RESEARCH ARTICLE Asian Journal of Dairy and Food Research, Volume 43 Issue 1: 85-89 (March 2024)

Evaluation of Urea Treated *Acacia nilotica* Pods as a Feed for Grower Lambs

M. Chellapandian[1], N. Arulnathan[1], D. Thirumeignanam[1]

10.18805/ajdfr.DR-1692

ABSTRACT

Background: Acacia pods are non-conventional protein rich feed resources that could be harnessed as a feed ingredient in sheep production. Though many workers have observed the utility of raw *Acacia nilotica* pods as a noteworthy feed for small ruminants, the information on nutritive value of urea treated pods is lacking. Hence the present study was undertaken to evaluate the nutritional potential of urea treated *Acacia nilotica* pods at different dietary levels for supporting growth and nutrient utilisation in lambs.

Methods: *Acacia nilotica* pods were collected, sun dried and ground in a hammer mill. The ground pods and seeds were treated in bulk with urea. Then the urea treated pods (UTP) was incorporated in three experimental concentrate mixtures @ 0, 15 or 30 per cent (R1, R2, R3) replacing deoiled rice bran. The concentrate mixtures were made isoproteinic and isocaloric. Napier Bajra hybrid grass ($CNCO_4$) was provided as the basal roughage component in the rations. The ingredient and proximate composition of concentrate mixtures. Fifteen ram lambs of native Kilakarsal breed of about six months of age and with an average initial body weight of 9.39 kg were divided on the basis of body weight into three groups with five lambs per dietary group in a completely randomized design. Daily record of feed consumption was maintained. The lambs were weighed at fortnightly intervals. At the end of the feeding experiment, digestion trial was conducted using the same ram lambs. The samples were analysed for proximate composition and the digestibility of nutrients in the three experimental rations were determined.

Result: Based on the data analyzed the DMI worked out to be 64.90, 65.84 and 65.43 g/kg $W^{0.75}$ in lambs fed with rations containing 0, 15 and 30% UTP in the concentrate mixture respectively. The corresponding values for ADG in the present study were 48.14, 47.43 and 48.57 g. The feed efficiency in terms of DMI required to gain one kg body weight were 8.28, 8.58 and 8.35 kg which did not vary between the treatment groups. DCP of experimental rations increased significantly ($P \leq 0.05$) as the level of UTP in the concentrate mixture increased which could be attributed to the increased crude protein digestibility. The TDN decreased significantly ($P \leq 0.05$) at 15% and level and was unaffected thereafter. Hence, it was concluded that *Acacia nilotica* pods treated with 5% urea at 40% moisture and stored for 14 days could safely be included up to 30 per cent level in the concentrate mixture of growing lamb ration.

Key words: Concentrate mixture, Growth, Lambs, Ration digestibility, Urea treated *acacia nilotica* pods.

INTRODUCTION

Sheep rearing forms the major source of livelihood providing both employment and income to landless, resourceless rural masses in many regions of India. The impact of reducing the feed cost and increasing the feed efficiency is likely to be enormous in economic sheep production. Feeding non conventional feeds as supplements is an important means of achieving reduction in overall feed costs. Tree pods are one such non conventional protein rich feed resources that could be harnessed as a feed ingredient in sheep production. In many areas in India, farmers collect the fruits of *Acacia* sp. and feed their sheep or the grazing sheep are taken directly to the trees and fed with naturally fallen or knocked down fruits. Topps and Oliver (1978) had suggested that the pods of *Acacia* sp. could very well serve as potential source of protein for diets based on poor quality cereal crop residues. Punj (1988) assessed that about 60,000 tonnes of *Acacia nilotica* pods are annually available in India. Milled *Acacia nilotica* pods with seeds could provide supplement similar to maize bran (Gohl, 1981) and adult sheep could be maintained by feeding these pods (Prabhakara Rao and Anjaneya Prasad, 1978). Babul (*Acacia nilotica*) pods could be safely included up to 16.5% in the total mixed ration (TMR) of pregnant goats (Raju Kushwaha *et al.,* 2012) and lactating goats (Raju Kushwaha and Rai, 2011) without affecting their performance. As the protein content in the fruits of *Acacia nilotica* is high, its palatability is also high and they may be suitable protein supplements for dry season diets; however presence of high amount of tannins tends to reduce the feeding value (Mohamed Abdalla *et al*., 2014). Addition of 4% urea at high moisture (55%) and storage for 10 days

[1]Department of Animal Nutrition, Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Tirunelveli-627 358, Tamil Nadu, India.

