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Effect of feeding water washed neem (*Azadirachta indica*) seed cake and salt sprinkled neem (*Azadirachta indica*) leaves on blood parameters, feed conversion efficiency and economics of feeding in Osmanabadi kids

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ABSTRACT : Twenty four Osmanabadi weaned male kids with average live weight of 10.80 kg (5-6 months old) were divided into four equal groups in a Randomized Block Design and fed with water washed neem (*Azadirachta indica*) seed cake (WWNSC) and salt (2%) sprinkled neem (*Azadirachta indica*) leaves for 182 days to study the effect on blood parameters, feed conversion efficiency and economics of feeding. The kids (T_0) were fed with control diet without WWNSC and salt sprinkled neem leaves, (T_1) WWNSC (15% DCP) individually, (T_2) salt sprinkled neem leaves individually (15% DCP), (T_3) WWNSC (15% DCP) in combination with salt sprinkled neem leaves (15% DCP) as a protein source along with concentrate mixture, green maize and *ad libitum* sorghum *kadbi*. The concentration of blood parameter (Blood glucose, total serum protein and heamoglobin) did not differ significantly ($P<0.01$) among all treatments groups. However, its concentrations increased throughout experimental period in all treatments group including control. While, Blood urea nitrogen concentration was significantly ($P<0.05$) higher in group fed with salt sprinkled neem leaves than group fed with WWNSC individually and in combination with salt sprinkled neem leaves while comparable with control groups. The feed conversion efficiency (FCE) for dry matter, DCP and TDN was comparatively higher in groups fed with salt sprinkled neem leaves individually than groups fed with WWNSC individually and in combination with salt sprinkled neem leave when compare with control groups. The feeding cost per kg live weight gain was comparatively less (Rs. 150.73) in group fed with salt sprinkled neem leaves individually than groups fed with control diet (Rs. 164.08) and group fed with WWNSC individually (Rs. 183.10) while comparable to groups fed with WWNSC and salt sprinkled neem leaves (Rs. 157.55) in combination. It concluded that, feeding of salt sprinkled neem leaves individually (15% DCP) was comparatively more economical than rest of all treatments groups without adverse effect on blood parameter.

KEY WORDS : Goat, Neem seed cake, Blood, Parameter, Efficiency

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INTRODUCTION

The increase in the cost of conventional feed stuffs with their irregular supply pose a great threat to future livestock industry including small ruminants. Most of feeds such as energy and protein sources namely maize, sorghum and groundnut cake used in the production of

livestock feed are also used for human consumption. It is therefore, necessary to seek alternative sources such as non-conventional feed resources and incorporate them in the preparation of animal feed (Anonymous, 1976).

Chronic shortage of protein and energy rich feed, shrinkage of grazing lands thrown a serious challenge to meet the feed and fodder requirement of 512.05 million livestock population (Anonymous, 2012) of our country. The liberalized export policies and diversion of conventional animal feeds for human consumption aggravates the shortage of digestible crude protein and total digestible nutrients. Hence, matter of imbalance between supply and demand for concentrate feed (23 vs. 53 million tonnes dry matter) is of great concern (Anonymous, 2013). Animal nutritionists are therefore, in constant search of alternate feed resources for economical livestock feeding.

Neem (*Azadirachta indica*) seed cake and neem leaves are non-conventional feeds are good source of protein *i.e.* 18-20 and 16-18 per cent, respectively for livestock feeding. Neem (*Azadirachta indica*) seed cake (NSC), a by-product of neem oil industry, is a non-conventional feed ingredients showing great potential for livestock feeding (Nath *et al*., 1974; Gowda and Prasad, 2005). Despite high CP content in neem seed and neem leaves, its incorporation in animal diets was discouraged due to their adverse effect on production traits because of presence of bitter taste and toxic triterpenoids, mainly nimbin, nimbidin, azadirachin and salanin (Paul *et al.*, 1996). To overcome these problems of incorporation of neem seed cake and neem leaves in animal feed, the water washing treatment to NSC and salt sprinkling treatment to neem leaves have practically more importance. Looking to the benefits of NSC and neem leaves in the diet of small ruminant; it was decided to use water washed NSC and salt sprinkled neem leaves in the diet of Osmanabadi male kids.

