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Economics of gram dust as a complete replacement for conventional concentrate in Mecheri lambs

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Abstract

Sheep farming is an important livelihood activity in Tamil Nadu, where feed cost constitutes a major portion of production expenses. The present study was undertaken to evaluate the growth performance and economic efficiency of replacing conventional concentrate mixture with dried gram dust in Mecheri lambs. Twelve female lambs (4 months old) were randomly divided into two groups (T_1 and T_2), with six animals in each group, and reared for 90 days. The control group (T_1) was fed concentrate mixture along with sorghum fodder ad libitum, whereas in the treatment group (T_2), concentrate mixture was completely replaced with gram dust. The concentrate mixture contained higher crude protein (20.1%) compared to gram dust (13.1%), while gram dust had higher crude fibre and gross energy. The average daily gain (ADG) was 73.70 ± 9.87 g in T_1 and 83.15 ± 2.93 g in T_2 , with no significant difference ($p > 0.05$). Feed cost per animal per day was lower in T_2 (Rs. 9.19) compared to T_1 (Rs. 10.81). The cost of producing one kilogram of live weight was Rs. 146.67 in T_1 and Rs. 110.52 in T_2 . The results indicate that gram dust can effectively replace concentrate mixture without affecting growth performance while significantly reducing production cost.

Keywords: Gram dust, Mecheri lambs, feed economics, concentrate replacement, growth performance

1. Introduction

Sheep production plays a vital role in the rural economy of India, particularly in regions such as Salem district, where the Mecheri sheep is widely reared for meat production. Fattening of lambs is increasingly preferred by farmers due to its lower investment requirement and shorter production cycle compared to breeding enterprises. Feed cost accounts for nearly 60-70% of total production cost, with concentrate mixtures being the most expensive component. The rising cost of conventional feed ingredients has negatively impacted the profitability of sheep farming systems. Therefore, the identification of low-cost alternative feed resources is essential for sustainable livestock production. Gram dust, a by-product of pulse processing, is commonly available in local markets and is used by farmers in the Mecheri region. It contains appreciable levels of energy and moderate protein, making it a potential substitute for concentrate mixture. However, scientific validation of its use as a complete replacement is limited. Hence, the present study was designed to evaluate the growth performance and economic feasibility of feeding gram dust as a complete replacement for conventional concentrate mixture in Mecheri lambs.

2. Materials and Methods

2.1 Experimental Location

The study was conducted at the Mecheri Sheep Research Station, Pottaneri, located in Salem district of Tamil Nadu, India.

2.2 Experimental Animals and Design

A total of twelve healthy female Mecheri lambs, aged four months, were selected for the study. The animals were randomly allocated into two experimental groups, each consisting of six lambs: T_1 (Control): Concentrate mixture + sorghum fodder ad libitum; T_2 (Treatment):

Gram dust + sorghum fodder ad libitum. The experimental trial was conducted over a period of 90 days.

2.3 Feeding and Management

All animals were maintained under uniform housing and standard management conditions throughout the experimental period. The respective concentrate mixture and gram dust were offered in measured quantities according to treatment

groups, while sorghum fodder was provided ad libitum. Fresh and clean drinking water was made available to all animals at all times.

2.4 Chemical Composition of Feed

The proximate composition and gross energy content of the experimental feeds are presented in Table 1.

Table 1: Chemical composition of concentrate mixture and gram dust

Parameter	Concentrate	Gram Dust
Crude Protein (%)	20.1	13.1
Crude Fibre (%)	7.9	19.8
Ether Extract (%)	3.2	4.3
Total Ash (%)	8.8	3.8
Gross Energy (kcal/kg)	3730.8	3880

2.5 Data Collection

Body weight of individual animals was recorded at 15-day intervals using a digital weighing balance. Daily feed intake was measured by recording the quantity of feed offered and refused. Average daily gain (ADG) was calculated as the difference between final and initial body weight divided by the number of experimental days. Feed efficiency was computed as the ratio of weight gain to feed intake.

Economic analysis was carried out based on prevailing market prices of feed ingredients, and cost of production per kilogram of live weight gain was calculated.

