Growth characteristics, economics and hair mineral status of camel calves reared in different systems of management

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ABSTRACT

Management systems were compared by conducting 2 trials with different feeding practices. Trials 1 and 2 were conducted by feeding *guar phalgati* and *moth chara* as manger feeding, respectively, for 165 days each to 5 camel calves each under intensive system of management (ISM) and semi-intensive system of management (SIM). Total gain in body weight was higher in SIM than ISM group in both the trials. Mean body weight and average growth rate significantly increased in SIM as compared to ISM group at the end of both the trials. The mean *moth chara* intake was significantly ($P < 0.05$) more in ISM than SIM. The important hair minerals (calcium, magnesium, copper, zinc, iron and manganese) increased significantly in SIM as compared to ISM group. The manganese status varied significantly ($P < 0.05$) between groups in *moth chara* trial. Feeding cost/calf/day and total cost were high in ISM than SIM group in both the trials. Total cost/kg body weight gain was quite less and economical in SIM as compared to ISM group. The study indicated SIM better than ISM for economic rearing of camel calf.

Key words: Camel, Economics, Farmers, Growth, Hair, Management system, Mineral

Mineral estimation in camel hair is a comparatively newer concept in India. Mineral analysis in hair tissue is an excellent tool for monitoring general health, nutritional status and toxic metal exposure for animals (Manson and Zlothoin 1985). Muller (1996) found scalp hair a useful indicator of internal mercury exposure. However, in India, so far camel hair has not been taken up for mineral estimation. The management system should be focused on higher growth performance, proper mineral and good health status, requiring lower economic intervention. Accordingly, present study was conducted with the major objective to investigate influence of management system on growth characteristics, level of important and relevant macro and micro minerals in hair and economical intervention of camel-calf rearing.

MATERIALS AND METHODS

Experimentation: Management systems were compared by conducting 2 experiments with different feeding practices. The first and second experiments were conducted by feeding *guar phalgati* (*Cyamopsis tetragonoloba*) and *moth chara* (*Phaseolus aconitifolius*) as manger feeding, respectively for 165 days each. Five camel calves (*Camelus dromedarius*), 12–15 month-old, belonging to the NRC on Camel, Bikaner, were allotted randomly into each group of management

system. The average initial body weight of 2 groups was more or less similar for both trials. The hetero breed and sex combination were kept in each group of both trials, as per field practice. It contained 2 Bikaneri, 2 Jaisalmeri and 1 Kutchi breed. Each group of both trials contained 3 males and 2 females. The first group was reared under intensive system of management (ISM) and the second group was reared under semi-intensive system of management (SIM) with provision of grazing/browsing daily for about 6 to 7 h and offered fodder in the evening. The manger feeding was given in both the management systems as per standard feeding schedule followed at the NRCC farm. Daily once watering was done for all camel calves in both groups and in each trial.

Sampling of hair: Camel hair accumulates all important minerals and is commonly available tissue which can easily be collected, stored and transported and if needed can easily be resampled. At the end of each trial hair samples were collected from shoulder, neck, hump and mid region of body of camel calves. The hair were cut with the stainless steel scissors into pieces of about 1 cm length from each region and mixed well to ensure homogeneity. The skirting of sample was done properly. Samples were washed with acetone and filtered, rinsed with adequate deionized water. These were dried in hot air oven and 0.5 g of dried mass was taken for further processing.

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Monitoring of growth: The body weight of camel calves were recorded first before shifting them to the respective treatments and thereafter all experimental calves were weighed at fortnightly intervals by using electronic balance. The average weight of 2 consecutive days was taken to represent fortnightly body weight. The weighing was always done in morning before offering feed or water. Body weight formed the basis of determining growth rate of camels. The samples of fodder were collected at fortnightly intervals for estimation of dry matter. The composite samples of fodder were analyzed for proximate principles (AOAC 1995).

Analysis of hair for minerals status: Concentrated nitric acid (2 ml) was added to each hair sample and was kept at 100°C until half of the total volume evaporated. The samples were then taken out and cooled. Concentrated perchloric acid (2 ml) was added and again sample were kept until half of the total volume had evaporated. After this procedure, distilled water was added to give a total volume of 10 ml (Brown *et al.* 1995). The solution was used for determination of important macro- and micro-minerals. Standards for different elements were prepared by diluting stock solution with deionized water as per standard condition for respective elements. The concentration of different elements was determined by atomic absorption spectrophotometer.

Statistical and economic analysis: The experimental data were subjected to statistical analysis. The paired-t test

(Snedecor and Cochran 1989) was applied between 2 management systems for every trial separately. The economic analysis of rearing of camel calves in different systems of management for both trials were carried out by considering the feed cost and the tabular analysis was carried out.

