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ORIGINAL ARTICLE

Effect of feeding Pulse Chunni Based Complete Diets on Growth and Body Condition Score of Nellore Ramlambs

Jagadamba Kunja[1], Ch. Harikrishna[2], P. Amareswari[3], M. Venkateswarlu[4]

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ABSTRACT

Background: Pulse chunnis are commonly used agro-industrial by-products that may serve as economical protein supplements in small ruminant feeding systems. However, their comparative effect on growth performance of growing lambs in complete diets is not well established.

Aim: To evaluate the effect of incorporating different pulse chunnis in sorghum straw–based complete diets on the growth performance of growing Nellore brown ram lambs.

Objectives:

1. To assess the influence of Red gram, Green gram and Bengal gram chunnis on feed intake and nutrient utilization.
2. To evaluate body weight gain, average daily gain (ADG), and feed conversion efficiency (FCE).
3 To monitor changes in body condition score (BCS) during the feeding trial.

Materials and Methods: Thirty-two growing Nellore brown ram lambs (96.30 ± 2.70 days old; 13.27 ± 0.03 kg body weight) were randomly allotted to four dietary treatments (n = 8 per group) and reared under an intensive system for 120 days at the Sheep Unit, Livestock Research Station, Mamnoor, Warangal.

AUTHOR'S AFFILIATION:

[1] Assistant Professor, Livestock Production Management, College of Veterinary Science, Sri Venkateswara Veterinary University, Garividi, Andhra Pradesh, India.

[2] Professor, Director of Research, P.V. Narsimha Rao Telangana Veterinary University, Hyderabad, Telanana, India.

[3] Professor (AGB), Livestock Farm Complex, College of Veterinary Science, P.V. Narsimha Rao Telangana Veterinary University, Rajendra Nagar, Hyderabad, Telanana, India.

[4] Professor and Head, Department of Animal Nutrition, College of Veterinary Science, P.V. Narsimha Rao Telangana Veterinary University, Korutla, Telangana, India.

CORRESPONDING AUTHOR:

Jagadamba Kunja, Assistant Professor, Livestock Production Management, College of Veterinary Science, Sri Venkateswara Veterinary University, Garividi, Andhra Pradesh, India.

E-mail: jagadambakunja@gmail.com

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Treatment diets included:

- **R1 (Control):** Complete diet without pulse chunni
- **R2 (RGCC):** Complete diet with 15% red gram chunni
- **R3 (GGCC):** Complete diet with 15% green gram chunni
- **R4 (BGCC):** Complete diet with 15% Bengal gram chunni

Growth performance, total feed intake, dry matter intake (DMI), body weight changes, ADG, and BCS were recorded. Data were statistically analyzed to determine treatment effects.

Results: Total feed intake and average daily DMI tended to be higher in lambs fed the R2 (red gram chunni) diet. Body weight of lambs differed significantly ($P < 0.01$) from the 2nd to 8th fortnights, with higher weights in R2, R3 and R4 groups compared to R1. Total weight gain (kg) across treatments was:

- R1: 10.65
- R2: 10.98
- R3: 10.76
- R4: 10.66

ADG was significantly higher ($P < 0.01$) in R2, R3, and R4 diets compared to R1. The highest overall ADG (91.46 ± 0.49 g) was observed in R2, compared with R1 (88.75 ± 0.90 g), R3 (89.69 ± 0.49 g), and R4 (88.85 ± 0.49 g). BCS remained non-significant during most of the experiment, except in the 8th fortnight, where R2 and R3 lambs recorded significantly higher ($P < 0.01$) scores. A linear improvement in BCS was observed in all groups.

Conclusion: Inclusion of pulse chunnis in sorghum straw–based complete diets improved growth performance in growing Nellore brown ram lambs. Among the tested chunnis, 15% red gram chunni (R2) yielded the highest body weight gain and ADG, indicating its superior nutritive value and effectiveness as a protein supplement in finishing lamb diets.

