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Effect of management systems on the performance of dromedary camel calves reared under organized farm condition

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ABSTRACT

Camel calves (10), 7- to 10-month-old, were allotted randomly into 2 comparable groups of 5 each. First group was reared under intensive system of management (ISM) with concentrate supplementation. The second group was reared under semi-intensive system of management (SISM) and allowed daily grazing/browsing for about 6 to 7 h. All animals were offered moth crop residue as manger feeding. Watering was done once daily for all camels in both the groups. After 180 days of trial period, mean body weight and average growth rate were significantly increased in ISM as compared to SISM group. The average total gain was almost double in ISM than SISM. The crop residue intake significantly ($P<0.05$) varied between the groups. Various biometrical parameters, viz. body length, heart girth, height at withers, hump circumference (horizontal), neck length and leg length (fore) significantly increased in ISM as compared to SISM group. Significant variation was also observed for leg length (hind), foot pad length and width (fore and hind) between groups. Significant and positive correlation between body weight and all biometrical parameters were observed for both the groups. The level of triglyceride and total protein significantly increased in ISM as compared to SISM group. Comparatively higher level of urea was found in ISM than SISM. The level of globulin significantly increased in ISM as compared to SISM. The levels of calcium and phosphorus were slightly higher in ISM as compared to SISM. The first in order of behavioral preference were *ganthia* (*Dactyloctenium aegypticum*), *phog* (*Calligonum polygonoides*) and *khejri* (*Prosopis cineraria*) among grasses, bushes and trees, respectively. The total feeding cost per calf for 180 days was more in ISM than in SISM group, whereas the total cost per kg body weight gain was quite less and economical in the former as compared to the later group.

Key words: Behaviour, Camel, Economics, Farmers, Growth, Management systems

Camel population in India has declined (from 1.03 million to 0.63 million, FAO 2002) within a decade due to fast mechanization, increased irrigation, shrinkage of grazing/browsing land and decline in flora of arid region. The management system should focus on higher growth performance, suitable body conformation and good health status. Pathak *et al.* (2007) reported that the health of individual/herd of camels has its role extending from economics to public health. Accordingly, the present study was conducted with the major objective of investigating the effect of management system on growth performance, biometry, behaviour, level of different types of protein, biochemical attributes and economical intervention of camel calves.

MATERIALS AND METHODS

Grouping and management: Ten camel calves (*Camelus dromedaries*), around 7 to 10 months of age, belonging to NRC on Camel, Bikaner, were allotted randomly into 2 comparable groups of 5 each. The average initial body weight of 2 groups was more or less similar. As per the prevailing field practice, the hetero breed and sex combinations were kept in each group which contained 3 Jaisalmeri and 1 each of Bikaneri and Kutchi breed. Each group contained 4 males and 1 female. The first group was reared under intensive system of management (ISM) with concentrate supplementation @ 1 kg/camel/day. The second group was reared under semi-intensive system of management (SISM). All animals were sent for grazing/browsing daily for about 6 to 7 h and offered crop residues in the evening. The manger feeding consisting of crop residue of moth (*Phaseolus aconitifolius*) 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.

Growth and biometrical parameters: Initial body weight of the camel calves was recorded before shifting these calves to the respective treatment groups and thereafter all the experimental animals were weighed at fortnightly intervals

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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 these camels. The biometrical parameters (Higgins and Kock 1984) were recorded by measuring tape at fortnightly interval 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 to ensure maximum precision. The samples of concentrate and crop residue were collected at fortnightly interval for estimation of dry matter. The composite sample of concentrate and crop residue was analyzed for proximate principles (AOAC 1995).

Biochemical analysis: At the end of trial the blood samples were collected from all camels of both groups. The blood sample was not taken before initiation of trial because initially the composition of both group was almost similar. The samples were analyzed for biochemical attributes, concentration of total protein, albumin, globulin, calcium and phosphorus etc. The 2 ml of plasma was mixed with equal volume of nitric acid in Kjeldhal digestion tube. The samples were kept overnight and then heated over digestion bench at below 90°C up to half. After that 5 ml of double acid mixture containing 3 parts of nitric acid and 1 part of 70% perchloric acid was added to it and again digested, till white fumes emanated and the volume was reduced to 0.5 ml. The digested samples were cooled and diluted to 50 ml with distilled water. Calcium and phosphorus concentration were estimated using atomic absorption spectrophotometer. Triglyceride, urea, total protein, albumin and globulin in serum samples were estimated by kit method.