Corresponding Author: M. Chellapandian, Department of Animal Nutrition, Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Tirunelveli-627 358, Tamil Nadu, India. Email: mcpandian69@gmail.com

How to cite this article: Chellapandian, M., Arulnathan, N. and Thirumeignanam, D. (2024). Evaluation of Urea Treated *Acacia nilotica* Pods as a Feed for Grower Lambs. Asian Journal of Dairy and Food Research. 43(1): 85-89. doi: 10.18805/ajdfr.DR-1692.

Submitted: 19-04-2021 **Accepted:** 11-05-2022 **Online:** 28-05-2022

resulted in considerable detannification (Total phenols 88%, Condensed tannins 100%) of mature oak leaves. This approach could become a practical method for detannification at farm level with the added advantage of increased nitrogen content (Makkar and Singh, 1993). Moreover, urea could provide nitrogen through ammonia that could be converted to microbial protein thereby providing additional protein to the host animal (Castro *et al.,* 1999). Adopting this principle, the total tannins were chemically reduced to a great extent and protein content was considerably enhanced in *Acacia nilotica* pods up on treatment with 5% urea and storage for 14 days at 40% moisture level (Chellapandian and Balachandran, 2004). Though many workers have observed the utility of raw *Acacia nilotica* pods as a noteworthy feed for small ruminants, the information on nutritive value of urea treated pods is lacking. Hence the present study was undertaken to evaluate the nutritional potential of urea treated *Acacia nilotica* pods at different dietary levels for supporting growth and nutrient utilisation in lambs.

MATERIALS AND METHODS

The feeding experiment in sheep with inclusion of *Acacia nilotica* pods in concentrate mixture was undertaken in an organized farm in Tirunelveli district of Tamil Nadu during the year 2019. The laboratory analytical works related to this experiment was done at the Department of Animal Nutrition, Veterinary College and Research Institute, Tirunelveli. *Acacia nilotica* pods were collected, sun dried and ground in a hammer mill to pass through medium mesh screen (2 mm) and preserved. The ground pods and seeds were treated in bulk with urea. To every 100 kg of the ground feed, 5 kg urea was added in a solution of 51 litres of water to achieve a moisture level of 40 per cent. The urea solution was sprayed, the feed was thoroughly mixed and stored for 14 days in tightly secured polythene bags. After 14 days of storage, the bags were opened and the treated feed was shade dried for about one hour. Then the urea treated pods (UTP) was incorporated in three experimental concentrate mixtures @ 0, 15 or 30 per cent (R1, R2, R3) replacing deoiled rice bran. The concentrate mixtures were made isoproteinic and isocaloric by adjusting the level of inclusion of other feed ingredients. The cost of the three concentrate mixtures-R1, R2 and R3 was Rs.19.25, Rs. 18.00 and Rs.17.20 respectively. Napier Bajra hybrid grass ($CNCO_4$) harvested at about 75 to 80 days of growth and chopped in a chaff cutter into pieces (2-3 cm length) was provided as the basal roughage component in the rations. The ingredient composition of the experimental concentrate mixtures with different level of urea treated pods (UTP) are given in Table 1. The experimental concentrate mixtures and $CNCO_4$ grass were analyesd for proximate composition (AOAC, 2012).

Fifteen ram lambs of native Kilakarsal breed of about six months of age and with an average initial body weight of 9.39±0.28 kg were used in this experiment. The lambs were divided on the basis of body weight into three groups with five lambs per dietary group in a completely randomized design. Prior to the experiment, the lambs were drenched with a broad spectrum anthelmintic. The lambs were housed in individual pens and fed with the experimental rations for a period of 70 days. All the lambs were provided with clean drinking water throughout the day during the entire trial period. Daily record of feed consumption was maintained. The lambs were weighed at fortnightly intervals. At the end of the feeding experiment, digestion trial was conducted using the same ram lambs. A preliminary period of 15 days followed by a collection period of 7 days was adopted. Twenty per cent of the dung voided was sampled and stored at -20°C. The samples were analysed for proximate composition (AOAC, 2012) and the digestibility of nutrients in the three experimental rations were determined. The data collected in the study were analysed as per methods suggested by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The proximate composition of the experimental concentrate rations and $CNCO_4$ grass are presented in Table 2 on % DMB. Since formulated as isoproteinic and isocaloric rations, there was no significant difference in the proximate composition of the experimental concentrate mixtures. CP, CF, EE, NFE and TA contents of $CNCO_4$ grass were 10.21, 30.48, 2.14, 40.97 and 16.20 respectively which correlated well with the earlier report of Chellapandian and Arulnathan (2016).

