Open Access

Check for updates

Research Article

Journal of Veterinary and Animal Sciences
ISSN (Print): 0971-0701, (Online): 2582-0605
https://doi.org/10.51966/jvas.2026.57.1.200-207

Growth performance, body condition score and body measurements of mecheri lambs fed with dhaincha and sunnhemp incorporated total mixed ration

D. Santhiya [1], N. Bharathy [2]*, D. Anandha Prakash Singh[1] and P. Vasanthakumar[3]

[1]Department of Livestock Production Management, [3]Department of Animal Nutrition Veterinary College and Research Institute, Namakkal - 637 002,[2]Department of Livestock Production Management, Veterinary College and Research Institute, Salem - 636 112. , Tamil Nadu Veterinary and Animal Sciences University, Tamil Nadu, India.

Citation: Santhiya, D., Bharathy, N., Singh, D.A.P. & Vasanthakumar, P. (2026). Growth performance, Body Condition Score and body measurements of Mecheri lambs fed with dhaincha and sunnhemp incorporated Total Mixed Ration. *Journal of Veterinary and Animal Sciences,* 57(1), 200-207
https://doi.org/10.51966/jvas.2026.57.1.200-207

Received: 06.02.2026 Accepted: 16.02.2026 Published: 31.03.2026

Abstract

A feeding trial was conducted to evaluate the effect of incorporating non-conventional legume fodders, dhaincha (Sesbania aculeata) and sunnhemp (Crotalaria juncea), in total mixed ration (TMR) on growth performance, body condition score (BCS) and linear body measurements of Mecheri lambs. Twenty four weaned Mecheri lambs (3 - 4 months of age) were randomly allotted to four dietary treatments with six lambs each: T_1 (20% dried hedge lucerne, control), T_2 (20% dried dhaincha), T_3 (20% dried sunnhemp) and T_4 (10% dried dhaincha + 10% dried sunnhemp). The experimental diets were iso-nitrogenous and iso-caloric and fed ad libitum for 120 days under intensive system of management. Growth parameters, feed intake, feed efficiency, BCS and body measurements were recorded at regular intervals. Final body weight (25.75 - 26.23 kg), total weight gain (11.10 - 11.82 kg), average daily gain (92.50 - 98.47 g) and feed efficiency did not differ significantly among treatments. Total feed intake was significantly higher ($p<0.05$) in the control group compared to dhaincha and sunnhemp based diets. Body condition score and linear body measurements showed progressive improvement with age, with no adverse effects due to legume inclusion. The study concludes that dhaincha and sunnhemp can effectively replace hedge lucerne up to 20 per cent in TMR without compromising growth performance, body condition or skeletal development of Mecheri lambs.

Keywords: *Dhaincha, sunnhemp, total mixed ration, growth performance*

Body condition score (BCS) and linear body measurements are widely used as practical indicators of nutritional status, growth efficiency and body reserves in small ruminants. Body condition scoring provides a rapid and reliable assessment of fat and muscle deposition, reflecting the balance between nutrient intake and utilization, and is closely associated with growth rate, reproductive efficiency and carcass quality in sheep (Ghosh et al., 2019). Similarly, linear body measurements such as height at withers, body length and chest girth are non-invasive tools used to evaluate skeletal development and muscular growth and have been shown to be strongly correlated with body weight and productivity in indigenous sheep breeds (Kandasamy et al., 2006).

**Corresponding author: lpmbharathi@gmail.com, Ph. 8012515699*

Mecheri sheep is a recognized indigenous breed of Tamil Nadu, primarily reared for mutton production. Although the breed is well adapted to the semi-arid tropical climate, its productivity is often constrained by seasonal feed scarcity, poor quality roughages and limited access to protein-rich fodders, leading to suboptimal body condition and uneven growth (Usha & Mahesh, 2025). Nutritional interventions aimed at improving energy and protein supply have been reported to enhance BCS, body measurements and overall growth performance in indigenous sheep breeds (Chinnathambi & Chitrambigai, 2025; Ebrahim & Alemayehu, 2025).

Incorporating non-conventional fodder into feeding systems can help to overcome nutritional constraints. *Sesbania aculeata* (Dhaincha) and *Crotalaria juncea* (Sunnhemp) are the fast growing tropical legumes capable of thriving under adverse conditions such as drought, waterlogging and salinity (Rathika et al., 2024). These species produce green foliage that is rich in crude protein, low in fiber and highly digestible. They can be cultivated on marginal lands with minimal inputs and improve soil fertility through nitrogen fixation, making them suitable for sustainable farming systems.

