Vol 16 No 1, p 77-81

COMPARATIVE STUDY ON CAMEL MANAGEMENT SYSTEMS FOR ECONOMIC SUSTAINABILITY

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ABSTRACT

Two trials were conducted with different management practices to compare 2 management systems. First and second trials were conducted by providing guar crop residue and moth crop residue as manger feeding, respectively for 182 days each. Five camel calves belonging to NRCC were allotted randomly into each group of management system. First group was reared under intensive system of management (ISM) and 2nd group was reared under semi-intensive system of management (SIM). The mean body weight and average growth rate were significantly (P<0.01) increased in SIM as compared to ISM group at the end of each trial. The average total gain was higher in SIM than ISM group in both trials. The body water was significantly (P<0.05) lower in SIM as compared to ISM group. The body fat, protein and ash (%) were significantly (P<0.05) higher in SIM as compared to ISM group. The nutrient, energy deposition in terms of protein was significantly (P<0.01) higher in SIM than ISM group. The total deposition was significantly (P<0.01) increased in SIM than ISM group. The body length, heart girth, height at wither, neck length, hump circumference (horizontal), leg length (fore and hind) and foot pad length (fore) were significantly (P<0.01) increased in SIM as compared to ISM group after end of both trials. The hump circumference (vertical), foot pad width (fore and hind) varied significantly (P<0.05) between groups for both trials. The level of urea significantly (P<0.05) increased in ISM than SIM group in 2nd trial but BUN level significantly (P<0.05) increased in ISM than SIM group in 1st trial. The average level of serum calcium and phosphorus significantly (P<0.05) increased in SIM than ISM group in 2nd trial. The level of total protein, albumin and globulin were significantly (P<0.05) increased in SIM as compared to ISM group in 2nd trial. The total feeding cost per calf for 182 days was high in ISM than in SIM group for both trials. The total cost per kg body weight gain was quite less and economical in SIM as compared to ISM group in both trials.

Key words: Body composition, camel, economics, farmers, management system, performance

Camels which are largely reared under extensive system of management are now facing problem due to shrinkage of grazing land and their management needs a better alternate system, which is socially acceptable and economically viable for effective use of camel's bio-energy. Camel population in India has declined from 1.03 million to 0.63 million (FAO, 2002) within a decade due to fast mechanisation, increased irrigation, shrinkage of grazing/browsing land and decline in flora of arid region. Due to shift in cropping pattern, camel keepers are facing a great problem to rear their camels in extensive system of management. So, they are forced to rear their camels in intensive and semi-intensive systems of management. But these systems may not be as economical as extensive management system and growth performance of animal is also affected. In field conditions, the breaking age of camel is about 3 to 4 years of age, i.e. camel calves who are reared under extensive management condition, used to achieve 350 to 400 kg body weight around that age. After achieving this body weight, body conformation reached to a level suitable for putting the camel to work such as carting, thereby becoming economically sustainable. The management system should be focused on higher growth performance, suitable body conformation, and good health status requiring lower economic intervention. Accordingly, the present study was conducted with the major objective to investigate the effect of management system on growth performance, body composition, biometry, biochemical attributes, level of different types of protein and economical intervention of camel calves rearing.

Materials and Methods

Management of trials: Two trials were conducted with different management practices to compare 2 management systems. The 1st and 2nd trials were conducted by providing guar crop

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residue (GCR) (*Cyamopsis tetragonoloba*) and moth crop residue (MCR) (*Phaseolus aconitifolius*) as manger feeding, respectively for 182 days each. Five camel calves (*Camelus dromedarius*), around 17 to 21 months aged, belonging to National Research Centre 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. As per the practice of farmer, the hetero breed and sex combination were kept in each group of both trials which contained 2 Bikaneri, 2 Jaisalmeri and 1 Kutchi breed. Each group of both trials contained 3 males and 2 females. The 1st group was reared under intensive system of management (ISM) and 2nd group was reared under semi-intensive system of management (SIM) with provision of grazing/ browsing daily for about 6 to 7 hours and offered crop residue in the evening. The manger feeding was given in both management systems as per standard feeding schedule followed at NRCC farm. Watering was done once daily for all camels in both groups and trials.

Growth performance: The body weight of camel calves were recorded first before shifting calves to the respective treatments and thereafter, all the experimental animals 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 the morning before offering feed or water. Body weight formed the basis of determining the growth rate of camels.

Body composition: The antipyrine dilution technique was followed to determine body composition at the end of 2nd trial. The body water, fat, protein, ash, nutrient and energy deposition of camel calves were estimated and compared in 2 management systems.