Behavioural aspect: The choice of vegetation (duration) by camel calf in range land area was observed twice in a week and the coded data were recorded on a five point scale which refers to the choice among bushes, grasses, trees, i.e. 1 point for 80 to 100%, 2 point for 60 to 79%, 3 point for 40 to 59%, 4 point for 20 to 39% and 5 point for 1 to 19% (Fraser 1988).

Economic and statistical analysis: The economic analyses of rearing of camel calves in different system of management as carried out by considering the feed cost. The statistical analysis of data was done using the paired - t test (Snedecor and Cochran 1989) and paired sample correlation method (Steel and Torrie 1981).

RESULTS AND DISCUSSION

Growth parameters: The average initial body weight was almost similar in 2 management groups (Table 1). After 180 days of trial period, mean body weight was significantly ($P<0.01$) increased in ISM as compared to SISM group. The average total gain was almost double in ISM group than SISM group after end of the trial. The average growth rate was significantly ($P<0.01$) higher in ISM than SISM group. The mean crop residue intake (from manger) was on higher side in ISM group than SISM group. The crop residue intake significantly ($P<0.05$) varied between groups.

The analysis of performance data under ISM revealed that total dry matter intake (DMI) was 5.09±0.39 kg/calf/day. The ratio between water intake and DMI was 1.96±0.16. The feed conversion efficiency was 11.72±0.75. The total DMI per 100 kg body weight was 2.27±0.12 kg/calf. Total intake per day per kg metabolic body size was 0.090±0.006 kg, since they were very young and growing animals. The average water intake (from trough) was also more in ISM as compared to SISM group but was statistically nonsignificant (Table 1). Singh *et al.* (2000) reported that the relationship between dry matter intake and growth of weaned calves was 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 g, respectively.

Table 1. The mean value of growth performance of camel calves in different systems of management

Parameters	Intensive system of management (ISM group)						Semi-intensive system of management (SISM group)				
	0 day	84 day	140 day	180 day	Overall		0 day	84 day	140 day	180 day	Overall
Body weight (kg)	170.0	211.2	243.0	274.2		**	165.0	188.4	204.6	220.2	
	±12.08	±12.08	±12.19	±13.07			±13.61	±12.23	±15.16	±15.02	
Total gain (kg)	–	41.2	31.8	31.2	104.2	**	–	23.4	16.2	15.6	55.2
Growth rate (g/day)	–	490	569	775	611	**	–	279	289	390	319
		±75	±61	±47	±60			±88	±73	±61	±71
Fodder intake (kg/day/calf)	3.6	5.5	6.4	6.6	5.53	*	3.19	4.09	4.99	5.19	4.37
	±0.61	±0.49	±0.37	±0.32	±0.29		±0.87	±0.56	±0.47	±0.39	±0.37
Water intake (lt/day/calf)	7.16	10.95	12.74	13.13	11.00	NS	6.64	10.59	12.46	12.88	10.64
	±1.79	±1.52	±1.53	±1.40	±1.50		±1.95	±1.82	±1.73	±1.62	±1.60

**Significant at 1%; *significant at 5%; NS, nonsignificant.

Table 2. The average ±SE of biometrical parameters of camel calves in different systems of management