A promising approach for efficient utilization of these fodders is the Total Mixed Ration (TMR) system, in which roughages and concentrates are blended in appropriate proportions to meet the nutritional requirements of animals. TMR feeding minimizes selective consumption, improves nutrient utilization and facilitates the inclusion of non-conventional fodder resources without affecting dietary balance. Incorporation of dhaincha and sunnhemp in TMR can partially replace costly concentrate ingredients, enhance dietary protein supply and ensure uniform nutrient intake. This strategy may help overcome seasonal feed scarcity, improve feed efficiency and support sustainable small ruminant production, particularly under resource-limited conditions.

Despite the nutritional potential of dhaincha and sunnhemp, information on their influence on body condition score and linear body measurements of Mecheri lambs is limited. Therefore, the present study was undertaken to evaluate the effect of dhaincha and sunnhemp incorporated total mixed ration on growth performance, body condition score and linear body measurements of growing Mecheri lambs.

Materials and methods

Experimental location

The present experiment was carried out from March to July, 2025 in the Livestock Farm Complex, Veterinary College and Research Institute, Namakkal, Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Tamil Nadu, India (78º9'41.11''E, 11º9'41''N). The mean temperature during the experimental period ranged from 22.85 to 36.81 ºC, with a mean relative humidity of 47.2 per cent.

Experimental design

A total of 24 weaned Mecheri lambs, (3 to 4 months of age) were allotted to four dietary treatments (T_1, T_2, T_3 and T_4) each consisting of six lambs (three males and three females) to evaluate the production performance of Total Mixed Ration. The details of the treatment groups are as follows:

Treatment groups	Number of animals	Details of experiment
T_1 (Control)	6	20 % dried hedge lucerne (*Desmanthus virgatus*) incorporated TMR
T_2	6	20 % dried dhaincha (*Sesbania aculeata*) incorporated TMR
T_3	6	20 % dried sunnhemp (*Crotalaria juncea*) incorporated TMR
T_4	6	10 % dried dhaincha (*Sesbania aculeata*) + 10 % dried sunnhemp (*Crotalaria juncea*) incorporated TMR

The remaining ingredients (10 per cent sorghum and 10 per cent kolukattai hay) were adjusted to maintain iso-nitrogenous and iso-caloric diets across all groups. Animals had *ad libitum* access to their respective TMRs, with feed quantities adjusted fortnightly according to individual body weights to ensure regular nutrient intake relative to growth. All four groups were reared under an intensive system for a period of four months (from 4 to 8 months of age) under uniform management conditions.

Procurement and processing of feed ingredients

The feed ingredients, including maize, soybean meal, de-oiled rice bran, sodium bicarbonate, salt, trace minerals, vitamins and yeast were utilized to formulate the experimental feed. Sorghum fodder, kolukattai grass, dhaincha fodder, sunnhemp fodder and hedge lucerne were harvested at the flowering stage (Fig.1) from the Livestock Farm Complex. These fodders were dried, shredded and incorporated into the study. All the ingredients were ground to a 4 mm particle size to prepare complete feed ration by handmix for growing weaned Mecheri lambs used in the study. Animals in all groups were fed individually according to their nutrient requirements (ICAR, 2024), based on body weight and average daily gain. Feed and water were provided *ad libitum* for all treatment groups during the

A B

Fig 1. Flowering stage of Dhaincha (A) and Sunnhemp (B)

experimental period. Standard management and health care practices were followed uniformly for all the four treatment groups.

Analysis of experimental feed and fodders

The TMR formulations were analysed for moisture, dry matter (DM), crude protein (CP), ether extract (EE), crude fibre (CF), calcium and phosphorus (AOAC, 2012, procedure no. 930.15, 984.13, 2003.06, 962.09, 927.02, 965.17, respectively). The total ash and acid insoluble ash was estimated by IS 14827-2000, IS 14826-2021. The results were expressed as percentage on dry matter basis (Table 1).