The average dry matter intake (DMI), average daily gain (ADG) and feed efficiency of the lambs fed with experimental rations are presented in Table 3. The DMI worked out to be 64.90, 65.84 and 65.43 g/kg $W^{0.75}$ in lambs fed with rations containing 0, 15 and 30% UTP in the concentrate mixture respectively. The observed dry matter intake (3.55-3.58% body weight) was within the range suggested as DMI for growth by Kearl (1982) for ruminants in tropical countries (1.1%-4.1% body weight). Similar high DMI in sheep had been previously reported by Reddy and Reddy (1989) and Kantwa *et al.* (2006) for complete ration containing groundnut hulls and fresh green Mulberry leaves respectively. The corresponding values for ADG in the present study were 48.14, 47.43 and 48.57 g. The DMI and ADG were not altered significantly by the inclusion of urea

Table 1: Ingredient composition (% DMB) of the experimental rations with different inclusion levels of urea treated Acacia pods (UTP).

Details	R1	R2	R3
Maize	35	40	43
Groundnut oilcake	17	15	15
Deoiled rice bran	30	15	0
UTP	0	15	30
Tapioca thippi	15	12	9
Mineral mixture	2	2	2
Salt	1	1	1
Total	100	100	100

Table 2: Per cent proximate composition of experimental concentrate mixture with different levels of urea treated acacia pods and $CNCO_4$ grass (% DMB).

Details	R1	R2	R3	$CNCO_4$ grass
Crude protein	15.28±0.86	15.39±1.17	16.02±1.04	10.21±0.54
Crude fibre	9.75±1.21	10.18±1.26	10.35±1.05	30.48±1.62
Ether extract	4.13±0.23	3.88±0.28	3.68±0.17	2.14±0.61
Nitrogen free extract	64.43±2.11	64.46±2.32	64.11±1.74	40.97±1.47
Total ash	6.41±0.66	6.09±0.83	5.84±0.39	16.20±1.33

Table 3: Dry matter intake, daily gain, feed efficiency and feed cost in lambs fed different levels of urea treated pods (UTP) in concentrate mixture and $CNCO_4$ grass.

Criteria	R1	R2	R3
DMI from concentrate mixture (g/day)	177.0±3.12	176.75±1.26	178.0±2.45
DMI from roughage (g/day)	221.48±5.70	230.19±5.87	227.68±4.94
Total DMI (g/day)	398.48±3.60	406.94±6.72	405.68±5.17
DMI/100 kg BW (%)	3.55±0.32	3.58±0.59	3.56±0.45
DMI/$kg^{0.75}$(g)	64.90±0.59	65.84±1.09	65.43±0.84
Average daily gain (g)	48.14±1.28	47.43±1.62	48.57±1.84
Feed efficiency (kg DM/kg gain)	8.28±0.21	8.58±0.18	8.35±0.14
Feed cost per kg live weight gain (Rs.)	$114.67±1.25^b$	$109.38±1.43^b$	$101.65±1.30^a$

Mean values in the same row with different superscripts (a, b) differ significantly (P<0.05).

Table 4: Nutrient digestibility in lambs fed different levels of urea treated pods (UTP) in concentrate mixture (digestibility coefficients of nutrients and the nutritive value (DCP, TDN) of the three experimental rations).

Details	R1	R2	R3
Dry matter	57.45±1.76	53.49±1.12	53.37±0.71
Organic matter	$61.99±2.24^b$	$57.42±0.88^a$	$57.24±0.75^a$
Crude protein	46.31±2.04	48.31±1.36	52.10±0.86
Crude fibre	$44.46±0.62^b$	$35.87±1.3^a$	$33.77±0.48^a$
Ether extract	80.94±1.26	77.09±0.54	77.43±1.16
NFE	$73.30±0.86^b$	$68.98±0.70^a$	$65.73±0.53^a$
DCP (%)	$6.87±0.28^a$	$7.34±0.16^{a\ b}$	$7.94±0.14^b$
TDN (%)	$60.23±0.95^b$	$56.11±0.40^a$	$54.49±0.44^a$

Mean values in the same row with different superscripts (a, b) differ significantly (P<0.05).

treated pods in the concentrate mixture. The feed efficiency in terms of DMI required to gain one kg body weight were 8.28, 8.58 and 8.35 kg which did not vary between the treatment groups. The protein to energy ratio in the experimental rations consumed by the animals in different treatment groups was almost similar (1:32, 1:28, 1:25) which had resulted in similar performance in terms of body weight gain and feed efficiency. The feed cost per kilogram live weight gain was Rs.114.67, Rs.109.38 and Rs.101.65 in lambs fed with rations containing 0, 15 and 30% UTP in the concentrate mixture respectively. Feed cost was observed to decrease with increase in level of UTP in the ration and was significantly (P≤0.05) low at 30% inclusion level.

