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Assessment of the nutritive value of feed resources from the native tract of Nattukuttai cattle

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Abstract

A study was conducted to collect the feed resources available from the native tract of Nattukuttai cattle and to assess their chemical composition in order to utilize them to formulate a balanced ration for Nattukuttai cattle. The feed ingredients commonly used by Nattukuttai cattle rearers for homemade concentrate preparation and the dry roughages available in its native tract were collected and evaluated for their nutritive value. Among the feed ingredients collected, groundnut oil cake contains highest crude protein content (42.66%) and among the dry roughages, ground nut haulms recorded the significantly highest ($p < 0.05$) crude protein (14.03%) content. Gram screenings recorded a crude protein content of 11.36 to 15.63 percent. Highest NDF (46.18 ± 0.47), ADF (35.59 ± 0.77) and cellulose (26.80 ± 0.34) content was recorded in black gram chunnies. With regard to mineral profile gram screenings had higher calcium (0.54%) and bran variety had higher phosphorus (1.20%) content. It was concluded that among the dry roughages groundnut haulms had high nutritive value compared to other dry roughages. Among the oil cakes, groundnut oil cake had high nutritive value followed by sesame oil cake and coconut oil cake. Black gram chunnies had a high nutritive value followed by bengal gram, green gram and red gram chunnies. Evaluation of nutritive value of feed resources would be helpful in formulation of balanced ration for Nattukuttai cattle.

Keywords: Fibre fractions, mineral content, Nattukuttai cattle, proximate composition

Introduction

Nattukuttai cattle locally known as Nattu Madu, is a non-descript indigenous breed, native of North eastern agro-climatic zone of Tamil Nadu comprising Chengalpattu, Kanchipuram, Tiruvallur and Viluppuram districts. Nattukuttai cattle is unique short-statured cattle with around 105 cm in height which makes it one among the shortest cattle breeds in India (Vinothkumar, 2014) [12]. Nattukuttai cattle are reared mostly under zero input system where animals sustain solely on grazing without supplementary feed and housing. In addition to grazing, paddy straw and other locally available groundnut haulms and sorghum stover were fed as dry roughage to Nattukuttai cattle. Majority of Nattukuttai cattle rearers does not feed concentrate feed to their animal, however, 20% of the Nattukuttai cattle rearers fed homemade concentrate feed only to milking animals. The homemade concentrate mixture consists of rice bran, wheat bran, gram chunni and oilcakes. These feed ingredients are purchased from local vendor, mixed together on their own to feed the animal and which do not meet the complete nutrient requirements of animals. Nattukuttai cattle rearers had less awareness on scientific feeding, thus the production potential of these cattle was poor. Hence, in order to improve the productivity of Nattukuttai cattle, a balanced feeding regimen according to the nutrient requirement of Nattukuttai cattle suitable for the particular agroclimatic condition has to be evolved. Knowledge of the nutrient composition of different feedstuffs helps in preparation of balanced rations for ruminants. Database on nutritive values, access, and use of such information will have a significant impact on improved animal performance and productivity (Devendra and Leng, 2011) [4]. In this context, a study was planned to collect the feed resources available from the native tract of Nattukuttai cattle and to assess their chemical composition in order to utilize them to formulate a balanced ration for Nattukuttai cattle.

Materials and Methods

The study was conducted in the native tract of Nattukuttai cattle viz., Chengalpattu, Kanchipuram, Tiruvallur and Viluppuram districts. The feed ingredients commonly used by Nattukuttai cattle rearers for homemade concentrate preparation were collected to analyze

their chemical composition. The dry roughages fed to Nattukuttai cattle in its native tract were also collected to evaluate their nutritive value. The collected samples were analysed for moisture as per AOAC (2019) [1], and dried in a hot air oven at a temperature of 60 °C to a constant weight, grounded to pass through 1mm sieve and stored in air tight containers for further analysis. The samples were analysed for proximate principles viz., crude protein (CP), crude fibre (CF), ether extract (EE), total ash (TA) and nitrogen free extract (NFE) as per AOAC (2019) [1] and expressed on% DM basis. The fibre fractions viz., neutral detergent fibre (NDF), acid detergent fibre (ADF), hemicellulose, cellulose and lignin content of feed resources were estimated as per the method described by Goering and Van Soest (1970) [6]. The feed resources were also analysed for calcium, sodium and potassium as per AOAC (2019) [1] using Flame photometer and for phosphorus using UV-Vis Spectrophotometer. Statistical analysis of data was done using one way ANOVA (Snedecor and Cochran, 2007) [11] and suitable superscripts were attributed to mean values for statistical significance.

Results and Discussion

The proximate composition and acid insoluble ash content of feed ingredients and dry roughages collected from native tract of Nattukuttai cattle is presented in Table 1. Among the oil cake variety, groundnut oil cake contains highest crude protein content (42.66%), sesame oil cake exhibited highest ether extract (12.33%) content, and coconut oil cake showed highest NFE content. The CP content of groundnut oil cake was comparable to the values reported by Davier and Ezenwa (2010) [5]. The NFE content was significantly highest in wheat bran (nice) variety. Among the cereal by-products, wheat bran (rough) variety contain highest crude protein (17.07%) and crude fibre (19.09%) content and the rice bran had significantly ($p<0.05$) higher acid insoluble ash.