Table 1. Nutritional composition (%) of experimental TMR feed

Nutrients (%)	T_1	T_2	T_3	T_4
Crude protein	16.57	15.75	15.84	17.03
Crude fibre	20.83	25.62	30.80	18.10
Crude fat	2.45	2.31	2.76	2.17
Crude ash	8.60	7.48	8.21	8.79
Acid insoluble ash	2.85	2.63	2.58	2.70
Calcium	0.76	0.57	0.96	0.57
Phosphorus	0.88	0.73	0.82	0.90
Salt	0.80	0.69	0.69	0.84

Growth performance

All the lambs were tethered individually in the morning before feeding so that the daily feed consumption and leftover of each animal could be measured accurately. The individual body weight of lambs was recorded at the beginning of the experiment and subsequently at 45 days intervals in the morning hours before feeding and watering. Total feed intake was recorded and feed efficiency was also derived for each treatment group. Fortnightly body weight gain was plotted against the corresponding feed efficiency to arrive at the coordinates to identify the best economic traits.

Body Condition Score (BCS)

The body condition score (BCS) chart was developed based on the system described by Abede et al. (2008) and Ghosh et al. (2019). In this system, the scores for sheep ranged from 1 (very thin condition) to 5 (very fat condition). Scoring is based on feeling the amount of muscling and fat deposition over and around the vertebrae in the loin region.

Body condition score was assessed by handling the animals along the top and side of the back bone in the loin area immediately behind the last rib and placing the hand on lumbar region by felt spinous and the transverse process (Girma, 2007).

Linear body measurements

Linear body measurements viz., height at withers, body length, chest girth and paunch girth of the animals were measured using a flexible measuring tape after proper restraining of the animal and holding it in an unforced position at a flat surface and measured in centimeters at every 45 days interval.

Height at withers : Height at withers was measured as the vertical distance from the highest point of withers to the base of the hoof.

Body length : The body length was measured at a distance between the anterior edge of the shoulder to the point of pin bone.

Chest girth : Chest girth (HG) was obtained as the smallest circumference around the chest of animal just behind the foreleg.

Paunch girth : Paunch girth (LG) was obtained as the circumference just before the hindlegs.

Data analysis

Data collected from various parameters were subjected to analysis of variance procedures appropriate for a completely randomized design using the SPSS software (version 27.0). The means are presented with their standard

error of the means, and the means of different experimental groups were tested for statistical significance by Duncan's multiple range test (Snedecor & Cochran, 1996).

Results and discussion

Growth performance of Mecheri lambs

The growth performance, feed intake and feed efficiency of Mecheri lambs fed total mixed ration (TMR) containing hedge lucerne (T_1), dhaincha (T_2), sunnhemp (T_3) and a dhaincha + sunnhemp combination (T_4) from 4 to 8 months of age are presented in Table 2.

The initial body weight of lambs was comparable ($p>0.05$) across treatments, indicating uniformity of experimental animals. After 120 days of feeding, final body weight did not differ significantly ($p>0.05$) among treatments and was 26.18 ± 1.39 kg in T_1, 26.23 ± 1.88 kg in T_2, 25.92 ± 1.04 kg in T_3 and 25.75 ± 1.22 kg in T_4. Similarly, total body weight gain (11.10 ± 0.10 to 11.82 ± 0.07 kg) and average daily gain (92.50 ± 4.80 to 98.47 ± 4.23 g) were statistically comparable, demonstrating that dhaincha and sunnhemp based TMR supported growth at par with hedge lucerne. These findings corroborate earlier reports on legume-based feeding in small ruminants. Comparable growth responses were reported by Hashmat Ali Khan (1985) in Teddy goats (7.98 kg gain), Fernandes (2004) in Osmanabadi goats (6.74 kg), Mohamed et al. (2022) and Salem *et al*. (2022) in sheep fed dhaincha (25.50 kg final weight). Sunnhemp based diets have shown variable responses: Chandrasekharaiah et al. (1996) recorded 10.3 kg gain in Nellore lambs, whereas Rachel et al. (2017) observed reduced gains (–3.17 kg) in Tellicherry kids; Byeng Ryel Min (2018) reported 8.4 kg gain in goats. Hedge lucerne and lucerne diets are often associated with superior growth, as observed by Malisetty et al. (2013) in Nellore lambs (10.15 kg gain) and Aoetpah et al. (2024) in Boer kids (9.6 kg). The present results indicate that dhaincha and sunnhemp, either alone or in combination, effectively sustained growth comparable to conventional hedge lucerne under tropical conditions.

