Indian Journal of Animal Sciences 69 (12): 1074-1076, December 1999

Performance of buffalo bull calves fed alkali treated or urea ammoniated neem (*Azadirachta indica*) seed kernel-cake as protein supplement

V R B SASTRY[1], R C KATIYAR[2] and D K AGRAWAL[3]

Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh 243 122

Received: 16 June 1998; Accepted: 16 July 1999

Key words: Alkali treatment, Neem kernel-cake, Urea ammoniation

Neem or margosa (*Azadirachta indica*), a large ever green fast growing perennial tree, is native to India and inhabitant of South East Asian countries. Even under unorganized seed collection, neem seed kernel-cake (NSKC), a byproduct of neem oil industry, is annually available to the tune of 0.7 million tonnes (Ketakar 1976). Despite high CP content (34 – 40%), its use as livestock feed is discouraged due to the presence of bitter and toxic triterpenoids (azadirachtin, salanin, nimbin, nimbidin, nimbidiol, etc.). Out of various methods tried to detoxify the cake, water washing (Nath *et al.* 1983) was proved to be effective, but for 22% DM loss. To avoid such loss, efforts were therefore made to evolve an economically viable and easily adaptable processing of NSKC through alkali treatment and urea ammoniation and to see the feasibility of feeding them to buffalo calves as a sole source of protein.

The alkali treated (ATNSKC) and urea ammoniated (UANSKC) neem seed kernel-cakes were prepared by soaking the cake in water (1: 1.5, w/v) containing either NaOH (2.5%, w/w) or fertilizer grade urea (3.5%, w/w) for 24 hr and 5days, respectively. They were then sun-dried and ground before being incorporated into the concentrate mixture (T2 and T3) to completely replace the deoiled groundnut-cake (DGNC) moiety of control (T1) containing maize, DGNC, wheat bran, mineral mixture and salt in the ratio of 30: 40: 27: 2: 1 respectively. These 3 concentrate mixtures were fed individually to 9 buffalo (*Bubalus bubalis*) bull calves (13-15 month, 203-255kg), divided at random into 3 groups, to meet daily CP requirements as per fortnightly body weight changes for maintenance and 500g daily gain (Kearl 1982) alongwith *ad lib.* wheat straw and 2 kg available green fodder for 270 days. At the end, a metabolism trial of 7 days duration was conducted and blood was analysed for haemoglobin (Benjamin 1985), transaminases (ALT and AST) (Wootton 1964), alkaline phosphatase (Bergmeyer 1974) and urea (Rahamtulla and Boyde 1980). The feed, faeces and urine were analysed for proximate principles (AOAC 1980) and Ca and P (Talapatra *et al.* 1940). The data were subjected to statistical analysis (Snedecor and Cochran 1967).

Table 1. Chemical composition of feeds and fodder (*per cent in DM*)

Constituent	Wheat straw	Concentrate mixture			Treated NSKC	
		T1	T2	T3	Alkali (2.5% NaOH)	Urea (3.5%)
Organic matter	90.2	88.8	84.0	87.1	80.1	84.9
Crude protein	3.5	21.6	21.1	23.8	33.8	40.9
Ether extract	0.5	3.1	4.5	4.4	5.4	4.4
Crude fibre	41.1	8.9	14.6	14.8	13.8	11.4
N-free extract	45.1	55.2	43.8	44.1	27.1	28.2
Total carbohydrate	86.2	64.1	58.4	58.9	40.9	39.6
Total ash	9.8	11.2	16.0	12.9	19.9	15.1
Calcium	0.2	2.7	1.9	2.0	0.8	0.9
Phosphorus	0.4	1.1	0.9	1.0	0.6	0.9

The CP content of ATNSKC was relatively lower as compared to the comparable values of DGNC and UANSKC and the respective cakes contributed 64, 64 and 69% protein in T1, T2 and T3 concentrate mixtures.