The digestibility coefficients of nutrients and the nutritive value (DCP, TDN) of the three experimental rations are given in Table 4. Dry matter digestibility decreased with inclusion of UTP in rations, though with non-significant difference between groups. The dry matter digestibility was lowest in the ration with 30% UTP. Similar decrease in DM digestibility was observed by Makkar and Singh (1993) in urea treated oak leaves stored more than five days. Inclusion of UTP stored for a longer period (14 days) could be the reason for the observed low DM digestibility of the experimental rations. The organic matter digestibility decreased with increased level of inclusion, the reduction being significant (P≤0.05) only up to 15% level. The crude protein digestibility increased from 46.31 to 48.31 and 52.10% as the level of inclusion of UTP increased from 0 to 15 and to 30%. However, the dry matter digestibility and crude protein digestibility did not differ significantly between the groups. Similarly increase in crude protein digestibility was also observed by Puga *et al.* (2001) in sheep supplemented with controlled release urea which was attributed to the availability of additional non protein nitrogen to ruminal bacteria for microbial protein synthesis. This could also be due to the effect of tannins in the pods that caused increase in the amount of ruminal by-pass protein available for post ruminal digestion (Atiba *et al.,* 2021). The crude fibre digestibility which was 44.46% at 0% inclusion decreased significantly (P≤0.05) to 35.87% at 15% inclusion and remained similar at 30% inclusion (33.77%). Similar low digestibility trend was observed in NFE also. Low crude fibre digestibility (48.7%) was also reported by Paswan *et al.* (2017) for concentrate mixture with 30% untreated *Acacia nilotica* pod meal fed to goats. Abdullah *et al.* (2018) has noted that there was a general tendency of decreasing digestibility of crude fibre with increasing level of *A. nilotica* pods in the concentrate mixture of sheep ration and attributed it to the activities of tannin content of the ration. Berhe Weldegebriel and Yadav (2017) had also reported significantly (P<0.01) lower NDF and ADF digestibility in rams fed rations supplemented with high level of *Acacia seyal* pods replacing wheat bran and attributed it to the fact

that Acacia species possess a variety of physical and chemical compounds causing reduction in the palatability and nutritive value. However, the poor digestibility of DM, fibre and NFE in this study might also be attributed to the presence of high level of structural carbohydrates in the pods compared to the deoiled rice bran which was replaced by the pods in the experimental rations. The untreated *Acacia nilotica* pods as analysed by Chellapandian and Murugan (2003) was found to contain high level of structural carbohydrates - 10.29% lignin, 14.43% cellulose and only 12.12% hemicellulose in their cell wall. DCP of experimental rations increased significantly ($P \leq 0.05$) as the level of UTP in the concentrate mixture increased which could be attributed to the increased crude protein digestibility. The TDN decreased significantly ($P \leq 0.05$) at 15% level and remained unaffected thereafter. Reduced digestibility of crude fibre and NFE resulted in decrease of the TDN content. The narrowing down of the nutritive ratio with increased level of UTP could be attributed to higher levels of DCP.

CONCLUSION

From the results of body weight gain, feed efficiency and nutritive value, it was inferred that *Acacia nilotica* pods treated with 5% urea at 40% moisture and stored for 14 days could safely be included up to 30 per cent level in the concentrate mixture of growing lamb ration replacing deoiled rice bran without any adverse effect on their growth performance. Inclusion of urea treated pods in lamb rations proved to be beneficial in terms of considerable reduction in feed cost.

ACKNOWLEDGEMENT

The authors are thankful to the Dean, Veterinary College and Research Institute, Tirunelveli, Tamil Nadu for providing the necessary facilities.

Conflict of interest

All authors declared that there is no conflict of interest.

REFERENCES

Abdullah, A.A.M., Farghaly, M.M. and Youssef, I.M.I. (2018). Effect of feeding *Acacia nilotica* pods to sheep on nutrient digestibility, nitrogen balance, ruminal protozoa and rumen enzymes activity. Journal of Animal Physiology and Animal Nutrition. 102: 662-669.

AOAC (2012). Official Methods of Analysis, Association of Official Analytical Chemists, 9th ed. Arlington, Virginia, USA.

Atiba, E.M., Laban, R.K., Sun, Z., Qingzhang, Z. and Aschalew, N.D. (2021). Implications of tannin containing plants for productivity and Health in small ruminant animals: A review. Agricultural Reviews. 42(2): 156-165. doi: 10.18805/ag.R-173.

