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Gram dust as a replacer for conventional concentrate feed for fattening of Mecheri lambs

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Abstract
The cost of concentrate feed represents a major limitation to profitable lamb production. This study evaluated the use of gram dust, a pulse-processing by-product, as a replacer for conventional concentrate feed in fattening diets for lambs. Twenty-four weaned Mecheri lambs (3-4 months old; average body weight 13.0 ± 0.8 kg) were randomly allotted to four treatment groups with six animals each: T_1 (control, 0%-gram dust), T_2 (25%), T_3 (50%), and T_4 (75%) replacement of concentrate feed with gram dust. The feeding trial lasted 90 days. Average daily gains (ADG) were 135.2, 130.4, 126.8, and 104.6 g/day for T_1-T_4 respectively. No significant differences ($P>0.05$) were observed up to 50% inclusion; however, higher replacement (75%) reduced performance. Feed conversion ratio and nutrient digestibility were unaffected up to 50% replacement. Feed cost per kg live weight gain decreased by 20-22% at 50% replacement.

Keywords: Gram dust, concentrate replacer, lamb fattening, feed cost, growth performance, by-product utilization

1. Introduction
Feed cost constitutes 65-70% of the total cost of sheep production. The rising prices of conventional feed ingredients such as maize, groundnut cake, and wheat bran limit the profitability of small ruminant farming (Reddy, 2018) [6]. The use of locally available agro-industrial by-products as partial substitutes for expensive feed components offers a practical solution for improving production economics.
Gram dust, generated during the cleaning and milling of gram (Cicer arietinum), consists of broken grains, hulls, and powder fractions rich in crude protein (16-20%) and total digestible nutrients (60-65%) (Banerjee, 2018) [2]. Owing to its abundance and low market value, gram dust can serve as an alternative concentrate ingredient. However, scientific evaluation of its effect on growth performance, nutrient utilization, and economics in lamb fattening systems is limited. The present study was conducted to determine the optimum inclusion level of gram dust as a replacer for conventional concentrate feed in lamb fattening.

2. Materials and Methods
2.1 Experimental Animals and Design
Twenty-four healthy Mecheri lambs (3-4 months old; mean body weight 13.0 ± 0.8 kg) were randomly divided into four groups (T_1-T_4) of six animals each. The treatments included gram dust replacing concentrate feed at 0%, 25%, 50%, and 75%, respectively summarized in Table 1.

2.2 Feeding Management
All animals received Cenchrus ciliaris hay ad libitum and the respective concentrate mixtures at 2% of body weight daily. Gram dust was analyzed for proximate composition using AOAC (2016) procedures. Clean water and mineral mixture were provided throughout the experiment.

Table 1: Different inclusion level of Gram Dust

Treatment	Gram Dust Replacement (%)	Diet Composition
T_1	0	100% concentrate (control)
T_2	25	25%-gram dust + 75% concentrate
T_3	50	50%-gram dust + 50% concentrate
T_4	75	75%-gram dust + 25% concentrate

2.3 Data Recording and Analysis
The body weights were recorded fortnightly to compute average daily gain (ADG). Feed intake was measured daily to calculate feed conversion ratio (FCR). Digestibility trials were conducted on a subset of lambs using total collection. Data were analyzed using one-way ANOVA (SPSS, Version 25.0), and treatment means were compared by Duncan's Multiple Range Test ($P<0.05$).

3. Results and Discussion
3.1 Nutrient Composition of Gram Dust
The gram dust contained 91.4% DM, 18.2% CP, 3.0% EE, 12.4% CF, 52.6% NFE, and 1.8% total ash. These values are comparable to standard concentrate ingredients like wheat bran and deoiled rice bran (Khan *et al.,* 2015) [5], supporting its potential as a feed component (Selvaraju *et al.,* 2015) [8].

3.2 Growth Performance
The growth performance assessment, derived from the Average Daily Gain (ADG) and ultimate body weight of the treatment group, is presented in Table 2.

Table 2: Growth performance between different groups

Treatment	ADG (g/day)	Final Body Weight (kg)
T_1	135.2 ± 3.1	25.6 ± 0.8
T_2	130.4 ± 2.8	24.9 ± 0.6
T_3	126.8 ± 3.5	24.4 ± 0.5
T_4	104.6 ± 3.7	22.3 ± 0.7

No significant differences were observed among T_1-T_3; however, T_4 showed lower ($P<0.05$) growth, indicating that excessive replacement reduced nutrient density. The findings are in agreement with Kannan and Rajendran (2020) [4], who reported similar performance when unconventional feeds were included up to 50%.

3.3 Feed Conversion and Digestibility
The FCR values were 6.8, 7.0, 7.3, and 8.4 for T_1-T_4, respectively. Digestibility coefficients for DM and CP remained unaffected up to 50% replacement, suggesting that moderate inclusion of gram dust does not impair nutrient utilization. The higher fiber fraction in T_4 likely contributed to reduced digestibility and performance (Singh *et al.,* 2016) [10].

3.4 Economic Efficiency
The cost per kilogram of live weight gain was ₹115.8, ₹102.4, ₹92.5, and ₹110.2 for T_1-T_4, respectively. Maximum savings of approximately 20% were achieved at 50% inclusion level, consistent with previous findings (Singh *et al.,* 2017) [9] that pulse-processing by-products improve profitability (ICAR, 2021).

4. Conclusion
Gram dust is an effective and economical feed resource for lamb fattening. It can replace up to 50% of conventional concentrate mixture without compromising growth or efficiency, while significantly reducing feed costs. Adoption of such by-products can enhance the sustainability and profitability of small ruminant production systems.

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6. Conflict of Interest
Not available

7. Financial Support
Not available

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