RESULTS AND DISCUSSION

Growth characteristic: The average body weight at 0 day of trial was almost similar in 2 management groups for both experiments (Table 1). After 165 days of trial period, mean body weight significantly ($P<0.01$) increased in SIM as compared to ISM for both trials. The average total gain and growth rate was significantly ($P<0.01$) higher in SIM as compared to ISM. The average fodder intake (from manger) per calf per day was on higher side in ISM as compared to SIM group for both trials. The intake of moth chara significantly ($P<0.05$) varied between management groups. Bhakat and Nagpaul (2005) had reported that despite similar dry matter content of fodder the intake in all groups were different, which is due to the difference in the types of management (housing) provided to animals.

The analysis of performance data under ISM group for both trials revealed that total dry matter intake (DMI) was 5.41 ± 0.86 kg/calf/day for *guar phalgati* trial and 6.40 ± 0.72 kg/calf/day for *moth chara* trial. The ratio between water intake and DMI was 1.88 ± 0.64 for *guar phalgati* trial and 1.98 ± 0.51 for *moth chara* trial. The feed conversion

Table 1. The growth characteristic of camel calves and economics in different management system with two experiments

		Intensive system of management (ISM)	Semi-intensive system of management (SIM)
Experiment with <i>Cyamopsis tetragonoloba</i>			
Mean body weight after 165 days	kg	272.35 ^{**} ±12.34	285.48 ^{**} ±8.66
Mean body weight at 0 day	kg	223.88 ^{NS} ±11.76	228.79 ^{NS} ±12.14
Total gain in body weight	kg	48.47	56.69
Average daily gain	g/day	278.46 ^{**} ±49.83	325.16 ^{**} ±47.18
Mean <i>guar phalgati</i> intake (manger)	kg/calf/day	6.02 ^{NS} ±0.85	5.14 ^{NS} ±0.73
Mean water intake (trough)	kg/calf/day	10.20 ^{NS} ±1.70	10.01 ^{NS} ±1.62
Economic analysis			
Total feeding cost for 165 days	Rs/calf	2085.93	1781.01
Daily feeding cost per calf	Rs	12.64	10.79
Overall total cost for 1 kg gain	Rs	43.04	31.42
Experiment with <i>Phaseolus aconitifolius</i>			
Average body weight after 165 days	kg	313.60 ^{**} ±11.24	348.35 ^{**} ±8.12
Average body weight at 0 day	kg	255.78 ^{NS} ±10.26	262.50 ^{NS} ±11.34
Total gain in body weight	kg	57.82	85.85
Average daily gain	g/day	330.76 ^{**} ±43.57	475.81 ^{**} ±39.33
Average intake of <i>moth chara</i> (manger)	kg/calf/day	7.91 [*] ±0.48	6.24 [*] ±0.29
Average intake of water (trough)	kg/calf/day	12.77 ^{NS} ±1.24	12.16 ^{NS} ±1.55
Economic analysis			
Total feeding cost for 165 days	Rs/calf	2,698.25	2,368.08
Total feeding cost	Rs/day/calf	16.35	14.35
Overall total cost for 1 kg gain	Rs	46.66	27.58

^{**}Significant at 1%, ^{*}significant at 5%, NS: Nonsignificant.

Table 2. Average $\pm$ SE of mineral status (mg/g) in hair of camel calves reared under different management system with two experiments

	Macro-mineral			Micro-mineral		
	Calcium	Magnesium	Copper	Zinc	Iron	Manganese
Experiment with <i>Cyamopsis tetragonoloba</i>						
Intensive management (ISM)	434.40 $\pm$ 60.21	67.60 $\pm$ 6.33	4.30 $\pm$ 0.44	57.56 $\pm$ 2.33	216.08 $\pm$ 30.89	20.60 ^{NS} $\pm$ 1.02
Semi-intensive management (SIM)	549.60 $\pm$ 74.45	88.92 $\pm$ 2.41	6.16 $\pm$ 0.72	66.04 $\pm$ 4.38	285.72 $\pm$ 26.55	21.56 ^{NS} $\pm$ 3.65
Experiment with <i>Phaseolus aconitifolius</i>						
Intensive system management (ISM)	476.00 $\pm$ 127.98	69.84 $\pm$ 3.18	5.72 $\pm$ 0.99	54.76 $\pm$ 1.46	261.92 $\pm$ 33.37	32.92 $\pm$ 4.36
Semi-intensive management (SIM)	719.72 $\pm$ 78.62	77.48 $\pm$ 3.67	7.36 $\pm$ 0.66	64.25 $\pm$ 2.04	319.36 $\pm$ 27.91	45.80 $\pm$ 1.83