Berhe Weldegebriel and Yadav, K.R. (2017) Effect of Replacing Wheat Bran with *Acacia seyal* Pods on the Performance of Tigray Highland Sheep. Indian Journal of Animal Nutrition 34(3): 264-269.

Castro, F.B., Selmer-Olsen, I., Orskoc, E.R., Johnsen, F. (1999). Lignin as a Carrier for Feed Grade Controlled-release Urea. V. In: Proceddings of the International Symposium of the Nutrition of Herbivores. 11-16 April. San Antonio TX, USA, 836 pp.

Chellapandian, M. and Arulnathan, N. (2016). Nutritional evaluation of cumbu napier hybrid grass hay based complete ration for goats. Indian Journal of Veterinary Sciences and Biotechnology. 11(4): 10-12.

Chellapandian, M. and Balachandran, S. (2004). Effect of urea treatment on tannins of tree pods. Indian Veterinary Journal. 81: 787-789.

Chellapandian, M. and Murugan, M. (2003). Chemical composition and nutritive value of *Acacia nilotica* pods for sheep. Indian Journal of Small Ruminants. 9(2): 130-132.

Gohl, B. (1981). Tropical Feeds. Feeds Information. Summaries and Nutritive Values: FAD, Rome, Italy, 529.

Kantwa, S.C., Lokesh Gupta, Singh, B.P. and Tailor, S.P. (2006). Nutritional evaluation of Mulberry (*Morus alba* L.) green leaves in sheep and goats. The Indian Journal of Small Ruminants. 12(2): 202-205.

Kearl, L.C. (1982). Nutrient Requirements of Ruminants in Developing Countries. International Feed Stuffs Institute. Utah Agriculture Experimental Station. Utah State University, Logon, Utah, USA.

Makkar, H.P.S. and Singh, B. (1993). Effect of storage and urea addition on detannification and in sacco dry matter digestibility of mature oak (*Quercus incana*) leaves. Animal Feed Science and Technology. 41: 247-259.

Mohamed S. Abdalla, Izeldin A. Babiker, Jehan S. Al-Abrahim, Afra E. Mohammed, Mudawi M. Elobeid and Kamal F. Elkhalifa (2014). Fodder potential and chemical composition of *Acacia nilotica* fruits for livestock in the dry lands of Sudan. International Journal of Plant, Animal and Environmental Sciences. 4(1): 366-369.

Paswan, J.K., Kaushalendra Kumar, Sanjay Kumar, Chandramoni, Singh, P.K., Abhishek Kumar, Shahla Perween and Amitava Dey (2017). Effect of feeding tanniferous *Acacia nilotica* pod meal on growth performance and nutrient utilization of Black Bengal kids. Animal Nutrition and Feed Technology 17: 333-341.

Prabhakara Rao, Z. and Anjaneya Prasad, D. (1978). Chemical composition and nutritive value of sundra (*Acacia sundra*) pods. Journal of Research, APAU. 1: 4-23.

Puga, D.C., Galina, H.M., Perez-Gil, R.F., Sangines, G.L., Aguilera, B.A., Haenlein, G.F.W., Barajas, C.R. and Herrera, H.J.G. (2001) Effect of controlled-release urea supplementation on feed intake, digestibility, nitrogen balance and ruminal kinetics of sheep fed low quality tropical forage. Small Ruminant Research. 41: 9-18.

Punj, M.L. (1988). Availability and utilization of non conventional feed resources and their utilization by ruminants in south Asia. Non Conventional Feed Resources and Fibrous Agricultural Residues. 50-61.

Raju Kushwaha and Rai, S.N. (2011). Effect of feeding *Acacia nilotica* pods on feed intake, nutrient utilization and balances of N, Ca and P in lactating goats. Indian Journal of Animal Nutrition. 28(3): 309-315.

Raju Kushwaha, Rai, S.N. and Singh, A.K. (2012). Influence of feeding *Acacia nilotica* pods on intake, nutrient utilization and immune status in pregnant goats. Indian Journal of Animal Research. 46(1): 8-14.

Reddy, G.V.N. and Reddy, M.R. (1989). Annual Report of AICRP on by Products Utilization, Hyderabad Centre, India.

Snedecor, G.W. and Cochran, W.G. (1994). Statistical Methods; 8th Ed. The Iowa State University Press, Iowa, USA.

Topps, J.H. and Oliver, J. (1978). Animal Foods in Central Africa. Rhodesian Agriculture Journal, Technical Handbook No. 2: 66-67.