MATERIAL AND METHODS

Animal, housing and feeding management :

Twenty four healthy, Osmanabadi weaned male kids (5-6 months of age) were allotted to four groups (T_0, T_1, T_2 and T_3) of six kids each in a Randomized Block Design. Experimental kids were drenched with anthelmintic (Fenbendazole 5 mg per kg BW) at the beginning of experiment and allowed to adapt for 10 days before experimental feeding. Experimental kids were housed in a clean, well-ventilated shed with facilities of individual feeding and watering. All the kids were fed individually. The kids in T_0, T_1, T_2 and T_3 treatment group were fed with concentrate, concentrate + water washed neem seed cake, concentrate + salt treated neem leaves and concentrate + water washed neem seed cake + salt treated neem leaves, respectively at 8.15 am daily. The green maize was fed to kids at 11.00 am as per treatment details. In the afternoon session, at 4.00 pm *ad libitum* sorghum *kadbi* was fed to all groups. Daily feed intake and weekly body weights for two consecutive days before feeding and watering were recorded throughout the 182 days of experimental period. Quantity of concentrates, green maize, WWNSC and sprinkled neem leaves to be offered daily was adjusted fortnightly as per body weight. Fresh and clean drinking water was provided *ad libitum*. The shed and surrounding area was sprayed with Blutox and Diptraz at an interval of one month. The kids were regularly groomed and cleaned. The kids were regularly checked for their healthy condition by veterinary doctor. Healthy and hygienic condition was maintained in the shed throughout experimental period.

Feeds :

The nutrient requirement of the experimental kids was considered as per the ICAR standard (Anonymous, 1998) for growing kids. The concentrate mixture (DCP-17.40%, TDN-70.55%) was fed to experimental kids prepared from 30 per cent maize grains, 30 per cent groundnut cake, 20 per cent gram chuni, 17 per cent wheat bran, 2.5 per cent mineral mixture and 0.5 per cent salt and experimental treatments were as T_0 included 50 per cent DCP from concentrate mixture + 50 per cent DCP from green maize fodder + *ad lib.* sorghum *kadbi*; T_1 included 35 per cent DCP from concentrate mixture + 15 per cent DCP from water washed neem seed cake + 50 per cent DCP from green maize fodder + *ad lib* sorghum *kadbi*; T_2 included 50 per cent DCP from concentrate mixture + 15 per cent DCP from salt sprinkled neem leaves + 35 per cent DCP from green maize fodder + *ad lib* sorghum *kadbi* and T_3 included 35 per cent DCP from concentrate mixture + 15 per cent DCP from water washed neem seed cake + 15 per cent DCP from salt sprinkled neem leaves + 35 per cent DCP from green maize fodder + *ad lib.* sorghum *kadbi*.

Blood parameter study :

The blood sample were collected from experimental kids at three times *i.e.* 0 (initial stage), 91th (middle stage) and 182th (final stage) days of experiment and analyzed for blood glucose, blood urea nitrogen, total serum protein and haemoglobin content to see the changes in blood parameter due to the treatment feed.

Analysis of blood constituents :

Blood glucose was estimated as per the method described by Dubowski (1962), total serum protein content as per the modified biuret and dumas method described by Varley (1980), haemoglobin content was estimated as per the method described by Shastry (1971) and blood urea nitrogen as per the Urease Nesslerization method described by Varley (1980).

Statistical analysis :

The observations of blood parameter were subjected to test of significance using Completely Randomized Design (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Blood parameter study :

The blood glucose content in experimental kids was within range of 40.77 to 56.28 mg/dl (Table 1). Although, differences in the mean values of blood glucose content in treatments groups (T_0, T_1, T_2 and T_3) were statistically non-significant at initial, middle and final stage of experiment but higher values of blood glucose content was observed in treatment group (T_2) fed with salt sprinkled neem leaves individually and lowest in T_1 at middle and final stage of experiment. From the blood glucose results, it was observed that the treatment feed had no significant effect on blood glucose content of Osmanabadi male kids. The results were in agreement with those of Dutta *et al.* (2012) who reported that there were non-significant differences in mean values of blood glucose content in all treatment groups kids fed with three iso-nitrogenous diets containing 0 (CT-0), 1.0 (CT-1) and 2.0 (CT-2) per cent condensed tannins through a dried and ground leaf meal mixture of *Ficus infectoria*, *Psidium guajava* and*Ficus bengalensis*. Mean values of blood glucose in present investigation were within the suggested physiological range for goats (Kaneko, 1997). Anandan *et al*. (1996) reported non-significant differences in the mean values of blood glucose in treatment group goats fed with iso-nitrogenous control (DGNC) and experimental (22.5 %) concentrate mixture. Musalia *et al.* (2000) reported non-significant differences in mean values of blood glucose in all treatment groups male lambs (Mandya x Merino) fed with 2.5 per cent urea treated neem seed kernel cake.