*Significant at 5%, NS, nonsignificant.

efficiency was 10.89 $\pm$ 0.56 for *guar phalgati* trial and 11.92 $\pm$ 0.78 for *moth chara* trial. The total DMI per 100 kg body weight was 2.20 $\pm$ 0.32 kg/calf for *guar phalgati* trial and 2.24 $\pm$ 0.21 kg/calf for *moth chara* trial. Total intake per day per kg metabolic body size was 0.088 $\pm$ 0.008 kg for *guar phalgati* trial and 0.086 $\pm$ 0.007 kg for *moth chara* trial. The average water intake (from trough) was more in ISM as compared to SIM group for both trials. The relationship between dry matter intake and growth of weaned calves seems positively correlated Singh *et al.* (2000). Tandon *et al.* (1993) found that dry fodder intake and water intake were positively correlated. Sahani *et al.* (1992) observed that the average daily gains in 2 months old Bikaneri and Jaisalmeri calves were 553.3 and 546.6 g, respectively. The present data are consistent with the earlier reports. Khanna *et al.* (1990) reported that significant correlation coefficients existed between body weight and measurement in Bikaneri, Jaisalmeri, Kutchi and Mewari breed of camels.

Hair macro mineral status: Calcium and magnesium were significantly ($P<0.05$) increased in SIM as compared to ISM group in both experiments (Table 2). The level of calcium varied between 286 and 604 mg/g in ISM whereas in SIM it varied between 330 and 720 mg/g in case of *guar phalgati* trial. The level of magnesium varied between 42.4 and 76 mg/g in ISM whereas in SIM it varied between 81.8 and 94 mg/g in *guar phalgati* trial. But in *moth chara* trial, magnesium ranged between 57.8 and 75 mg/g in ISM whereas in SIM it varied between 68.6 and 86.8 mg/g. Kayar *et al.* (2004) reported that levels of some elements were affected to a higher or lower degree by nutritional differences in horse.

Hair micro mineral status: The important micro-mineral like copper, zinc, iron and manganese were higher in SIM as compared to ISM group in both the experiments. The level of copper, zinc, iron significantly ($P<0.05$) varied between management systems in each trial. The copper ranged between 4 and 9.6 mg/g in ISM whereas in SIM it varied between 5.8 to 9.4 mg/g in *moth chara* trial. The level of zinc varied between 49.4 and 62.6 mg/g in ISM whereas in SIM it varied between 53.2 and 77.2 mg/g in *guar phalgati* trial. But in *moth chara* trial, the zinc ranged between 49.6

and 58.6 mg/g in ISM whereas in SIM it varied between 59 and 71.24 mg/g. The level of iron widely varied i.e 140.6 and 318 mg/g and 235.8 and 366 mg/g in ISM, SIM respectively, in *guar phalgati* trial. Similarly, the iron status ranged between 165.6 and 374 mg/g in ISM whereas in SIM it varied between 226 and 384.8 mg/g in *moth chara* trial. The manganese status varied significantly ($P<0.05$) between management system in *moth chara* trial but non-significant variation was found in *guar phalgati* trial. In case of *moth chara* trial, the manganese status ranged between 19.4 and 46 mg/g and 43 and 52.8 mg/g in ISM and SIM, respectively. Chatterjee *et al.* (2005) found almost similar manganese status in yak hair.

Economic analysis: Almost all kinds of costs for camel calves rearing were more or less similar except feeding cost. The total feeding cost (Rs) per calf for 165 days was more in ISM group as compared to SIM group for both trials (Table 1). The total feeding cost per day per calf was high in ISM than SIM group in both trials. Total cost per kg body weight gain was quite less in SIM as compared to ISM. Since total body weight gain and average growth rate were quite high, in SIM, so it was more economical than ISM. Pathak *et al.* (2007) reported that the health of individual/herd of camels has its role from the economic point of view as well as from public health consideration. Camel hair is being formed and exposed to internal metabolic environment including blood, lymph and extra cellular fluids. Constituents entering into body are then accumulated in hair and reflect a time weighed exposure record of nutritional and toxic metal intake. The minerals concentration in camel hair can very well be used as an indicator of trend of mineral deficiency/toxicity in soil. The levels of mineral in camel hair can be used in the diagnosis of various diseases and metabolic disorders and determination of nutritional status. The study indicated that as far as present management practices are concerned semi-intensive system of management is better over the intensive system of management for economic rearing of camel-calf.

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