Among the gram screenings, black gram chunni contain highest crude protein (16.4%) and bengal gram chunni contain highest crude fibre (46.55%) content. The NFE content was significantly highest in green gram and black gram chunnies and lower in bengal gram chunni. The CP content recorded in black gram chunni was consistent with the value reported by Arivumani *et al.* (2024) [2] and slightly

higher than that reported by Rajeshkumar Pal *et al.* (2017) [9]. The proximate composition of cereal by-products (wheat bran and rice bran) and gram screenings (red gram, black gram, green gram, and bengal gram) showed considerable variations. These differences in chemical composition of gram screenings might be attributed to variations in grain and pulse milling processes and as well as the proportion of pulses present in the screenings (Patel, 1961) [8].

Among the dry roughages evaluated, ground nut haulms recorded the significantly highest ($p<0.05$) crude protein (14.03%). The crude fibre content was significantly highest in paddy straw (33.67%) and lowest in groundnut haulms. The NFE content was significantly higher ($p<0.05$) in ground nut haulms and black gram straw. Paddy stubbles contained the highest total ash content; however, they also contained a higher acid insoluble ash content (12.88%) which limits its utilization. Paddy straw, the predominant dry roughage fed to Nattukuttai cattle in their breeding tract, exhibited CP and CF content similar to that reported by Singh *et al.* (2022) [10].

The fibre fractions of feed ingredients and dry roughages collected from the native tract of Nattukuttai cattle is presented in Table 2. Among the feed ingredients, black gram chunni recorded the highest NDF, ADF and cellulose contents. Hemicellulose content was highest in rice bran (22.58%) while black gram chunni contained the highest lignin content (9.94%).

Regarding feed ingredients, the NDF, ADF, cellulose and hemicellulose content of groundnut oil cake recorded in this study were lower than the values reported by Malik *et al.* (2017) [7]. The black gram chunni exhibited the highest NDF, ADF and cellulose content, similar to the values reported by Arulnathan *et al.* (2013) [3]. The highest cellulose content was found in rice bran. The NDF and ADF values of paddy straw observed in this study align with those reported by Singh *et al.* (2022) [10].

The major mineral composition of feed ingredients collected from native tract of Nattukuttai cattle is presented in Table 3. Among the feed ingredients gram screenings had highest calcium and wheat bran had highest phosphorus (1.20%). Furthermore, the potassium content was higher in oil cake and bran variety compared to gram screenings. These findings are consistent with those reported by Arivumani *et al.* (2024) [2].

Table 1: Proximate composition and acid insoluble ash content (% DMB) of feed ingredients and dry roughages collected from native tract of Nattukuttai cattle (Mean $\pm$ SE)

S. No	Feed Ingredients	Proximate composition (% DMB)					
		Crude Protein	Ether Extract	Crude Fibre	Total Ash	NFE	AIA
	Oil cakes						
1	Groundnut oil cake	42.66 $\pm$ 0.32	8.03 $\pm$ 0.07	4.22 $\pm$ 0.11	4.82 $\pm$ 0.08	40.27 $\pm$ 0.27	0.65 $\pm$ 0.08
2	Sesame oil cake	35.55 $\pm$ 0.23	12.33 $\pm$ 0.27	7.60 $\pm$ 0.18	7.02 $\pm$ 0.12	37.48 $\pm$ 0.25	0.38 $\pm$ 0.05
3	Coconut oil cake	22.79 $\pm$ 0.33	10.63 $\pm$ 0.26	6.94 $\pm$ 0.14	5.52 $\pm$ 0.19	54.10 $\pm$ 0.41	0.84 $\pm$ 0.15
	Cereal by-products						
1	Rice bran	14.21 $\pm$ 0.30	5.99 $\pm$ 0.41	14.33 $\pm$ 0.38	9.61 $\pm$ 0.35	55.84 $\pm$ 0.53	5.06 $\pm$ 0.67
2	Wheat bran (Rough)	17.07 $\pm$ 0.19	4.60 $\pm$ 0.14	19.09 $\pm$ 0.13	5.53 $\pm$ 0.13	53.69 $\pm$ 0.24	3.75 $\pm$ 0.21
3	Wheat bran (Nice)	16.30 $\pm$ 0.14	3.65 $\pm$ 0.07	16.78 $\pm$ 0.26	4.20 $\pm$ 0.17	59.05 $\pm$ 0.16	3.52 $\pm$ 0.16
	Gram screenings (chunnies)						
1	Red gram	11.36 $\pm$ 0.26	1.53 $\pm$ 0.10	30.13 $\pm$ 0.44	3.17 $\pm$ 0.31	53.79 $\pm$ 0.72	0.24 $\pm$ 0.01
2	Black gram	16.4 $\pm$ 0.35	1.75 $\pm$ 0.11	21.46 $\pm$ 0.22	4.10 $\pm$ 0.28	56.26 $\pm$ 0.43	0.75 $\pm$ 0.08
3	Green gram	13.06 $\pm$ 0.26	1.67 $\pm$ 0.13	24.60 $\pm$ 0.63	3.31 $\pm$ 0.26	57.34 $\pm$ 0.62	0.69 $\pm$ 0.11
4	Bengal gram	15.63 $\pm$ 0.32	0.80 $\pm$ 0.40	46.55 $\pm$ 0.55	3.67 $\pm$ 0.09	33.34 $\pm$ 0.63	0.41 $\pm$ 0.06
	Dry roughages						
1	Paddy straw	4.04 $\pm$ 0.16	1.31 $\pm$ 0.11	33.67 $\pm$ 0.35	10.79 $\pm$ 0.26	50.18 $\pm$ 0.16	6.72 $\pm$ 0.23
2	Groundnut haulms	14.03 $\pm$ 0.22	2.67 $\pm$ 0.08	21.90 $\pm$ 0.36	9.63 $\pm$ 0.18	51.74 $\pm$ 0.35	1.61 $\pm$ 0.16
3	Black gram straw	8.29 $\pm$ 0.16	1.29 $\pm$ 0.10	30.00 $\pm$ 0.41	8.18 $\pm$ 0.07	52.23 $\pm$ 0.45	2.09 $\pm$ 0.12
4	Paddy stubbles from harvested field	3.68 $\pm$ 0.16	0.83 $\pm$ 0.08	32.70 $\pm$ 0.33	16.74 $\pm$ 0.18	46.04 $\pm$ 0.19	12.88 $\pm$ 0.26

