

ON FARM TESTING OF CAMEL MANAGEMENT PRACTICES IN CHANGING AGRO-ECOLOGICAL SCENARIO

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ABSTRACT

In a feeding management experiment eight camel calves were allotted randomly into two equal groups and reared under stall feeding management condition (group-I) and under stall feeding along with grazing management practices (group-II) for a period of 173 days. The average growth rate, body weight and morpho-metric parameters viz: body length, heart girth, height at wither, neck length, and leg length (fore & hind) were significantly ($P < 0.01$) higher in group-II animals as compared to group-I. The horizontal hump circumference was found to be similar but vertical the hump circumference varied significantly ($P < 0.05$) between two groups. The ethological aspect of feeding behaviour indicated the order of feeding behavioural preference was for Khejri (*Prosopis cineraria*), followed by Phog (*Calligonum polygonoides*) and Ganthia (*Dactyloctenium aegyptium*) among trees, bushes and grasses, respectively. Overall better performance of group-II was due to higher plane of nutrition as compared to group-I. The levels of glucose, total protein and globulin were significantly ($P < 0.05$) higher in group II also indicated better management practices in group-II as compared to group-I. Similarly the average levels of serum calcium, phosphorus, zinc and iron as well as levels of hair minerals like sulphur, calcium, zinc and iron were also significantly ($P < 0.05$) higher in group-II than group-I. The total feeding cost per calf was higher in group-I as compared to group-II and due to it the cost involved for one kg body weight gain was quite less and economical in group-II than group-I. Thus the practice of stall feeding along with grazing management found to be better as compared to stall feeding alone for camel calf rearing.

Key words: Behaviour, bio-chemical, camel, economics, farmers, mineral, performance

The traditional extensive camel rearing practice is being replaced by either rearing camel under intensive or semi-intensive systems where no or limited grazing is allowed as a result of increased urbanisation, use of land for growing food crop on a large scale and shrinkage of grazing land and browsing area. Despite low inputs in the extensive practice, the growth, behaviour and overall performance of camel is also affected which is not economical in long run as the animal require more than 3 to 4 years to attain body weight (BW) of 350 to 400 kg when animals are put to use by the farmers or camel users. The alternate management practices should be aimed at achieving higher growth performance, suitable morpho-metric conformation, good health and behavioural status requiring lower economic intervention and which should be socially acceptable and economically viable for effective use of camel's bio-energy. After achieving the desirable BW, morpho-metric conformation also need to reach to a level suitable for putting the camel to work such as carting/agricultural operations, thereby becoming economically sustainable. Accordingly, the

present study was conducted with major objective to study the influence of management practices on growth performance, morpho-metric conformation, behaviour, macro and micro minerals, biochemical attributes and economics of practices for scientific rearing.

Materials and Methods

The experimental groups: Eight camel (*Camelus dromedarius*) calves, aged about 1 to 2 year, belonging to National Research Centre on Camel, Bikaner were allotted randomly into 2 comparable groups on the basis of BW. To maintain hetero breed and sex combination, 2 animals each of Bikaneri and Jaisalmeri breed camels were kept and sex wise each group was having one male and 3 female camel calves.

Management practices: During experimental period of 173 days 2 different management practices were offered as stall feeding alone (group-I) and stall feeding with supplements in the morning and fodder in the evening and in addition to daily grazing / browsing for about 6 to 7 hours (group-II). The

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groundnut fodder (*Arachis hypogaea*) was provided to both groups in the manger and daily once watering was done for all camels in both the groups.

Growth variables: The BW of camel calves were recorded at fortnightly intervals before offering morning feed and water, consecutively for two days and average weight was considered.

Morpho-metric parameters: The morpho-metric parameters were recorded by measuring tape at fortnightly intervals before morning feeding when camel was standing evenly on foot pad with neck elevated to a normal position on plain ground level for the maximum precision. The height was measured with the help of height measuring stand (Higgins and Kock, 1984).