The test rations were found equally palatable to the DGNC containing one as evidenced by similar DMI (Table 2) per unit metabolic body size (kg $W^{0.75}$). The calves on all the 3 rations digested the nutrients to the similar extent, despite lower concentrate moiety in T2, except for higher ($P<0.05$) NFE digestibility in calves on DGNC incorporated ration because of increased intake, as the intake and digestibility of NFE are positively correlated (Hamilton 1942). Alkali treatment or urea ammoniation of NSKC therefore removed the depressing effect on nutrient digestibility in contrast to the observations on crossbred and buffalo calves fed raw neem seed-cake (Bedi *et al.* 1975 a, b). Moreover, the anti-urease activity usually seen with water extract of NSKC (Agarwal *et al.* 1991) seems to be nullified through alkali and urea processing as evidenced by similar CP digestibility in calves on all the diets. Incorporation of ATNSKC and UANSKC

Present address: [1]Senior Scientist, [2]Former Senior Scientist, [3]Principle Scientist, Division of Animal Nutrition.

Table 2. Growth rate, feed intake, nutrient utilization and plane of nutrition

Particulars	Treatments		
	T1	T2	T3
Initial B. wt (kg)	235.5±29.5	203.0±30.3	221.3±25.7
Av. daily gain (g)	357.4±35.2	375.9±33.5	371.3±54.0
DM intake/kg $W^{0.75}$ (g)	84.2±7.5	84.3±2.4	84.4±5.4
Concentrate: roughage	51:49	46:54	54:46
Nutrient digestibility (%)			
Dry matter	55.1±3.2	52.5±1.2	52.9±1.7
Organic matter	57.6±3.6	54.6±1.2	56.2±2.0
Crude protein	63.9±4.0	61.9±0.7	63.7±0.7
Ether extract	60.7±8.2	64.9±2.1	66.5±3.1
Crude fibre	45.0±4.3	49.9±2.2	52.9±3.4
N-free extract *	61.6±2.7[b]	54.1±1.3[a]	55.0±1.4[a]
Total carbohydrate	56.0±3.5	52.5±1.6	54.1± 2.2
Nutrient balance			
N-retention (g/day)	34.4± 6.7	36.6±2.3	31.41±2.3
Percentage N-retention from intake	28.0±6.8	30.1±3.5	24.8 ± 1.5
Ca-retention (g/day)	19.4±5.5	15.6 ± 2.0	16.8 ± 2.0
P-retention (g/day)	10.2±1.7	9.6 ± 1.1	9.9 ± 0.5
Nutritive value of rations			
DCP (%)	7.9±1.1	8.1±0.2	8.3±0.6
TDN (%)	52.6±3.6	49.4±1.0	51.2±1.9
Plane of nutrition			
CP intake (g/day)	776.8±37.7	774.7±40.4	792.3±33.0
DCP intake (g/day)	494.6± 6.6	478.9±22.6	504.4±16.4
TDN intake (kg/day)	3.3±0.2	3.0±0.2	3.2±0.2

Means bearing different superscripts in a row differ significantly; *P<0.05.

improved CF digestibility by 11 and 18% when compared to DGNC inclusion, clearly indicating that the anti-cellulase activity pronounced due to NSKC feeding (Garg *et al.* 1993) was suppressed by processing the cake in alkaline medium. The calves on all the rations were in positive N, Ca and P balance and per day retention of these nutrients did not differ due to dietary variations. The nutritive value of all the 3 composite rations was comparable and the variation in the intake of protein (CP and DCP) and energy (TDN) among calves did not differ due to dietary variations. Though, the intake of protein was sufficient to meet requirements for 500 g daily gain, the intake of TDN fell short by 25% than the stipulated requirements (Kearl 1982) because of feeding poor quality roughage (wheat straw) with a limited quantity of greens. This resulted in lower than expected, but comparable, growth rates on all the 3 diets.