Total feed intake differed significantly ($p<0.05$) among treatments. Lambs fed hedge lucerne based TMR (T_1) recorded a higher cumulative feed intake (103.07 ± 1.22 kg) compared to dhaincha and sunnhemp based diets (95.08 ± 1.07 to 96.24 ± 1.06 kg). The 7 to 8 per cent higher intake in T_1 may be attributed to better palatability, moderate fibre content and lower levels of anti-nutritional factors. Similar observations were reported by Sonawane et al. (2019) and Malisetty et al. (2013), who noted higher dry matter intake in hedge lucerne or lucerne fed lambs.

Table 2. Growth performance of Mecheri lambs fed with dhaincha and sunnhemp incorporated TMR

Parameters (4 – 8 months of age)	T_1 (control)	T_2 (20%dhaincha)	T_3 (20%sunnhemp)	T_4 (10%dhaincha +10%sunnhemp)
Initial (0)	14.53 ± 1.51	14.80 ± 1.09	14.75 ± 0.54	14.65 ± 0.45
45	18.49 ± 1.50	18.42 ± 1.39	18.32 ± 0.55	18.20 ± 0.62
90	23.14 ± 1.33	22.95 ± 1.67	22.40 ± 0.71	22.40 ± 0.91
120	26.18 ± 1.39	26.23 ± 1.88	25.92 ± 1.04	25.75 ± 1.22
Total weight gain (kg)	**11.82 ± 0.07**	**11.43 ± 0.08**	**11.17 ± 0.10**	**11.10 ± 0.10**
0 - 45	4.13 ± 0.52	3.62 ± 0.53	3.57 ± 0.38	3.55 ± 0.39
45 - 90	4.65 ± 0.54	4.54 ± 0.59	4.08 ± 0.45	4.21 ± 0.60
90 - 120	3.05 ± 0.30	3.28 ± 0.33	3.52 ± 0.47	3.35 ± 0.40
Overall daily gain (g)	**98.47 ± 4.23**	**95.28 ± 4.62**	**93.06 ± 4.78**	**92.50 ± 4.80**
0 - 45	91.5 ± 7.4	80.4 ± 7.9	79.3 ± 6.6	78.8 ± 7.2
45 - 90	103.4 ± 8.1	101.7 ± 9.6	90.7 ± 7.1	93.6 ± 9.2
90 - 120	101.6 ± 6.9	109.6 ± 7.3	117.7 ± 12.6	111.8 ± 10.9
Total feed intake (kg)	**103.07^{b} ± 1.22**	**95.58^{a} ± 1.08**	**96.24^{a} ± 1.06**	**95.08^{a} ± 1.07**
0 - 45	28.14^{b} ± 0.65	27.02^{b} ± 0.74	27.06^{a}± 0.10	26.47^{a} ± 0.15
45 - 90	41.64^{b} ± 0.19	37.85^{a} ± 1.29	38.21^{ab} ± 0.12	37.87^{ab} ± 0.19
90 - 120	33.30^{b} ± 0.17	30.71^{a} ± 0.74	30.98^{a} ± 0.13	30.74^{a} ± 0.27
Overall mean Feed efficiency (FE)	**9.22 ± 0.42**	**9.11 ± 0.45**	**9.18 ± 0.38**	**9.14 ± 0.38**
0 - 45	7.34 ± 0.62	8.50 ± 1.03	7.97 ± 0.87	7.91 ± 0.75
45 - 90	9.58 ± 0.94	8.90 ± 1.23	9.94 ± 1.05	9.84 ± 1.12
90 - 120	11.51 ± 1.06	9.83 ± 0.89	9.86 ± 1.38	9.95 ± 1.17

^{a,b,c}Means with different superscripts in the same row differ significantly ($p<0.05$)

Each value is the mean of 6 observations (3 males and 3 females)

Table 3. Body Condition Score (BCS) of Mecheri lambs fed with dhaincha and sunnhemp incorporated TMR

Trial period (days)	T_1 (control)	T_2 (20% dhaincha)	T_3 (20% sunnhemp)	T_4 (10% dhaincha + 10% sunnhemp)
Initial (0)	2.67 ± 0.21	2.67 ± 0.17	2.67 ± 0.17	2.67 ± 0.17
45	2.75 ± 0.11	2.75 ± 0.11	2.75 ± 0.11	2.75 ± 0.11
90	2.83 ± 0.11	2.92 ± 0.08	2.92 ± 0.08	3.00 ± 0.00
120	3.25 ± 0.11	3.17 ± 0.11	3.33 ± 0.11	3.17 ± 0.11