Total serum protein content in experimental kids was in the range of 5.98 to 7.45 g/dl (Table 1). Differences in the mean values of total serum protein content in treatments groups (T_0, T_1, T_2 and T_3) were statistically non-significant at initial, middle and final state of experiment but higher values of total serum protein content was observed in treatment group (T_2) fed with salt sprinkled neem leaves individually and lowest in T_1 at middle and final stage of experiment. From the results, it was observed that experimental feed treatment had no significant effect on total serum protein content of Osmanabadi male kids. The results were comparable to Radhakrishnan (2005a) who reported non-significant differences in the mean values of total serum protein content in experimental group kids fed with complete diet plus neem leaves and 10 per cent *Stylo hammata* hay (N + S), 10 per cent tapioca leaves (N + T) and 10 per cent groundnut haulms (N + G). Verma *et al.* (1995) reported that feeding of water washed neem seed cake decreased total serum protein content non-significantly ($P<0.01$) in growing kids.

The blood haemoglobin content in experimental kids was in the rage of 8.40 to 10.08 mg/dl (Table 1). Differences in the mean values of blood haemoglobin content in treatments groups (T_0, T_1, T_2 and T_3) were statistically non-significant at initial, middle and final state of experiment but higher values of blood haemoglobin content was observed in treatment group (T_2) fed with salt sprinkled neem leaves individually and lowest in T_1 at middle and final stage of experiment. From the results, it was observed that experimental feed treatment had no significant effect on blood haemoglobin content of Osmanabadi male kids. The present results were comparable to Radhakrishnan (2005a) who reported non-significant differences in the mean values of haemoglobin content in experimental group kids fed with complete diet plus neem leaves and 10 per cent *Stylo hammata* hay (N

+ S), 10 per cent tapioca leaves (N + T) and 10 per cent groundnut haulms (N + G). Verma *et al.* (1995) reported that feeding of water washed neem seed cake decreased blood haemoglobin content non-significantly (P<0.01) in growing kids.

The blood urea nitrogen content in experimental kids was within range of 17.53 to 21.72 mg/dl (Table 2). The mean values of blood urea nitrogen content were significantly (P<0.05) lower in treatments groups (T_1 and T_3) than control (T_0) and treatment group (T_2). The control (T_0) and treatment group (T_2) didn't differ significantly from each other; whereas, T_1 and T_3 differed significantly from each other at middle and final stage of experiment. It indicates that treatment group fed with WWNSC individually (T_1) and in-combination with salt sprinkled neem leaves (T_3) significantly decreased blood urea nitrogen content; whereas, treatment group fed with salt sprinkled neem leaves (T_2) significantly increased blood urea nitrogen level throughout the experimental period. The significantly lower level of blood urea nitrogen content in treatment groups T_1 and T_3 could be due to lower intake of DCP. Whereas, significantly higher blood urea nitrogen content in treatment group (T_2) could be due to higher intake of DCP. The results were in agreement with Radhakrishnan (2005a) who reported higher blood urea nitrogen content in experimental kids fed with complete diet plus neem leaves and 10 per cent *Stylo hammata* hay (N + S), 10 per cent tapioca leaves (N + T) and 10 per cent groundnut haulms (N + G) as compared to control groups. Verma *et al.* (1995) reported that feeding of water washed neem seed cake decreased blood urea nitrogen level significantly (P<0.01) in growing kids.

Feed conversion efficiency :

Feed conversion efficiency (FCE) for dry matter, DCP and TDN in treatment groups for one kg live body weight gains were within a range of 13.66 to 16.03; 0.804 to 0.942 and 8.35 to 10.04, respectively (Table 2). From the results, it was observed that treatment group fed with salt sprinkled neem leaves individually (T_2) showed highest FCE for DM, DCP and TDN and lowest in treatment group fed with WWNSC (T_1). The results of FCE for DM were in agreement with those of Verma *et al.* (1995) *i.e.* 11.40 $\pm$ 0.63 to 14.60 $\pm$ 1.68 in growing kids fed with concentrate mixture containing WWNSC at 15 and 25 per cent, Radhakrishnan reported FCE in non-descript make kids (13.49 $\pm$ 0.68 to 16.37 $\pm$ 0.53) fed with complete ration containing neem leaves at 0, 20, 40 and 60 per cent level as a roughage source and Radhakrishnan

Table 1 : Effect of feed treatment on blood parameters *viz.*, blood glucose, total serum protein, haemoglobin and blood urea nitrogen content under different treatment groups