*Mean of three observations

Means bearing different alphabets as superscripts in the same column differ significantly ($p<0.05$)

Table 2: Fibre fractions (% DMB) of feed ingredients and dry roughages collected from native tract of Nattukuttai cattle (Mean*±SE)

S. No	Botanical name	Fibre fractions (% DMB)				
		NDF	ADF	Hemi cellulose	Cellulose	Lignin
	Feed Ingredients					
1	Groundnut oil cake	23.46 ^a ±1.01	13.42 ^a ±0.43	10.03 ^a ±0.57	12.55 ^a ±0.32	6.56 ^b ±0.33
2	Rice bran	43.86 ^b ±0.76	21.28 ^b ±0.53	22.58 ^d ±1.10	14.24 ^b ±0.37	5.44 ^{ab} ±0.66
3	Wheat bran	45.93 ^b ±1.42	26.86 ^c ±0.81	19.07 ^c ±1.06	13.77 ^{ab} ±0.64	4.31 ^a ±0.28
4	Red Gram Chunni	44.45 ^b ±1.01	28.71 ^c ±0.37	15.73 ^b ±0.76	16.30 ^c ±0.51	6.31 ^b ±0.17
5	Black gram Chunni	46.18 ^b ±0.47	35.59 ^d ±0.77	10.59 ^a ±0.29	26.80 ^d ±0.34	9.94 ^c ±0.31
	Dry roughages					
1	Paddy straw	75.68 ^b ±0.22	47.24 ^b ±0.36	28.44 ^b ±0.75	35.23 ^b ±0.29	6.97±0.15
2	Groundnut haulms	44.72 ^a ±0.91	30.48 ^a ±0.67	14.24 ^a ±0.83	20.65 ^a ±0.13	6.91±0.57

*Mean of three observations

Means bearing different alphabets as superscripts in the same column differ significantly ($p < 0.05$)**Table 3:** Mineral composition (% DMB) of feed ingredients collected from native tract of Nattukuttai cattle (Mean*±SE)

S. No	Herbage/Feed type	Mineral composition (% DMB)			
		Ca	P	Na	K
1	Groundnut oil cake	0.13 ^a ±0.01	0.56 ^b ±0.03	0.03 ^a ±0.05	1.45 ^b ±0.15
2	Rice bran	0.09 ^a ±0.01	0.93 ^c ±0.03	0.05 ^a ±0.01	1.61 ^b ±0.20
3	Wheat bran	0.13 ^a ±0.02	1.20 ^d ±0.05	0.09 ^b ±0.02	1.17 ^{ab} ±0.15
4	Red gram chunni	0.53 ^b ±0.05	0.40 ^a ±0.02	0.03 ^a ±0.03	0.68 ^a ±0.48
5	Black gram chunni	0.54 ^b ±0.02	0.31 ^a ±0.01	0.02 ^a ±0.02	0.89 ^a ±0.08

*Mean of three observations

Means bearing different alphabets as superscripts in the same column differ significantly ($p < 0.05$)

Conclusion

The study concluded that among the dry roughages groundnut haulms had a high nutritive value compared to other dry roughages. Among the feed ingredients, groundnut oil cake had high nutritive value followed by sesame oil cake and coconut oil cake. Black gram chunnies had a high nutritive value followed by bengal gram, green gram and red gram chunnies. Evaluation of nutritive value of various feedstuffs helps in the formulation of balanced rations for animals ensuring efficient utilization of feed resources for improved animal productivity.

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Conflict of Interest

The authors declare that there is no conflicts of interest.

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