Ethological aspects: The behavioural pattern and the choice of vegetation by camel calves in the 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 trees, bushes and grasses, i.e. 1 point for 80 to 100%, 2 points for 60 to 79%, 3 points for 40 to 59%, 4 points for 20 to 39% and 5 points for 1 to 19%, according to Fraser (1988) scale.

Hair sampling: In order to study the accumulation of minerals the hair samples were collected from shoulder, neck, hump and mid region of body of camel calves at the end of experimentation. The hairs were cut with the stainless steel scissors into pieces of about 1 cm length from each region and mixed well to ensure homogeneity and proper skirting of sample was done. After its washing with acetone the samples were filtered, rinsed with adequate deionised water and were dried in hot air oven and for further processing 0.5 g of dried mass was taken.

Analysis of hair for minerals status by AAS: The 2 ml concentrated HNO₃ was added to each hair samples and were kept at 100°C until half of the total volume had evaporated. The samples that were cooled, 2 ml concentrated perchloric acid was added and was again kept until half of the total volume had evaporated. There after with distilled water the volume of 10 ml was made up (Brown and Taylor, 1995) which was used for determination of important macro and micro-minerals using standards for different elements.

Blood biochemical and mineral estimation: At the end of experimentation the blood serum samples collected from all camel calves of both groups were analysed for glucose, total protein, albumin, globulin and urea. The important macro and micro serum

minerals viz: calcium, magnesium, phosphorus, copper, zinc, manganese and iron were estimated using atomic absorption spectrophotometer.

The economics of management practices: The economics of experimental management practices of camel calves were analysed by considering the feed cost in each group. The tabular analysis was carried out.

Statistical analysis: The experimental data were analysed by paired - t test (Snedecor and Cochran, 1989) for all parameters.

Results and Discussion

The growth variables: During period of experimentation the average BW (Kg) and growth rate (g/d) were significantly ($P < 0.01$) higher in group II animals (290.21±9.35 , 316.67±68.84, respectively) as compared to group I (275.20±11.32 , 262.38±62.18, respectively). The average total gain (Kg) during the experimental period was higher in group-II (61.61) than group-I (51.09) (Table 1). The average daily gains in early age of 2 months old Bikaneri and Jaisalmeri calves were observed to be higher 553.3 and 546.6 gm, respectively (Sahani *et al*, 1992). The present data is consistent with the earlier reports.

Table 1. The comparative growth performance (average±SE) of camel calves in different management practices.

Sl. No.	Parameters	Group	
		I	II
1	Body weight (Kg)		
	a) Initial	224.11±12.35	228.60±10.45
	b) Final **	275.20±11.32	290.21±9.35
	c) Total gain **	51.09±10.26	61.61±10.15
2	Growth rate ** (g/d)	262.38±62.18	316.67±68.84
3	Feed Intake (kg / d / calf)		
	a) Total	5.81±1.86	4.43±1.96
	b) DMI	5.27±0.61	3.98±0.75
	c) % DMI	2.24±0.43	2.11±0.98
	d) Kg / W ^{0.75}	0.89±0.008	0.81±0.009
4	FCR (kg/ kg body weight gain)	12.75±0.85	12.96±0.99
5	Water Intake (l/d)	10.81±1.74	10.33±1.87
6	W.I (l)/ kg DMI	1.99±0.83	1.97±0.88

** Significant at 1%

During whole experimental period the average feed intake in group II animals was found comparatively less than group-I as the group-II animals seemed to have fulfilled the daily feed requirement during grazing/browsing which was

allowed for 6-7 hr daily. The average DMI for group-I calf was 5.27 Kg which was 2.24% of BW and the FCR was 12.75 whereas the average DMI for group- II calf was 3.98 Kg which was 2.11% of BW and the partial FCR was 12.96. Bhakat and Nagpal (2005) found different intakes in camels reared under different management conditions despite similar dry matter content of fodder. Singh *et al* (2000) reported positive relationship between dry matter intake and growth of weaned camel calves.