Particulars	Treatments											
	T_0			T_1			T_2			T_3		
	0 day	91th day	182th day	0 day	91th day	182th day	0 day	91th day	182th day	0 day	91th day	182th day
Blood glucose (mg/dl)	40.90 $\pm$0.88	46.21 $\pm$0.45	54.87 $\pm$1.14	41.42 $\pm$0.81	45.16 $\pm$0.68	53.70 $\pm$2.72	40.77 $\pm$0.61	47.19 $\pm$1.19	56.28 $\pm$2.29	41.11 $\pm$0.60	46.26 $\pm$0.80	53.97 $\pm$2.07
Total serum protein (g/dl)	6.19 $\pm$0.14	6.84 $\pm$0.16	7.39 $\pm$0.19	6.00 $\pm$0.07	6.77 $\pm$0.18	7.16 $\pm$0.28	6.35 $\pm$0.23	7.01 $\pm$0.11	7.45 $\pm$0.17	5.98 $\pm$0.09	6.77 $\pm$0.09	7.28 $\pm$0.12
Haemoglobin (g/dl)	8.75 $\pm$0.18	9.34 $\pm$0.13	10.06 $\pm$0.08	8.65 $\pm$0.14	9.17 $\pm$0.14	10.00 $\pm$0.15	8.86 $\pm$0.30	9.29 $\pm$0.23	10.08 $\pm$0.17	8.40 $\pm$0.35	9.03 $\pm$0.29	9.91 $\pm$0.25
Blood urea nitrogen (mg/dl)	17.53 $\pm$0.47	20.03 $\pm$0.27^a	21.20 $\pm$0.27^a	17.68 $\pm$0.35	17.75 $\pm$0.35^c	17.80 $\pm$0.35^c	18.02 $\pm$0.31	20.55 $\pm$0.27^a	21.72 $\pm$0.22^a	17.91 $\pm$0.32	18.71 $\pm$0.23^b	18.90 $\pm$0.24^b

Table 2 : Effect of feed treatment on feed conversion efficiency and economics of feeding of Osmanabadi kids

Particulars	T_0	T_1	T_2	T_3
Feed conversion efficiency				
DM	14.29	16.03	13.66	15.02
DCP	0.823	0.942	0.804	0.905
TDN	8.95	10.04	8.35	9.22
Economics of feeding				
Total feed cost (Rs.)	1161.65	977.74	1160.60	1043.00
Total live wt. gain	7.08	5.34	7.70	6.62
Cost per kg live wt. gain (Rs.)	164.08	183.10	150.73	157.55

(2005b) reported FCE in Madras Red lambs (12.22 ± 0.70 to 15.47 ± 1.42) fed with ration (T_1) contained 60 per cent of green fodder hay while experimental ration (T_2) contained 60 per cent of Neem:SS: GNH 25:37.5:37.5, (T_3) Subabul : GNH: RS 25:37.5:37.5 or (T_4) Gliricidia : GNH : RS 25:37.5:37.5. The results of FCE for DCP were in agreement with those of Nawale (1979) *i.e.* 0.837 to 0.987 kg in Osmanabadi growing kids fed with 100, 120 and 80 per cent DCP as per NRC. The results of FCE for TDN were in agreement with those of Sarode (1984) *i.e.* 8.90 to 11.22 kg in Osmanabadi kids fed with diet 100:100, 100:80, 80:100 and 80:80 of protein and energy combinations.

Economics of feeding :

The feeding cost per kg live weight gain in T_0, T_1, T_2 and T_3 were Rs. 164.08, 183.10, 150.73 and 157.55, respectively (Table 2). From the results, it was observed that treatment group fed with salt sprinkled neem leaves (T_2) showed lowest feeding cost per kg live body weight gain and highest in treatment group fed with WWNSC (T_1). The results were in agreement with those of Radhakrishnan (2005a) who conducted experiment with weaned male kids fed with complete ration containing neem leaves at 0, 20, 40 and 60 per cent level as a roughage source and reported lower feeding cost per kg live weight gain in treatment group as compared to control. Radhakrishnan (2005b) conducted experiment in Madra red lamb fed with ration (T_1) contained 60 per cent of green fodder hay while experimental ration (T_2) contained 60 per cent of Neem: SS: GNH 25: 37.5: 37.5, (T_3) Subabul : GNH: RS 25:37.5:37.5 or (T_4) Gliricidia: GNH: RS 25:37.5:37.5 and recorded lower feeding cost per kg live weight gain in treatment groups as compare to control. Madhavi *et al.* (2006) noted comparable feeding cost in Nellore lambs of control and experimental group fed with complete diet formulated with 15 per cent level of water washed and 4 per cent of urea-ammoniated neem seed cake, 28.5 per cent Bajra (*Pennisetum americanum*) straw and 10 per cent groundnut (*Araches hypogaea* L.) haulms.

It concluded that, feeding of salt sprinkled neem leaves individually (15% DCP) was comparatively more economical than rest of all treatments groups without affecting blood constituents.

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