Means within a row bearing no different superscripts do not differ significantly (p>0.05)

Each value is mean of 6 observations (3 males and 3 females)

Table 4. Linear body measurements of Mecheri lambs fed with dhaincha and sunnhemp incorporated TMR

Trial period (days)	T_1 (control)	T_2 (20% dhaincha)	T_3 (20% sunnhemp)	T_4 (10% dhaincha + 10% sunnhemp)
Height at withers (cm)				
Initial (0)	57.83 ± 1.58	58.67 ± 1.28	60.00 ± 1.21	57.67 ± 0.84
45	59.67 ± 0.76	59.50 ± 1.12	60.17 ± 0.70	58.83 ± 0.54
90	64.33 ± 1.36	62.33 ± 0.76	62.67 ± 1.36	61.00 ± 0.82
120	67.50^{ab} ± 1.50	68.50^{b} ± 1.48	66.67^{ab} ± 1.50	64.17^{a} ± 0.54
Body length (cm)				
Initial (0)	46.33 ± 1.63	45.67 ± 1.43	46.17 ± 0.87	47.00 ± 1.51
45	47.67 ± 2.09	46.83 ± 1.58	48.83 ± 0.91	49.50 ± 1.48
90	55.83 ± 1.51	53.83 ± 1.83	52.17 ± 1.74	52.50 ± 0.22
120	58.50 ± 1.38	59.67 ± 2.36	58.50 ± 1.34	59.67 ± 1.17
Chest girth (cm)				
Initial (0)	64.17 ± 2.18	62.33 ± 1.84	62.17 ± 1.08	62.67 ± 1.50
45	65.00 ± 2.22	65.33 ± 1.63	64.33 ± 0.67	65.33 ± 0.49
90	73.00 ± 2.11	73.33 ± 2.08	69.67 ± 0.42	70.33 ± 0.84
120	76.17 ± 1.56	77.50 ± 1.95	76.00 ± 1.00	74.67 ± 1.65
Paunch girth (cm)				
Initial (0)	65.33 ± 1.93	61.33 ± 2.47	65.50 ± 0.85	62.50 ± 1.69
45	66.50 ± 1.93	64.83 ± 1.90	67.17 ± 1.01	68.67 ± 0.61
90	76.83 ± 2.18	77.00 ± 2.22	76.83 ± 1.11	74.00 ± 1.67
120	80.67 ± 1.54	78.83 ± 2.37	80.17 ± 2.02	78.67 ± 1.41

^{a,b,c}Means with different superscripts in the same row differ significantly (p<0.05)

Each value is mean of 6 observations (3 males and 3 females)

Slightly reduced intake in dhaincha based diets has been attributed to secondary metabolites (Worku et al., 2015; Tekliye et al., 2018; Farghaly et al., 2022). However, the present intake levels in T_2 (≈ 796 g/day) and T_3 (≈ 802 g/day) confirm acceptable voluntary intake when dhaincha and sunnhemp are incorporated into balanced TMR. Comparable intakes were reported by Reddy et al. (2011) and Rachel et al. (2017), while earlier reports by Dhanunjayudu (1996) and Mohan et al. (1984) showed lower and variable intake, reflecting differences in forage maturity and inclusion levels.

Feed efficiency remained statistically similar (p>0.05) among treatments, ranging from 9.11 ± 0.45 to 9.22 ± 0.42, indicating efficient utilization of nutrients irrespective of fodder source. These values are in agreement with reports by Sivaramakrishna et al. (2021) and Malisetty et al. (2013) for lucerne fed lambs, Ibrahim et al. (2012) and Salem et al. (2022) for dhaincha based diets and Chandrasekharaiah et al. (1996); Dhanunjayudu (1996); Rachel et al. (2017) for sunnhemp diets.

Body Condition Score (BCS)

The mean (± SE) body condition score (BCS) of Mecheri lambs fed dhaincha and sunnhemp incorporated TMR is presented in Table 3. Body condition score of Mecheri lambs increased progressively from 2.67 ± 0.17 at the beginning to 3.33 ± 0.11 at 120 days, with no significant differences (p>0.05) among treatments. The uniform improvement in BCS indicates adequate nutrient supply and efficient energy utilization across all diets. Similar

trends were reported by Santhoshkumar (2017), who recorded an increase in BCS from 2.71 to 3.63 in Mecheri lambs, and Sribalaji (2022), who observed significant improvement in BCS with higher fibre by-product inclusion. Comparable responses in goats fed dhaincha based diets were also reported by Sonawane et al. (2019) and Gholve et al. (2021).