KEYWORD

• Nellore Brown Ram Lambs • Pulse Chunnies • Complete Diets • Growth Performance • Body Condition Score

INTRODUCTION

Background

Crop residues such as sorghum stover form a major component of ruminant diets in many developing countries. However, their nutritive value is inherently low and they cannot meet the maintenance requirements of livestock when fed as the sole diet. Formulating complete feeds by blending roughage with concentrates is an effective strategy to reduce wastage, lower feed and labour costs, and improve nutrient use efficiency (Suarez *et al.*, 2007). The quality of stover used in complete feeds significantly influences livestock productivity and overall farm economics (Anandan *et al.*, 2010a; 2010b). Optimizing the roughage-to-concentrate ratio is also essential for maintaining proper rumen fermentation and desirable volatile fatty acid production (Ramana Reddy *et al.*, 2016). Sorghum is a climate-resilient crop valued for its drought, heat, and salinity tolerance, making its stover an important roughage source, especially under climate change scenarios (Sanchez *et al.*, 2002; Chikuta & Okori, 2012). Despite the availability of agro-industrial by products such as pulse chunnis which may provide cost-effective protein supplementation there is limited research on their chemical composition, nutritive value, and appropriate inclusion levels in ruminant diets. Therefore, evaluating their use in complete feeds is necessary. Padmaja (1996) conducted a study and suggested that the effective level of inclusion of Urad chunni in complete rations for sheep is 30% without

affecting the digestibility of nutrients and balances of N, Ca and P. The complete rations with a roughage (GN haulms) to concentrate ratio of 50:50 containing 30 parts of Urad chunni can meet the nutrient requirements of 20 kg sheep growing at a rate of 90 grams per day. Radhakrishna (1999) included green gram chunni up to 50 per cent level in concentrate mixtures of buffaloes on rice-straw based rations for maintenance, which did not affect nutrient utilization.

Aim

To assess the effect of incorporating different pulse chunnis into sorghum straw based complete diets on the growth performance of growing Nellore brown ram lambs.

Objectives

1. To evaluate the effect of red gram, green gram, and Bengal gram chunnis on feed intake and dry matter intake (DMI) in lambs.
2. To determine their influence on growth performance and study the changes in body condition score (BCS) of lambs fed diets containing different pulse chunnis.
3. To identify the most suitable pulse chunni for inclusion in sorghum stover based complete diets for optimum growth performance.

Hypothesis

Inclusion of pulse chunnis (red gram, green gram, and Bengal gram) at 15% level in sorghum straw–based complete diets will improve the feed intake, growth performance, and body condition score of growing Nellore brown ram lambs compared to a complete diet without pulse chunni.

MATERIALS AND METHODS

Location of the study and Duration of the Experiment

The study was conducted to assess the effect of feeding sorghum straw–based complete diets containing different pulse chunnies on the growth performance and body condition score of growing Nellore ram lambs. The experiment was carried out at the Livestock Research Station, PVNRTVU, Mamnoor, Warangal district, situated at an altitude of 290 m above mean sea level, at 17.9°N latitude and 79.59°E longitude.

During the experimental period, the average maximum and minimum temperatures were 35.5°C and 25.6°C, respectively. The growth trial spanned 120 days, from February to June 2022.

Preparation of Experimental Complete Rations

Four sorghum straw–based complete rations were formulated (Table 1) for use in the growth trial. The dietary treatments included:

- **R1 (Control):** Complete diet processed into mash without chunni.
- **R2 (RGCC):** Mash-form complete diet containing red gram chunni, incorporated at 15% of the concentrate mixture.
- **R3 (GGCC):** Mash-form complete diet containing green gram chunni, incorporated at 15% of the concentrate mixture.
- **R4 (BGCC):** Mash-form complete diet containing bengal gram chunni, incorporated at 15% of the concentrate mixture.

Housing and Management of Experimental Ram Lambs

The ram lambs were maintained under hygienic conditions in well-ventilated pens measuring 24 ft×10 ft, each with an additional open area of 24 ft × 10 ft for daytime movement. The animals were kept indoors and not allowed to graze during the experimental period.

All lambs were dewormed at the beginning of the experiment and again at two months using Ivermectin for external parasites and Fenbendazole for internal parasites. They were vaccinated against PPR seven days after the initial deworming. Cleanliness and sanitary conditions were regularly maintained in the housing facility. Each lamb was ear-tagged to ensure accurate individual data recording. The four diets (R1, R2, R3, and R4) were randomly allocated to four groups of animals for the 120-day growth trial. The respective complete rations were offered ad libitum, twice daily at 9:00 AM and 3:00 PM, using pre-weighed quantities measured on an electronic digital balance. Feed refusals were collected and weighed the following morning to determine daily feed intake. Fresh, clean drinking water was provided ad libitum throughout the study.