Parameter	Intensive system of management				Semi-intensive system of management				
	0 day	90 day	150 day	180 day	0 day	90 day	150 day	180 day	
BL (cm)	82.4±5.3	105.8±4.1	116.2±3.3	121.2±3.5	81.9±4.8	99.6±4.5	105.2±4.1	112.6±3.4	**
HG (cm)	108.1±6.7	144.4±3.8	160.4±4.9	169.6±5.3	105.6±5.1	132.1±4.6	149.2±5.7	160.2±3.5	**
HW (cm)	127.1±3.3	149.8±3.5	161.8±4.1	172.2±3.1	126.7±3.5	138.8±3.8	152.1±3.5	163.2±3.5	**
HCH (cm)	31.6±3.8	47.1±3.6	63.4±3.5	71.2±3.5	31.1±3.6	45.3±3.9	57.4±3.9	67.3±3.5	**
HCV (cm)	12.1±4.1	24.3±3.7	28.1±4.1	31.5±3.9	10.0±2.8	21.4±3.5	26.3±3.7	28.4±4.1	NS
NL (cm)	62.6±5.3	77.8±5.4	86.2±3.5	91.8±3.5	61.2±3.6	70.2±4.9	81.8±3.6	90.1±3.5	**
LLF (cm)	103.1±3.3	116.2±3.4	124.2±3.5	130.2±3.5	101.0±3.3	109.3±3.7	118.2±3.4	127.2±3.5	**
LLH (cm)	108.1±4.0	121.3±3.6	131.8±3.6	137.2±3.7	106.0±3.3	114.5±3.2	122.2±3.6	132.8±3.3	*
FPLF (cm)	7.0±1.3	9.1±1.8	12.2±1.7	14.2±1.8	6.0±1.5	8.2±1.9	10.2±1.9	12.1±1.7	*
FPWF (cm)	6.0±1.1	8.2±1.6	11.3±1.5	14.1±2.1	5.0±1.1	7.1±1.8	10.0±1.7	13.2±1.6	*
FPLH (cm)	6.0±1.1	8.3±1.7	11.2±1.9	13.4±1.8	5.0±0.7	7.3±1.4	10.3±1.8	12.3±1.0	*
FPWH (cm)	5.0±1.1	7.1±1.5	10.4±1.8	12.3±1.9	4.0±1.1	6.5±1.8	9.1±1.7	11.2±1.5	*

**Significant at 1%; *Significant at 5%; NS, nonsignificant; 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 3. The positive correlations between body weights and biometry of camel calf in different systems of management

	Intensive System of Management (ISM)			Semi-intensive System of Management (SISM)			
	Body weight		Body weight		Body weight		Body weight
Body length	0.76	Footpad length (fore)	0.54	Body length	0.47	Footpad length (fore)	0.56
Heart girth	0.75	Footpad width (fore)	0.57	Heart girth	0.64	Footpad width (fore)	0.42
Height at wither	0.76	Footpad length (hind)	0.55	Height at wither	0.41	Footpad length (hind)	0.42
Neck length	0.71	Footpad width (hind)	0.62	Neck length	0.64	Footpad width (hind)	0.36
Leg length (fore)	0.72	Hump circumference horizontal	0.80	Leg length (fore)	0.49	Hump circumference horizontal	0.57
Leg length (hind)	0.67	Hump circumference vertical	0.73	Leg length (hind)	0.49	Hump circumference vertical	0.41

All values are significant at 1% level.

Biometrical parameters: The mean values of all biometrical parameters were more or less similar at 0 day of trial (Table 2). After 180 days of trial period the body length was 47.08% increased in ISM group whereas only 37.48% increment was in SISM group. The heart girth increased 56.89% in ISM group whereas in SISM group only 51.7% increment was obtained. The height at wither increased 35.48% in first group whereas only 28.80% increment was found in second group. The body length, heart girth, height at wither were significantly ($P<0.01$) increased in ISM group as compared to SISM group. After end of the trial, leg length (fore) was 26.29% increased in ISM group however only 25.94% increment was obtained in SISM group. Almost similar trend of increment was found in leg length (hind). The foot pad length (fore) was 102.86% increased in first group whereas slightly lower increment (101.67%) was obtained in second group. Proportionate higher growth of neck length, hump circumference (horizontal and vertical) were obtained in ISM group as compared to SISM group. The neck length, hump circumference (horizontal), leg length (fore) were significantly ($P<0.01$) increased in first group as compared to second group. The significant ($P<0.05$) variation was also observed for leg length (hind), foot pad length and

Table 4. The economic analysis for rearing of camel calves in different systems of management

Parameters	Intensive system of management	Semi-intensive of management
Total feeding cost for 180 days (Rs/calf) (Saras Gold Pashu Aahar and crop residue of moth)	3034	1843
Total feeding cost (Rs/day/calf)	16.85	10.24
Total cost (Rs)/kg gain	29.17	33.51

Table 5. Mean±SE of calves blood biochemical in different systems of management

Group	Triglyceride* mg/dl	Urea NS mg/dl	Total protein* g/dl	Albumin NS g/dl	Globulin* g/dl	Calcium NS mg/dl	Phosphorus NS mg/dl
ISM	34.79±3.67	30.92±4.78	6.28±0.26	2.39±0.27	3.89±0.34	8.56±0.48	4.93±0.64
SISM	19.05±2.92	28.79±1.97	4.67±0.40	2.72±0.33	1.95±0.32	7.55±0.58	3.49±0.95

*Significant at 5%; NS, nonsignificant.

width (fore and hind) between group (Table 2).