The average water intake (l/d) was slightly higher (10.81) in case of group-I as compared to group-II (10.33) although the variation was non-significant and water intake /Kg DMI was similar in both groups. Tandon *et al* (1993) found that dry fodder intake and water intake were positively correlated.

Ethological aspects: The analysis of data on feeding behavioural pattern and choice of vegetation of camel calves in rangeland area revealed that among trees the first order of preference was for Khejri (*Prosopis cineraria*), followed by Jal (*Salvadora persica*) and Ardu (*Ailanthus excelsa*). The time devoted for browsing the tree was 31% for Khejri, 21% for Jal and 18% on Ardu. The grazing and resting cycle revealed that camel calf devoted 70% time for browsing / grazing and 30% time for resting during 6 to 7 hours period in rangeland area. Among the bushes and shrubs, first order of preference was Phog (*Calligonum polygonoides*) followed by Pala (*Zizyphus nummularia*), Muralikakani (*Lysium barbarum linn*), Ker (*Capparis deciduas*), Bui (*Aerua pseudotomentosa*) and Kheemp (*Leptadenia pyrotechnica*). The time devoted for grazing the bushes and shrubs (in rangeland area) was 16% for Phog, 15% on Pala, 12% for Muralikakani, 11%

on Ker, 10% for Bui, 6% on Kheemp. Among the grasses first order of preference was for Ganthia (*Dactyloctenium aegyptium*), followed by Dhaman (*Cenchrus setigerus*) and Sewan (*Lasiurus sinducus*), Gramina (*Penicum antidotale*), Dhamasa (*Fagonia indica*), Boor (*Andropogan lamiges*) and Bhurut (*Cenchrus biflorus*). The time devoted for grazing the grasses was 18% for Ganthia, 12% on Dhaman, 10% for Sewan, 9% on Gramina, 8% for Dhamasa, 7% on Boor and 6% for Bhurut.

Analysis of behavioural pattern of calves reared in group- I practice revealed that maximum time involved in standing posture was for 0 to 2 hours (80%), when groundnut fodder supplied at manger. There after it was gradually reduced as the time elapsed. Maximum time involved in lying posture was 10 to 12 hours at night time. The present findings are consistent with the observation of Bhakat *et al* (2004).

Morpho-metric parameters: During the period of experiment body length, heart girth, height at wither, neck length, and leg length (fore & hind) were found significantly higher (P<0.01) in group-II as compared to group-I (Table 2) which is due to development of skeletal structure and muscular tissues mainly. There was no much variation observed in the hump circumference (horizontal) but the hump circumference (vertical) was found significantly (P<0.05) higher in group-II as compared to group-I. Development of hump circumferences of horizontal type and vertical type were mainly due to deposition of adipose tissue.

Bio-chemical attributes, serum mineral and hair mineral status: The bio-chemical parameters of glucose, total protein, and globulin were significantly (P<0.05) higher in group-II as compared to group-I whereas

Table 2. The average \pm S.E of morpho-metric parameters of camel calves in different management practices.