2.6 Statistical Analysis

The experimental data were analysed using Statistical Package for the Social Sciences (SPSS, version XX). An independent sample *t*-test was employed to compare means between the two groups. Differences were considered statistically significant at $p \leq 0.05$.

3. Results

3.1 Growth Performance

Both experimental groups exhibited a consistent and progressive increase in body weight throughout the 90-day study period. The average daily gain (ADG) was numerically higher in the treatment group (T_2) compared to the control group (T_1) (Figure 1). However, the difference between the groups was not statistically significant ($p > 0.05$), indicating that complete replacement of concentrate mixture with gram dust did not adversely affect the growth performance of Mecheri lambs.

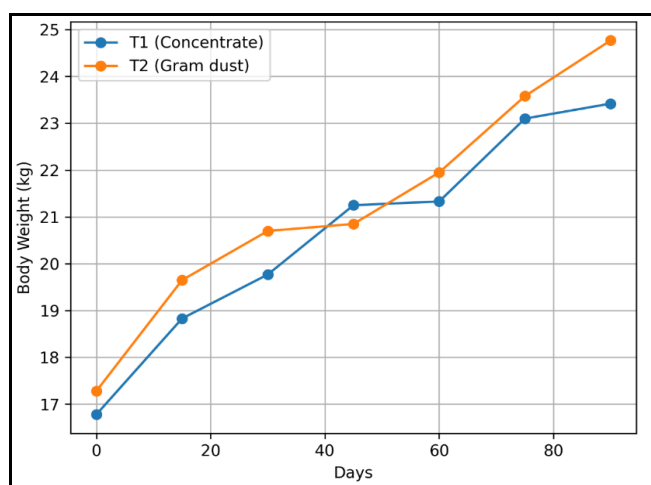


Fig 1: Growth performance between treatments

3.2 Feed Intake

No significant difference ($p > 0.05$) was observed in the intake of concentrate mixture and gram dust between the two groups, suggesting similar palatability and acceptability of the experimental diets. However, sorghum fodder intake and total feed intake differed significantly ($p \leq 0.05$) between treatments. This variation in roughage intake may be attributed to differences in dietary fibre content, which can influence voluntary feed intake and rumen fill.

3.3 Economic Analysis

The economic evaluation revealed a clear advantage of using gram dust as a substitute for conventional concentrate mixture. The cost of concentrate mixture was ₹26/kg, whereas gram dust was comparatively cheaper at ₹20/kg. Consequently, the feed cost per animal per day was lower in the treatment group (₹9.19) compared to the control group (₹10.81).

Furthermore, the cost of production per kilogram of live weight gain was substantially reduced in T_2 (₹110.52) compared to T_1 (₹146.67), indicating improved economic efficiency (Figure 2). The reduction in feeding cost highlights the potential of gram dust as a cost-effective alternative feed resource in sheep production systems.

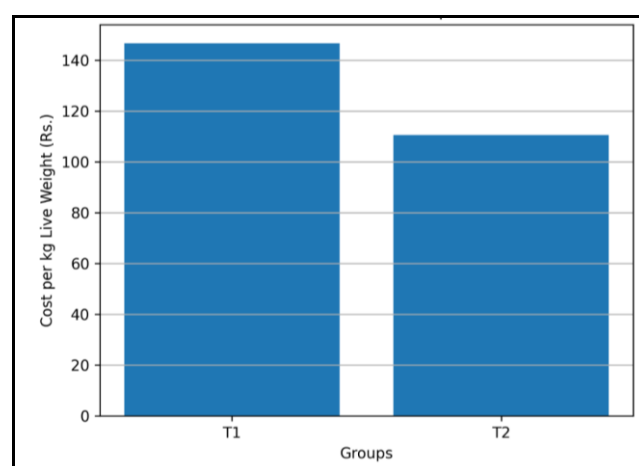


Fig 2: Comparison of Cost production

4. Discussion

The present study clearly demonstrated that dried gram dust can effectively replace conventional concentrate mixture in Mecheri lambs without adversely affecting growth performance. Although the crude protein content of gram dust (13.1%) was lower than that of the concentrate mixture

(20.1%), the comparable average daily gain (ADG) observed between treatment groups suggests that the nutrient supply was adequate to meet the requirements of growing lambs. This indicates that growth performance in small ruminants is influenced not only by crude protein concentration but also by overall dietary energy balance, nutrient digestibility, and rumen microbial efficiency.