Biometrical parameters: The biometrical parameters (Higgins and Kock, 1984) were recorded by measuring tape at fortnightly intervals before morning feeding. The height was measured with the help of height measuring stand. The measurements were recorded when camel was standing evenly on foot pad with neck elevated to a normal position on plain ground level for the maximum precision and due care was taken to avoid any kind of error. The samples of crop residues were collected at fortnightly interval for estimation of dry matter. The composite samples of crop residues were analysed for proximate principles (AOAC, 1995).

Biochemical analysis: The blood samples were collected from all camels of both groups at the end of each trial. The samples were analysed for biochemical attributes, concentration of total protein, albumin, globulin, macro mineral like calcium and phosphorus level etc.

Economic and statistical analysis: 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. The experimental data were subjected to statistical analysis. The paired - t test (Snedecor and Cochran, 1989) was applied between two management systems for every trial separately.

Results and Discussion

The growth performance: The average value ± SE of growth performances of camel calves in different management system for two trials are presented in Table 1. The average initial body weight was almost similar in two management groups for both trials. After 182 days of trial period, mean body weight was significantly (P<0.01) increased in SIM as compared to ISM group for both trials. The average total gain was higher in SIM group than ISM group after end of each trial. The average growth rate was significantly (P<0.01) higher in SIM group as compared to ISM group for both trials. The mean crop residue intake (from manger) was found to be

Table 1. The Mean ± SE value of growth performances of camel calves in different management system for 2 trials.

Parameters	Significance	ISM with 1st Practice (G.C.R.)	ISM with 1st Practice (G.C.R.)	ISM with 2nd Practice (M.C.R.)	ISM with 2nd Practice (M.C.R.)
Initial Body Weight (Kg)	NS	223.88±11.76	228.79±12.14	255.78±10.26	262.50±11.34
Body Weight after 182 days (Kg)	**	276.25±12.43	290.87±8.60	316.58±10.32	351.60±8.10
Total gain (Kg)		52.37	62.07	60.80	89.10
Growth rate (gm/day)	**	290.50 ±56.84	341.08±57.95	342.64±38.82	489.71±46.19
Fodder Intake (manger) Kg / calf /day	NS	6.10±0.72	5.17±0.82	7.44±0.63	6.39±0.71
Water Intake (trough) Kg / calf /day	NS	10.25±1.83	10.07±1.75	12.87±1.32	12.19±1.67

** Significant at 1%, NS : Non-significant.

on higher side in case of ISM group as compared to SIM group for both trials. Bhakat and Nagpaul (2005) 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 5.61 ± 0.98 kg/calf/day for GCR practice and 6.84 ± 0.83 kg/calf/day for MCR practice. The ratio between water intake and D.M.I was 1.82 ± 0.79 for GCR practice and 1.88 ± 0.56 for MCR practice. The feed conversion efficiency was 11.68 ± 0.43 for GCR practice and 12.79 ± 0.57 for MCR practice. The total D.M.I. per 100 kg body weight were 2.23 ± 0.38 kg/calf for GCR practice and 2.28 ± 0.26 kg/calf for MCR practice. Total intake per day per kg metabolic body size was 0.089 ± 0.007 kg for GCR practice and 0.087 ± 0.006 kg for MCR practice. The average water intake (from trough) was more in case of ISM as compared to SIM group for both trials. Singh *et al* (2000) reported that the relationship between dry matter intake and growth of weaned calves seems positively correlated. 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 gm, respectively. The present data is consistent with the earlier reports.

The body composition: The body composition of camel calves in different management systems are presented in table 2. The body water (%) was significantly (P<0.05) lower in SIM group (70.64 ± 0.37) as compared to ISM group (71.65 ± 0.31). The body fat, protein and ash (%) were significantly (P<0.05) higher in SIM group as compared to ISM group. The nutrient and energy deposition in terms of protein was significantly (P<0.01) higher in SIM than ISM group. The nutrient and energy deposition in term of fat was also significantly (P<0.05) lower in ISM as compared to SIM group. The total deposition was significantly (P<0.01) increased in SIM than ISM group. Pathak *et al* (2007) reported that the health of individual / herd of camels have its role from the economic point of view, as well as public health consideration.

The biometrical parameters: The table 3 represents the mean ± SE of biometrical parameters (cm) of camel calves in different systems of management for two trials. The average initial values of all biometrical parameters were similar in 2

Table 2. Body composition of camel calves in different management system.