Linear body measurements

The effect of feeding dhaincha and sunnhemp incorporated TMR on the linear body measurements viz., height at withers, body length, heart girth and paunch girth of Mecheri lambs are presented in Table 4.

Height at withers increased from 57.67 ± 0.84 to 68.50 ± 1.48 cm over the experimental period. Although most periods showed no significant differences, a significant variation ($p<0.05$) was observed at 120 days, with T_2 lambs recording the highest value (68.50 ± 1.48 cm) and T_4 the lowest (64.17 ± 0.54 cm), while T_1 and T_3 remained intermediate. These results are consistent with earlier findings in Madras Red, Mecheri and Coimbatore sheep (Meenakshisundaram et al., 2002; Karunanithi et al., 2004; Kandasamy et al., 2006), as well as Katchakatty and Nellore Brown sheep (Ravimurugan, 2014; Rangamma, 2020).

Body length increased uniformly from 45.67 ± 1.43 to 59.67 ± 1.50 cm, with no significant differences among treatments. This indicates that dhaincha and sunnhemp supported longitudinal skeletal growth comparable to hedge lucerne. Similar values were reported by Karunanithi et al. (2004); Kandasamy et al. (2006); Ravimurugan (2014); Santhoshkumar (2017) and Sribalaji (2022).

Chest girth increased steadily from 62.17 ± 1.08 to 77.50 ± 1.95 cm during the 120 day period, with no significant differences among dietary treatments. This reflects normal thoracic development with age and adequate muscle deposition. Comparable results were reported by Karunanithi et al. (2004); Kandasamy et al. (2006); Ravimurugan (2014); Santhoshkumar (2017); Sheeba et al. (2021) and Rangamma (2020).

Paunch girth increased from 61.33 ± 2.47 to 80.67 ± 1.54 cm, without significant variation among treatments, indicating uniform rumen development and digestive adaptation. The present values are comparable to those reported in Ramnad White, Kilakarsal and Nellore sheep by Ravimurugan and Devendran (2009); Ravimurugan et al. (2010); Rani et al. (2014) and Rangamma (2020).

Conclusion

The present study concluded that incorporation of dhaincha (*Sesbania aculeata*) and sunnhemp (*Crotalaria juncea*), individually or in combination at 20 per cent level in total mixed ration, supported growth performance, feed efficiency, body condition score and linear body measurements of Mecheri lambs comparable to the hedge lucerne based control diet. Although total feed intake was significantly higher in the hedge lucerne group, dhaincha and sunnhemp based diets maintained satisfactory voluntary intake and efficient nutrient utilization. The uniform improvement in BCS and normal progression of skeletal measurements indicated adequate energy and protein supply across treatments. These findings suggested that dhaincha and sunnhemp can serve as effective, locally available and cost-efficient alternative protein sources in TMR for growing Mecheri lambs, contributing to sustainable and economical sheep production under tropical farming conditions.

Acknowledgements

The authors are thankful to the Tamil Nadu Veterinary and Animal Sciences University for providing all the facilities to perform the study.

Conflict of interest

No conflict of interest

References

AOAC. (2012). *Official methods of analysis* (19th ed.). Association of Official Analytical Chemists.

Abede, G., Yami, A., & Merkel, R. C. (2008). Sheep and goat management. In *Sheep and goat production handbook for Ethiopia* (pp. 43–45).

Aoetpah, A., Gardiner, C., Gummow, A., Mialon, A., & Walker, G. (2024). Undegradable dietary protein limits growth and carcass yield in crossbred Boer kids fed Desmanthus hay or Rhodes grass (*Chloris gayana*) hay supplemented with urea and/or cottonseed meal. *Animal Production Science, 64*, 1–9.

Min, B. R. (2018). On-farm evaluation and use of sunn hemp (*Crotalaria juncea* L.) legume to improve sustainable meat goat production and health in southern USA. *Sustainable Agriculture Research Project Final Report* (OS14-088).

Chandrasekharaiah, M., Reddy, M. R., & Reddy, G. V. N. (1996). Effect of feeding urea treated maize stover on growth and nutrient utilization by sheep and goats. *Small Ruminant Research, 22*, 141–147.