The slightly higher ADG observed in the gram dust-fed group (T₂) may be attributed to its higher gross energy content and ether extract levels, which could have enhanced energy availability for growth. Energy-rich diets are known to improve feed conversion efficiency and support better weight gain in growing lambs. Similar findings have been reported by Kumar *et al.* (2021) ^[5], who observed that alternative feed resources with adequate energy density can sustain or even improve growth performance in small ruminants when compared to conventional concentrate-based diets. Likewise, Singh *et al.* (2022) ^[13] reported that partial or complete replacement of concentrate with agro-industrial by-products did not significantly affect weight gain, provided that nutrient requirements were met.

The absence of significant differences ($p>0.05$) in feed intake between concentrate and gram dust groups indicates good palatability and acceptability of gram dust. However, the significant variation ($p\leq 0.05$) observed in sorghum fodder intake suggests that animals adjusted their roughage consumption to compensate for differences in concentrate composition. This compensatory feeding behaviour is commonly observed in ruminants and is influenced by dietary fibre levels and rumen fill (Sahoo *et al.*, 2020) ^[12]. The higher crude fibre content in gram dust may have contributed to changes in rumen fermentation patterns, leading to more stable digestion and efficient nutrient utilization.

The economic analysis revealed a substantial reduction in feed cost when gram dust was used as a complete replacement for concentrate mixture. The cost of feed per animal per day and the cost of production per kilogram of live weight were significantly lower in the treatment group. This reduction is primarily due to the lower market price of gram dust compared to conventional concentrate feed. Feed cost is widely recognized as the major component of total production cost in sheep farming, accounting for up to 70% of total expenses (Indian Council of Agricultural Research, 2013). Therefore, the use of low-cost feed resources such as gram dust can significantly enhance the profitability of sheep production systems.

The reduction in cost of production per kilogram of live weight by approximately 25% in the present study is consistent with findings reported by Patel *et al.* (2023) ^[17], who highlighted that the inclusion of agro-industrial by-products in ruminant diets can substantially reduce feeding costs without compromising animal performance. Similarly, Reddy *et al.* (2024) ^[11] emphasized that locally available feed resources can improve economic efficiency and sustainability in smallholder livestock systems, particularly in developing regions like Tamil Nadu.

From a nutritional perspective, the successful replacement of concentrate mixture with gram dust suggests that the latter provides sufficient nutrients for maintenance and growth. The presence of moderate protein levels along with higher energy content makes gram dust a suitable feed ingredient for growing lambs. Moreover, the fibre content may play a beneficial role in maintaining rumen health and preventing metabolic disorders. According to Sahoo *et al.* (2020) ^[12], optimal fibre levels are essential for proper rumen function, as

they stimulate chewing activity, saliva production, and microbial fermentation.

The findings of the present study also support the concept of sustainable livestock production through the utilization of locally available feed resources. The use of gram dust not only reduces dependence on commercial concentrate feeds but also promotes efficient utilization of agro-industrial by-products, thereby contributing to environmental sustainability. This aligns with global recommendations by the National Research Council (2007), which emphasize the importance of resource-efficient feeding strategies in ruminant production systems.

Overall, the results indicate that gram dust is a nutritionally viable and economically advantageous alternative to conventional concentrate mixture. Its adoption by farmers can lead to improved profitability, especially in resource-limited settings. However, further studies with larger sample sizes and longer experimental durations are recommended to validate these findings under different management conditions and production systems.

5. Conclusion

Dried gram dust can be used as a complete replacement for conventional concentrate mixture in Mecheri lambs without affecting growth performance. It significantly reduces feed cost and improves economic returns. Therefore, gram dust is recommended as a cost-effective feeding strategy for sheep farmers.

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