Table 1: Ingredient composition of experimental rations (kg/100 kg) used for growth study in Nellore ram lambs

Ingredients	Complete diets			
	R1 (without any chunni: Control)	R2 (with Red gram chunni: RGCC)	R3 (with Green gram chunni: GGCC)	R4 (with Bengal gram chunni: BGCC)
Sorghum straw	50.0	50.0	50.0	50.0
Red gram chunni	-	7.5	-	-
Green gram chunni	-	-	7.5	-
Bengal gram chunni	-	-	-	7.5
Maize	13.0	14.0	15.0	13.0
Ground nut cake	21.5	20.5	19.5	21.5
Wheat bran	7.5	-	-	-
Molasses	5.0	5.0	5.0	5.0
Mineral mixture	2.0	2.0	2.0	2.0
Salt	1.0	1.0	1.0	1.0
Total*	**100.0**	**100.0**	**100.0**	**100.0**

*Vitamin A supplement was added @ 10 g/100 kg complete diet.

Body Condition Score (BCS)

Body condition scoring is a reliable method to assess the nutritional status and energy reserves of sheep. It involves palpation of the muscle and fat cover over the lumbar vertebrae and short ribs, as well as evaluation of fat deposition around the sternum and intercostal spaces. The technique provides an indication of the animal's energy stores. Scoring was carried out on a five-point scale with 0.5-unit intervals, as suggested by Russel (1969). The criteria for scoring are presented in Table 2.

Table 2: Body condition score (BCS) scale for sheep

Visual appraisal and palpation	Body condition score
Emaciated	1
Thin	2
Average	3
Fat	4
Obese	5

Statistical analysis of the data was carried out according to the procedures suggested by Snedecor and Cochran (1994). Least-square Analysis of variance was used to test the significance of various treatments and the difference between treatment means was tested for significance by Duncan's Multiple Range and F Test (Duncan, 1955).

RESULTS

The initial body weights of lambs did not differ significantly among the four treatment groups (R1–R4). Statistical analysis revealed no significant difference ($P>0.05$) in body weights up to the first fortnight Table 3. However, from the second fortnight onwards, significant ($P<0.01$) differences were observed among treatments. Lambs fed experimental complete diets containing red gram, green gram, or bengal gram chunni (R2, R3, R4) showed significantly higher body weights compared to those in the control group (R1). The growth performance of Nellore ram lambs was evaluated using body condition score (BCS).

Body Condition Score (BCS)

The average body condition score (BCS; Mean ± SE) of lambs fed different complete rations is presented in Table 4. The BCS of lambs was non-significant throughout the experiment except 8th fortnight, where the R2 and R3 groups showed significantly higher ($P<0.01$) BCS compared to R1 and R4 groups (Table 4). The initial BCS of lambs across groups was comparable (1.35–1.38), and it increased linearly with age and weight gain. At the end of the experiment, the final BCS values were 2.28 ± 0.12, 2.84 ± 0.11, 2.71 ± 0.10 and 2.55 ± 0.09 for R1, R2, R3 and R4 groups, respectively Table 3. Statistical analysis revealed no significant differences ($P>0.05$) except at the 8th fortnight, where R2 and R3 groups recorded significantly higher BCS ($P<0.01$) compared with R1 and R4. The consistent improvement in BCS reflected better nutrient intake and enhanced fat reserves and muscle thickness in lambs fed pulse chunni diets, particularly R2.