Chinnathambi, V., & Chitrambigai, K. (2025). Optimizing sheep reproductive performance through nutritional interventions. *Journal of Experimental Agriculture International, 47*(4), 113–121.

Dhanunjayudu, T. (1996). *Evaluation of complete ration containing different leguminous fodder crops in*

Nellore sheep (M.V.Sc. thesis). Andhra Pradesh Agricultural University.

Ebrahim, H., & Alemayehu, K. (2025). Dietary supplements improve growth performance and carcass yields of indigenous sheep in Ethiopia: A systematic review and meta-analysis. *Veterinary Medicine and Science, 11*, e70129.

Farghaly, M. M., Youssef, I. M. I., Radwan, M. A., & Hamdon, H. A. (2022). Effect of feeding *Sesbania sesban* and reed grass on growth performance, blood parameters and meat quality of growing lambs. *Tropical Animal Health and Production, 54*, 1–13.

Fernandes, A. P. (2004). *Effect of intensive feeding of energy and protein on nutritive value and feeding potential of dhaincha (Sesbania aculeata) vis-à-vis lucerne (Medicago sativa) for goats* (Ph.D. thesis). Mahatma Phule Krishi Vidyapeeth.

Gholve, A. U., Deshpande, K. Y., Munde, V. K., Amurtkar, S. A., Sonale, P. D., & Naitam, N. D. (2021). Effect of partial replacement of concentrate mixture by *Sesbania sesban* on nutrient utilization, growth performance, blood metabolites and economics of production in growing Osmanabadi goats. *Animal Nutrition and Feed Technology, 21*, 151–165.

Ghosh, C. P., Datta, S., Mandal, D., Das, A. K., Roy, D. C., Roy, A., & Tudu, N. K. (2019). Body condition scoring in goat: Impact and significance. *Journal of Entomology and Zoology Studies, 5*(2), 554–560.

Girma, A. (2007). *Body condition scoring of sheep and goats* (Technical Bulletin No. 8).

Khan, H. A. (1985). Effect of feeding green dhaincha on growth rate and feed efficiency in Teddy goats. *Pakistan Journal of Agricultural Research, 6*(3), 234–237.

Ibrahim, F. A., Soliman, E. S., Abd El-Hamid, A. A., & Ahmed, M. E. (2012). Growth performance and feed utilization efficiency of Rahmani lambs fed some legume and/or grass silages. *Egyptian Journal of Sheep and Goat Sciences, 7*(2), 1–10.

Indian Council of Agricultural Research. (2024). *Nutrient requirements of sheep, goat and rabbit* (4th ed.). ICAR.

Bureau of Indian Standards. (2000). *Animal feeding stuffs – Determination of ash insoluble in hydrochloric acid* (IS 14826).

Bureau of Indian Standards. (2000). *Animal feeding stuffs – Determination of crude ash* (IS 14827).

Kandasamy, N., Pannerselvam, S., Devendran, P., & Thiruvenkadan, A. K. (2006). *Survey, evaluation and characterization of Coimbatore sheep breed* (Final report). Veterinary College and Research Institute.

Karunanithi, K., Purushothaman, M. R., Thiruvenkadan, A. K., Singh, G., Sadana, K., Jain, A., Singh, A., & Singh, P. K. (2004). *Mecheri sheep monograph*. TANUVAS & NBAGR.

Malisetty, V., Reddy, Y. R., Nagalakshmi, D., Mallam, M., Krishna, C. H., Reddy, A. R., & Prakash, M. G. (2013). Effect of feeding maize silage supplemented with concentrate and legume hay on growth in Nellore ram lambs. *Veterinary World, 6*(4), 209–213.

Meenakshisundaram, S., Sivakumar, T., Ramesh, V., & Gnanraj, P. T. (2002). Comparative performance of Madras Red sheep under different management systems. *Indian Journal of Animal Sciences, 72*, 904–907.

Mohamed, M. Y., Mahgoub, A. E. M. A. S., Abd El-Hafeez, A. M., Shaarawy, A. B. M., & Nassar, M. I. (2022). Efficiency of feeding sesban hay as a replacement for clover hay on growth performance and semen quality of sheep. *Advances in Animal and Veterinary Sciences, 10*, 1434–1443.