Parameters	Significance	Intensive System of Management (ISM)	Semi-intensive System of Management (ISM)
Body composition (%)			
Body water	*	71.65±0.31	70.64±0.37
Body fat	*	4.87±0.27	5.77±0.33
Body protein	*	20.32±0.09	20.03±0.11
Body ash	*	3.15±0.15	3.56±0.25
Nutrient deposition (Gm/day)			
Protein deposited	**	34.56±2.05	56.07±2.73
Fat deposited	*	7.79±0.44	9.23±0.53
Energy deposition (Kcal/day)			
Protein	**	194.21±11.53	315.10±15.39
Fat	*	72.92±4.13	86.39±4.96
Total deposition	**	267.12±11.63	401.49±17.08

* Significant at 5 % level, ** Significant at 1 % level

management groups for both trials. The body length, heart girth, height at wither, neck length, hump circumference (horizontal), leg length (fore and hind) and foot pad length (fore) were significantly (P<0.01) increased in SIM as compared to ISM group after end of both trials. The proportionate higher growth of hump circumference (horizontal and vertical) and neck length were obtained in SIM as compared to ISM group. The hump circumference (vertical), foot pad width (fore and hind) were varied significantly (P<0.05) between groups for both trials. The foot pad width for hind leg varied non-significantly between 2 systems of management for both trials. The growth achievement of camel calf was due to development of skeletal structure and muscular tissues mainly. Development of hump circumferences (horizontal and vertical) was due to deposition on adipose tissue. Khanna *et al* (1990) reported that significant correlation coefficients existed between body weight and heart girth and leg length in Bikaneri, Jaisalmeri, Kutchi and Mewari breed of camels.

Blood bio-chemical attributes: The mean ± SE of calves blood biochemical attributes in different systems of management for 2 trials are presented in table 4. The level of urea significantly (P<0.05) increased in ISM group (17.47 ± 0.48 mg/dl) as compared to SIM group (11.83 ± 1.21 mg/dl) in 2nd trial. Similar trend of observation was found in case of 1st trial with non-significant variation. In case of level of blood urea nitrogen (BUN), the variation was found to be non-significant between the groups in 2nd trial, although comparatively higher average level

Table 3. The mean ± SE of biometrical parameters (cm) of camel calves in different systems of management for two trials.

	Significance	Initial of ISM with 1st Practice (G.C.R)	Result of ISM with 1st Practice (G.C.R)	Initial of ISM with 1st Practice (G.C.R)	Result of ISM with 1st Practice (G.C.R)	Initial of ISM with 2nd Practice (M.C.R)	Result of ISM with 2nd Practice (M.C.R)	Initial of ISM with 2nd Practice (M.C.R)	Result of ISM with 2nd Practice (M.C.R)
BL	**	108.2±7.3	117.0±6.6	109.2±5.2	122.0±5.7	118.3±7.2	135.4±6.8	119.2±6.8	143.1±6.5
HG	**	149.0±7.4	159.0±6.6	150.0±6.4	164.6±7.0	165.2±7.3	184.4±7.2	166.5±7.1	193.4±3.4
HW	**	157.8±3.1	165.0±3.5	158.0±3.2	171.0±3.3	169.4±3.6	183.2±6.9	170.3±3.5	191.4±3.4
HCH	**	58.0±4.1	64.0±3.2	59.0±4.9	75.4±4.0	66.1±4.2	75.0±2.7	67.2±4.1	89.4±4.0
HCV	*	26.0±4.6	29.0±3.5	27.0±4.7	33.0±3.7	28.2±4.1	34.0±3.5	29.3±4.5	41.2±3.1
NL	**	82.0±3.5	86.0±3.5	83.0±3.3	91.0±3.3	90.1±3.4	98.4±3.5	91.2±3.1	105.2±3.5
LLF	**	120.0±3.5	124.0±3.4	122.0±3.5	129.0±3.4	128.2±3.4	135.8±3.7	130.4±3.5	144.2±3.6
LLH	**	128.1±3.3	132.0±2.6	130.0±3.7	138.0±3.7	138.3±3.2	143.8±3.6	140.5±3.4	151.2±3.5
FPLF	**	10.0±1.1	13.0±1.2	10.0±1.6	15.0±1.3	13.0±1.2	15.0±1.1	13.0±1.1	16.0±1.5
FPWF	*	9.0±1.2	12.0±1.5	9.0±1.3	13.0±1.1	12.0±1.1	14.0±1.1	12.0±1.2	15.0±1.3
FPLH	*	9.0±1.0	12.0±1.6	9.0±1.7	13.0±1.3	12.0±1.3	14.0±1.5	12.0±1.0	15.0±1.2
FPWH	NS	8.0±1.1	11.0±1.4	8.0±1.6	12.0±1.4	11.0±1.0	13.0±1.0	11.0±1.1	14.0±1.9

** Significant at 1%, * Significant at 5%, NS: Non-significant.

BL: body length, HG: heart girth, HW: height at wither, HCH: hump circumference horizontal, HCV: hump circumference vertical, NL: neck length, LLF: leg length (fore), LLH: leg length (hind), FPLF: footpad length (fore), FPWF: footpad width (fore), FPLH: footpad length (hind), FPWH: footpad width (hind).

