daily gain was also significantly higher in lambs maintained under the intensive system than in those maintained under the semi-intensive system (Table 1).

The superior growth performance observed under intensive management may be attributed primarily to the higher and more consistent plane of nutrition. Lambs in T2 were maintained under controlled housing and received a formulated concentrate diet together with fodder, whereas T1 lambs had access to grazing and comparatively limited concentrate supplementation. Thus, T2 provided a more predictable supply of dietary energy and protein during the growing period.

The present findings are in agreement with Mahanthesh *et al.* (2019), who reported higher body weight in Kenguri sheep maintained under an intensive system compared with a semi-intensive system. Their intensive group received concentrate supplementation along with green fodder and paddy straw, whereas animals under the semi-intensive system depended largely on grazing and supplementary roughage. Similar improvements in growth with intensive management have been reported in Deccani lambs by Bharambe and Burte (2012). Wang *et al.* (2015) also reported that concentrate supplementation improved live weight and average daily gain in male Tan lambs.

The role of dietary composition is particularly important in explaining the observed differences. Liu *et al.* (2019) demonstrated that the concentrate-to-forage ratio influences growth performance, nutrient utilization and rumen fermentation in sheep. Similarly, Claffey *et al.* (2018) reported improved average daily gain, feed conversion efficiency and carcass performance in lambs receiving diets with greater concentrate inclusion. Karthik *et al.* (2021) also reported differences in growth and nutrient utilization among sheep maintained under different farming systems. Therefore, the higher growth observed in T2 may reflect the combined effects of greater nutrient availability, controlled feeding and reduced dependence on variable grazing resources.

The contribution of roughage availability should also be considered. In the present study, T2 lambs received measured quantities of fodder in addition to concentrate, whereas actual roughage intake of T1 was not quantified because the lambs had access to grazing and green fodder. Consequently, differences in nutrient supply between the systems may have contributed to the observed difference in growth. The present results should therefore be interpreted as the response to the respective complete rearing and feeding systems, rather than as an independent effect of housing.

Economics of semi-intensive and intensive systems of rearing

The economic performance of lambs maintained under the two rearing systems is presented in Table 2. The intensive system involved greater expenditure on concentrate and fodder and consequently resulted in a higher total variable cost. Labour and treatment/miscellaneous expenditure remained similar between the two systems. The cost per kilogram of live weight gain was also higher under the intensive system (Table 2).

Despite the greater feed expenditure, the intensive system produced greater final live weight and carcass output, resulting in higher gross returns and net profit compared with the semi-intensive system (Table 2). The increased expenditure on feed and fodder was therefore accompanied by increased marketable live weight and carcass production. Similar economic advantages of intensive rearing in Kenguri ram lambs have been reported by Mahanthesh *et al.* (2019), who observed higher economic returns under intensive management. The improved carcass performance under intensive management is likely related to the greater growth achieved during the feeding period. Adequate and consistent nutrient availability promotes tissue deposition and consequently increases saleable live weight and carcass yield. Similar effects of feeding system on carcass characteristics have been reported by Karaca *et al.* (2016) and da Silva *et al.* (2020).

Although intensive management resulted in greater economic returns in the present study, the higher feed expenditure should be considered when adopting this system under farm conditions. Feed price, availability of fodder, access to grazing, labour costs and prevailing market prices can substantially influence profitability. Therefore, the economic advantage of intensive feeding is dependent on the ability to convert the additional feed investment into sufficient additional live weight and carcass output.

Table 1. Effect of different systems of rearing on growth performance in Kenguri ram lambs

Parameter	Semi-intensive system (n=6)	Intensive system (n=6)	Significance
Birth Weight (Kg)	2.97 ± 0.09	3.02 ± 0.19	NS
1 st Month (Kg)	6.79 ± 0.26	7.90 ± 0.39	*
2 nd Month (Kg)	10.58 ± 0.28	12.13 ± 0.42	**
3 rd Month (Kg)	13.89 ± 0.21	16.75 ± 0.71	**
4 th Month (Kg)	17.09 ± 0.21	21.74 ± 0.94	**
5 th Month (Kg)	19.77 ± 0.52	27.22 ± 1.12	**
6 th Month (Kg)	22.55 ± 0.94	32.47 ± 1.28	**
Overall ADG (g)	108.79 ± 5.01	163.59 ± 6.56	**
Pre-slaughter weight (PSW) (Kg)	22.55 ± 0.938	32.47 ± 1.280	**

* Significant at (P<0.05), ** Significant at (P<0.01), NS- non-significant

Table 2. Economics of different system of rearing in Kenguri ram lambs

A. Variable cost	Semi-intensive system (n=6)	Intensive system (n=6)
Amount of feed consumed (Kg)	16.50	32.60
Cost of feed (Rs.) (Rs. 30/Kg)	495.00	978.00
Amount of fodder consumed (Kg)	-	342
Cost of fodder (Rs. 5.00/kg)	-	1,710.00
Cost of labour (Rs.) (Rs. 200/lamb/month)	1200.00	1200.00
Cost of treatment & miscellaneous (Rs.) (Rs. 50/lamb/month)	300.00	300.00
Total cost (A) (Rs.)	1995.00	4,188.00
Cost per Kg live weight gain (Rs.)	101.89	159.93
Out put		
B. Net live weight produced	22.55 ± 0.938	32.47 ± 1.280
C. Price of live weight obtained cost/kg live weight @ Rs. 400/kg	9,020.00	12,988.50
Hot carcass weight (HCW) (kg)	11.04 ± 0.435	16.84 ± 0.689
D. Net profit (C-A) (Rs.)	7,025.00	8,800.00

Conclusion

Intensive rearing of Kenguri ram lambs resulted in superior growth, average daily gain and carcass performance compared with the semi-intensive system. Although intensive rearing involved higher feed and fodder costs, the improved productive performance resulted in greater economic returns, indicating its potential as a viable production system where adequate feed resources and proper housing facilities are available.

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