The blood biochemical profile, in terms of concentration of Hb and blood urea and the activity of alkaline phosphatase and transaminases (ALT and AST), was found similar in calves fed rations containing processed NSKC and DGNC (Table 3), which corraborates with the findings of Katiyar *et al.* (1993). No discernable effect or clinical symptoms of ill health could be noticed due to feeding of processed NSKC

Table 3. Blood biochemical and enzymatic profile

Constituent	Treatments		
	T1	T2	T3
Blood haemoglobin (g%)	11.0 ± 0.5	12.1 ± 1.1	13.8 ± 0.1
Serum alkaline phosphatase activity (units/litre)	17.3 ± 1.0	17.8 ± 1.9	20.8 ± 2.8
SGPT (IU/litre)	25.1 ± 5.5	24.3 ± 3.6	29.7± 6.0
SGOT (IU/litre)	29.2 ± 1.5	30.2 ± 1.9	34.4 ± 5.1
Urea (mg/100ml)	32.8 ± 4.2	39.2 ± 3.8	35.3 ± 4.4

during entire 270 days of experimentation. The overall performance, thus, confirmed complete detoxification of NSKC by either of the processing methods.

Alkali treatment or urea ammoniation therefore converts NSKC into a wholesome substitute of DGNC for feeding growing buffalo calves and can, to some extent, mitigate the chronic shortage of oil-cakes in the developing countries.

REFERENCES

Agarwal N, Kewalramani N, Kamra D N, Agrawal D K and Nath K.1991. Effect of water extracts of neem (*Azadirachta indica*) on the activity of hydrolytic enzymes of mixed rumen bacteria from buffalo. *Journal of Food Science and Agriculture* **57**: 147-50.

AOAC. 1980. *Official Methods of Analysis*. 13th edn. Association of Official Analytical Chemists, Washington D C.

Bedi S P S, Vijjan V K and Ranjhan S K. 1975a. Effect of neem (*Azadirachta indica*) seed-cake on growth and digestibility of nutrients in crossbred calves. *Indian Journal of Animal Sciences* **45**: 618-21.

Bedi S P S, Vijjan V K and Ranjhan S K. 1975b. Utilization of neem (*Azadirachta indica*) seed-cake and its influence on nutrients digestibility in buffaloes. *Indian Journal of Dairy Science* **28**: 104-107.

Benjamin M M. 1985. *Outline of Veterinary Clinical Pathology*, 3rd edn, pp. 233-54. Kalyani Publishers, New Delhi.

Bergmeyer H U. 1974. *Methods of Enzymatic Analysis* Vol. 2. Academic Press Inc., USA.

Garg A K, Singh R and Agrawal D K. 1993. Effect of neem bitters on rumen fermentation pattern. Annual Report, Animal Nutrition Division, IVRI, Izatnagar, India.

Hamilton T S. 1942. The effect of added glucose upon the digestibility of protein and of fibre in rations for sheep. *Journal of Nutrition* **23**: 101.

Katiyar R C, Sastry V R B and Agrawal D K. 1993. Nutrient utilization from alkali detoxified neem (*Azadirachta indica*) seed kernel-cake by cattle and buffalo. *Indian Journal of Animal Nutrition* **10**: 223-26.

Kearl L C. 1982. *Nutrient Requirements of Ruminants in Developing Countries*. International Feed Stuffs Institute, Utah, USA.

Ketkar C M. 1976. *Utilization of Neem* (Azadirachta indica A Juss) *and Its Byproducts*. Final Technical Report, Khadi and Village Industries Commission, Pune, India.

Nath K, Rajagopal S and Garg A K. 1983. Water washed neem (*Azadirachta indica* A Juss) seed kernel-cake as a cattle feed.

Journal of Agriculture Science (Cambridge) **101**: 323-26.

Rahamtullah M and Boyde T R C. 1980. Improvement in the determination of urea using diacetyl monoxime methods with or without deproteinization. *Clinical Chemica Acta* 107: 3-9.

Snedecor G W and Cochran W G. 1967. *Statistical Methods.* 6th edn. Oxford and IBH Pub. Co., New Delhi.

Talapatra S K, Roy S C and Sen K C. 1940. Estimation of phosphorus, chlorine, calcium, magnesium, sodium and potassium in food stuffs. *Indian Journal of Veterinary Science and Animal Husbandry* **10**: 243-58.

Wootton I D P. 1964. *Microanalysis in Medical Biochemistry* 4th edn. J and A Churchill Ltd, 104 Gloncester Place, London, W.I.