Table 3: Effect of feeding experimental complete diets on Weight Gain, ADG, DMI, FCR in Nellore ram lambs

Parameters	Complete diets#			
	R1 (without any chunni: Control)	**R2 (with Red gram chunni: RGCC)**	**R3 (with Green gram chunni: GGCC)**	**R4 (with Bengal gram chunni: BGCC)**
Initial weight (Mean ± SE; kg)	13.26 ± 0.08	13.28 ± 0.06	13.22 ± 0.01	13.27± 0.04
Final weight (Mean ± SE; kg)	23.91 ± 0.05	24.26 ± 0.02	23.98 ± 0.05	23.92± 0.06
Total weight gain(kg)	10.65	10.98	10.76	10.66
Average daily gain (g)	88.75 ± 0.90	91.46 ± 0.49	89.69 ± 0.49	88.85± 0.49
Total feed intake (kg)	108.27	109.55	108.38	108.32
Total DMI (kg)	74.63	79.93	78.45	75.21
DMI/day (g)	621.90	666.08	653.75	626.75
FCR (kg feed/kg gain)	10.17	9.98	10.07	10.16

#Each value is an average of eight observations; DMI = Dry matter intake; FCR = Feed conversion ratio

Table 4: Fortnightly body condition score (BCS) of Nellore ram lambs fed experimental complete diets

Complete diets	n	Initial BCS	Fortnightly body condition score# (BCS; Mean ± SE)							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8** (Final BCS)**
R1 (without any chunni: Control)	8	1.35 ± 0.08	1.30 ± 0.06	1.38 ± 0.05	1.48 ± 0.07	1.56 ± 0.07	1.78 ± 0.08	1.98 ± 0.08	2.11 ± 0.14	2.28a ± 0.12
R2 (with Red gram chunni: RGCC)	8	1.38 ± 0.10	1.45 ± 0.09	1.48 ± 0.09	1.59 ± 0.09	1.70 ± 0.08	1.89 ± 0.07	2.24 ± 0.09	2.61 ± 0.14	2.84b ± 0.11
R3 (with Green gram chunni: GGCC)	8	1.36 ± 0.11	1.36 ± 0.10	1.56 ± 0.14	1.63 ± 0.14	1.71 ± 0.15	1.88 ± 0.15	2.05 ± 0.13	2.47 ± 0.13	2.71b ± 0.10
R4 (with Bengal gram chunni: BGCC)	8	1.38 ± 0.09	1.35 ± 0.01	1.43 ± 0.12	1.51 ± 0.11	1.66 ± 0.14	1.88 ± 0.14	2.12 ± 0.13	2.25 ± 0.16	2.55ab ± 0.09
SEM		0.047	0.046	0.056	0.053	0.056	0.057	0.055	0.078	0.064
P value		0.993	0.783	0.692	0.715	0.796	0.912	0.432	0.095	0.008

#Each value is an average of eight observations; n = Number of animals in each treatment; P = Probability Value; SEM: Standard Error Mean abMeans with different superscripts column wise differ significantly **(P<0.01)

DISSCUSION

Overall, the BCS reflected the growth trends observed in body weight and ADG. The R2 group exhibited superior body condition score, in line with its higher nutrient intake and growth performance, suggesting that inclusion of red gram chunni at 15% level improved the overall growth pattern of Nellore ram lambs without adverse effects. The observed improvement in BCS of lambs fed pulse chunni-based diets (R2 and R3) may be attributed to higher nutrient density, efficient nutrient utilization, and greater body weight gains, which contributed to better fat deposition and muscle development. Similar trends in BCS improvement with high-plane nutrition and complete diets have been reported in Deccani lambs (Bhokre *et al.*, 2020; Tharuntej *et al.*, 2020), Nellore sheep at breeding (Rangamma *et al.*, 2021), and Nellore ram lambs (Pandu, 2021).

SUMMARY

The body condition score (BCS) of lambs increased linearly throughout the experiment, with significant differences observed at the 8th fortnight. Lambs on R2 and R3 recorded higher (P<0.01) BCS than R1 and R4. This improvement suggests better fat deposition and muscle development, consistent with higher growth rates. This could be due to high plane of nutrition, fast growth rate, increased body weight of lambs maintained on sorghum straw based complete diets with roughage to concentrate ratio 50:50, that reflected in increased body fat reserves and muscle thickness into a better BCS.

Conflict of Interest

On behalf of all the co-authors hereby, I declare that there is no conflict of interest for the manuscript entitled **"Effect of Pulse chunni based complete diets on growth and body condition score of Nellore ram lambs"** Moreover, I declare that all the other authors fully agree on its content and approve the text. This manuscript describes an original work and it is not under consideration by any other journal and has never been published before in any form.

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Ethics Declaration:

None of the data were deposited in on official repository. Raw data supporting the findings of this study are available from the corresponding author [J.K.] on request.

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