Table 4. The mean ± SE of calves blood biochemical attributes in different systems of management for two trials.

	Significance	ISM with 1st Practice (G.C.R)	ISM with 1st Practice (G.C.R)	Significance	ISM with 2nd Practice (M.C.R)	ISM with 2nd Practice (M.C.R)
Urea(mg/dl)	NS	27.92 ± 3.08	24.04 ± 2.14	*	17.47 ± 0.48	11.83 ± 1.21
BUN(gm/dl)	*	7.56 ± 0.63	5.52 ± 0.56	NS	13.04 ± 1.44	11.20 ± 1.00
Calcium(mg/dl)	NS	10.06 ± 0.71	10.24 ± 0.33	*	10.42 ± 0.74	12.51 ± 0.21
Phosphorus(mg/dl)	NS	5.43 ± 0.40	5.49 ± 0.24	*	5.35 ± 0.26	6.32 ± 0.38
Total Protein(gm/dl)	NS	6.26 ± 0.13	6.33 ± 0.17	*	6.37 ± 0.14	8.15 ± 0.53
Albumin(gm/dl)	NS	3.25 ± 0.27	3.47 ± 0.25	*	2.84 ± 0.17	4.04 ± 0.29
Globulin(gm/dl)	*	3.30 ± 0.12	3.80 ± 0.10	*	3.07 ± 0.25	4.10 ± 0.41

NS: Non-significant, * Significant at 5%

of urea was found in ISM group (13.04 ± 1.44 gm/dl) as compared to SIM group (11.20 ± 1.00 gm/dl). The level of BUN significantly (P<0.05) increased in ISM group (7.56 ± 0.63 gm/dl) as compared to SIM group (5.52 ± 0.56 gm/dl) in 1st trial.

Macro mineral status: The average level of serum calcium significantly (P<0.05) increased in SIM group (12.51 ± 0.21 mg/dl) than ISM group (10.42 ± 0.74 mg/dl) in 2nd trial. The average level of serum calcium was slightly high in SIM group (10.24 ± 0.33 mg/dl) as compared to ISM group (10.06 ± 0.71 mg/dl) in 1st trial. The average level of phosphorus was significantly (P<0.05) increased in SIM than ISM group in 2nd trial. But in case of 1st trial the variation was found to be non-significant with slightly higher level in SIM than ISM group. Jakhmola and Nagpal (1992) reported that calcium and phosphorus level in calf (1 year aged) with barley supplementation were 9.95 ± 1.39 mg/dl and 5.73 ± 0.09 mg/dl, respectively. Kuria *et al* (2006) found that camel plasma concentration of calcium decreased and phosphorus increased from dry to wet season.

Protein level: The level of total protein, albumin and globulin were significantly (P<0.05) increased in SIM as compared to ISM group in 2nd trial. The level of globulin significantly (P<0.05) increased in SIM group (3.80 ± 0.10 gm/dl) as compared to ISM group (3.30 ± 0.12 gm/dl) in 1st trial. The level of total protein and albumin varied non-significantly

Table 5. The economic analysis for rearing of camel calves in different systems of management for two trials.

	ISM with 1st Practice (G.C.R)	ISM with 1st Practice (G.C.R)	ISM with 2nd Practice (M.C.R)	ISM with 2nd Practice (M.C.R)
Total feeding 182 days cost for (Rs/calf)	2525	2139	2811	2415
Total feeding cost (Rs/day/calf)	13.87	11.75	15.44	13.27
Total cost (Rs)/Kg gain	48.21	34.46	46.23	27.10

with higher average level in SIM as compared to ISM group in 1st trial.

Economic analysis: The economic analysis for rearing of camel calves in different system of management for two trials are presented in table 5. Almost all kind of cost for camel calves rearing was more or less similar except feeding cost. The total feeding cost (in Rs.) per calf for 182 days was more in intensive management group as compared to semi-intensive management group for both trials. Similarly, 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 group. Since total body weight gain and average growth rate were quite high, in SIM group it was more economical than ISM group. Camel rearing is considered cost-effective, sustainable, environment friendly and socio-culturally acceptable in desert ecosystem. The study indicates that, as far as present management practices are concerned, semi-intensive system of management is better over the intensive system of management for economic and scientific rearing of camel calf.

Acknowledgement

Authors are thankful to ICAR for funding the work under Livestock Production and Management project. The authors are equally indebted to the overall administration, farm, NRCC for providing necessary facilities.

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