Correlations between body weight and biometry: Significant (P<0.01) and positive correlations between body weight and all biometrical parameters were observed in both the groups (Table 3). The body length, heart girth, height at wither, neck length, leg length (fore and hind), hump circumference (horizontal and vertical) were highly correlated with each other. It clearly indicated that growth of camel calves was mainly due to development of skeletal structure and muscular tissues. Development of hump circumferences (horizontal and vertical) were due to deposition of adipose tissues. Khanna *et al.* (1990) reported that significant correlation coefficients existed between body weight and heart girth and heart girth and leg length in Bikaneri, Jaisalmeri, Kutchi and Mewari breeds of camels.

Blood biochemicals: The level of triglycerides significantly (P<0.05) increased in ISM group as compared to SISM group. In level of urea, the variation was nonsignificant between the groups, although comparatively higher average level of urea was found in ISM group as compared to SISM group. The level of total protein significantly (P<0.05) increased in ISM group as compared to SISM group. The level of total protein was higher in all calves of first group as compared to that of second group (Table 5). The level of globulin significantly (P<0.05) increased in ISM group as compared to SISM group. This globulin level was higher in all calves of first group as compared to that of second group. The level of albumin varied nonsignificantly in first group and in second group.

Macro mineral status: The average level of serum calcium was slightly higher in ISM group as compared to that of SISM group. The average level of phosphorus was more in ISM group as compared to SISM group because mineral content of feed (concentrate) for ISM group was high. Jakhmola and Nagpal (1992) reported that calcium and phosphorus level in calves (1 year old) 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.

Behavioural aspects: The analysis of data on behavioural pattern and choice of vegetation of camel calves in rangeland area revealed that among the shrubs and bushes, first order of preference was *phog* (*Calligonum polygonoides*) followed by *pala* (*Zizyphus nummularia*), *muralikakani* (*Lysium barbarum linn*), *ker* (*Capparis deciduas*), *bui* (*Aerua pseudotomentosa*), *kheemp* (*Leptadenia pyrotechnica*) and *sinio* (*Crotolaria burhia*). The time devoted (in rangeland area) as 14% for *phog*, 11% for *pala* and *muralikakani*, 10% on *ker*, 9% for *bui*, 8% on *kheemp* and 7% for *sinio*. Among the grasses, first order of preference was *ganthia* (*Dactyloctenium aegypticum*) followed by *dachab* (*Cyperus rotundus*) and *sewan* (*Lasiurus sinducus*). The time devoted was 28% for *ganthia*, 24% on *dachab* and 18% for *sewan*. The grazing and resting cycle revealed that calves devoted 70% time for grazing/browsing and 30% time for resting during 6 to 7 h period in rangeland area. Among the trees, first order of preference was *khejri* (*Prosopis cineraria*), followed by Israeli *babool* (*Acacia tortilis*), *jal* (*Salvadora persica*), *ardu* (*Ailanthus excelsa*) and *neem* (*Azadirachta indica*). The time devoted as 18% for *khejri*, 16% for *babool*, 15% on *jal*, 14% for *ardu* and 7% on *neem*. Analysis of behavioural pattern of calf posture under intensive system of management revealed that maximum time involved in standing posture at first 0 to 2 h (95%) followed by 2 to 4 h (89%) of concentrate supply at manger. Then it was gradually reduced as the time lapsed. Maximum time involved in lying posture (10 to 12 h) during night time. The present findings are consistent with the observation of Bhakat *et al.* (2004) in different types of shelter management for camel.

Economic analysis: Almost all kind of costs for camel calves rearing was more or less similar except feeding cost (Table 4). The concentrate and crop residue of *moth* was used as feed materials. The total feeding cost (Rs) per calf for 180 days was more in intensive management group (Rs 3 034) than semi-intensive management group (Rs 1 843). Similarly, total feeding cost per day per calf was more in first group (Rs 16.85 versus Rs 10.24). Total cost per kg body weight gain was quite less in first group (Rs 29.17) as compared to the second group (Rs 33.51). Since, total body weight gain and average growth rates were quite high in first group, it was economical and better than second group.

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