Mohan, D. V. G. K., Reddy, K. S., Naidu, C. M., Munirathnam, D., & Reddy, K. K. (1984). Effect of different levels of energy supplementation on the performance of weaner lambs fed legume hay. *Indian Journal of Animal Sciences, 54*, 1170–1172.

Rachel, J., Gnanaraj, E. P. T., Muthuramalingam, T., Devi, T., & Bharathidasan, A. (2017). Effect of hydroponic sun hemp fodder on post-weaning growth performance of Tellicherry kids. *Indian Journal of Animal Sciences, 87*, 191–194.

Rangamma, B. (2020). *Performance of Nellore brown sheep under different systems of rearing* (Ph.D. thesis). PVNRTVU.

Rani, M., Ekambaram, B., & Punyakumari, B. (2014). Biometrical measurements of Nellore sheep under field conditions. *Indian Veterinary Journal, 91*, 17–21.

Rathika, S., Ramesh, T., Jeyaprakash, P., & Vanniarajan, C. (2024). Enhancing seed yield of dhaincha (*Sesbania aculeata* L.) through optimum spacing and nutrient management. *Legume Research*. https://doi.org/10.18805/LR.5328

Reddy, R. V., Reddy, R. R., Rao, D. S., Reddy, D. V., & Rao, Z. P. (2011). Nutritional evaluation of sunn hemp (*Crotalaria juncea*) hay as sole roughage and its

use in complete ration for sheep. *Indian Journal of Animal Nutrition, 16*(1), 38–43.

Ravimurugan, T. (2014). Growth performance of Katchakatty sheep under extensive management. *Aayvagam International Journal of Multidisciplinary Research, 1*(12), 11–12.

Ravimurugan, T., & Devendran, P. (2009). Body measurements and body weight of Ramnad White sheep. *Indian Journal of Small Ruminants, 15*(2), 266–267.

Ravimurugan, T., Devendran, P., & Joshi, B. K. (2010). Distribution and characterization of Kilakarsal sheep. *Indian Journal of Small Ruminants, 16*(1), 122–124.

Salem, A. M. M., Soliman, E. B., Abd Ghani, A. A., & Mahgoub, A. S. (2022). Effect of feeding sesban and its mixtures with summer forage crops on productive performance of Ossimi sheep. *Minia Journal of Agricultural Research and Development, 42*(2), 207–222.

Santhoshkumar, R. (2017). *Early weaning performance in Mecheri lambs* (M.V.Sc. thesis). TANUVAS.

Sheeba, A., Reetha, T. L., Ilavarasan, S., & Jyothipriya, R. (2021). Body measurements of Ramnad White sheep reared under farm conditions. *Asian Journal of Microbiology, Biotechnology and Environmental Sciences, 23*(2), 231–232.

Sivaramakrishna, J., Suresh, J., Gangaraju, G., Punya Kumari, B., & Sreedhar, S. (2021). Evaluation of lucerne hay on growth performance of Nellore Jodipi lambs. *Journal of Entomology and Zoology Studies, 9*(1), 1329–1332.

Snedecor, G. W., & Cochran, W. G. (1996). *Statistical methods* (8th ed.). Iowa State University Press.

Sonawane, A. S., Deshpande, K. Y., Rathod, S. B., Shelke, P. R., Nikam, M. G., & Gholve, A. U. (2019). Effect of feeding hedge lucerne (*Desmanthus virgatus*) on intake, growth performance and body condition score in growing Osmanabadi goats. *Indian Journal of Animal Sciences, 89*, 881–884.

Sribalaji, N. (2022). *Production performance of Mecheri lambs fed cotton gin trash* (Ph.D. thesis). TANUVAS.

Tekliye, T., Mekuriaw, Y., Asmare, B., & Mehret, F. (2018). Nutrient intake, digestibility, growth performance and carcass characteristics of Farta sheep fed urea-treated rice straw supplemented with dried *Sesbania sesban* leaves. *Agriculture & Food Security, 7*, 77.

Usha, S., & Mahesh, T. (2025). Housing and feeding management of Mecheri sheep in its native tract. *International Journal of Veterinary Science and Animal Husbandry, 10*(2), 96–99.

Worku, A., Animut, G., & Urgie, M. (2015). Supplementation of rice bran and *Sesbania sesban* leaf on digestibility and performance of Kaffa sheep. *International Journal of Agricultural Science Research, 4*(3), 57–66. ■