Parameters	Group							
	I				II			
	Initial	60 D	120 D	173 D	Initial	60 D	120 D	180 D
BL** (cm)	103.5 \pm 7.8	106.75 \pm 7.4	108.75 \pm 6.5	111.75 \pm 6.3	104.75 \pm 8.1	108.25 \pm 7.9	113.25 \pm 6.8	116.25 \pm 6.6
HG** (cm)	143.75 \pm 6.7	146.75 \pm 6.5	150.5 \pm 6.4	154.5 \pm 5.7	144.25 \pm 6.9	149.25 \pm 6.8	155.25 \pm 6.4	160.5 \pm 5.4
HW** (cm)	151.5 \pm 5.9	154.5 \pm 5.7	157.0 \pm 5.1	160.0 \pm 4.8	152.75 \pm 5.7	156.0 \pm 5.2	162.5 \pm 4.9	165.5 \pm 4.5
HCV* (cm)	23.0 \pm 5.6	25.0 \pm 5.8	26.0 \pm 4.9	30.5 \pm 4.4	24.0 \pm 5.8	27.0 \pm 5.2	28.0 \pm 4.7	31.0 \pm 4.2
HCH (cm)	50.75 \pm 5.7	52.5 \pm 5.5	55.75 \pm 4.9	58.75 \pm 4.3	51.0 \pm 5.8	55.0 \pm 5.7	55.5 \pm 4.8	58.5 \pm 4.4
NL** (cm)	75.25 \pm 5.3	78.25 \pm 5.6	80.25 \pm 4.8	82.25 \pm 4.7	76.75 \pm 5.7	80.0 \pm 5.2	85.25 \pm 5.5	87.25 \pm 4.2
LLF** (cm)	114.0 \pm 5.3	116.0 \pm 5.0	117.0 \pm 4.8	119.25 \pm 4.7	115.5 \pm 5.9	117.5 \pm 5.7	121.25 \pm 4.8	124.25 \pm 4.5
LLH** (cm)	123.75 \pm 5.9	125.5 \pm 5.8	126.75 \pm 5.4	127.75 \pm 5.3	124.75 \pm 5.8	126.5 \pm 5.6	130.5 \pm 4.9	132.5 \pm 4.4

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

Note - D: day, 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).

the level of urea and albumin in both the groups was similar.

Table 3. Serum biochemical attributes and minerals status (average±S.E) of camel calves in different management practices.

Parameters	Group	
	I	II
Glucose* (mg/dl)	76.52±4.95	85.02±5.20
Albumin (g/dl)	3.06±0.14	3.14±0.23
Total Protein* (g/dl)	4.29±0.42	6.22±0.29
Globulin* (g/dl)	1.53±0.19	3.06±0.30
Urea (mg/dl)	36.09±5.56	33.31±2.34
Serum minerals		
Calcium* (mg/dl)	8.71±0.46	10.76±0.68
Magnesium (mg/dl)	3.25±0.22	3.77±0.25
Phosphorus* (mg/dl)	4.14±0.31	5.57±0.25
Copper (ppm)	1.2±0.35	1.6±0.41
Zinc* (ppm)	1.07±0.25	1.65±0.24
Manganese (ppm)	0.48±0.21	0.65±0.13
Iron* (ppm)	25.33±2.74	32.50±1.36
Hair minerals		
Sulphur* (mg/dl)	6.77±0.48	7.70±0.71
Calcium* (mg/dl)	124.73±10.44	176.60±10.57
Magnesium (mg/dl)	79.25±8.15	89.12±6.56
Zinc* (ppm)	65.15±1.84	70.80±2.69
Copper (ppm)	4.10±0.17	4.22±0.35
Iron* (ppm)	274.00±26.58	354.05±21.58
Manganese (ppm)	23.00±2.97	18.80±1.94

* Significant at 5%

The blood mineral levels revealed that calcium, phosphorus, zinc, iron significantly ($P<0.05$) increased in group-II as compared to group-I.

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 Zlotkin, 1985). Kayar *et al* (2004) reported that levels of some elements are affected to a higher or lower degree by nutritional differences in horse. The hair mineral estimation is considered as an economic tool for determination of nutritional status. 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 levels of mineral in camel hair can be used in the diagnosis of various diseases and metabolic

disorders. The analysis of hair minerals also indicated significantly ($P<0.05$) higher level of sulphur, calcium, zinc, iron in group-II animal which all together indicated better plane of nutrition for the animal reared in group-II. It may be due to grazing with additional supplement which might have improved the blood bio-chemical attributes, serum mineral and hair mineral status. Similar results of higher level of serum calcium and phosphorus in camel calf supplemented with barley have been reported by Jakhmola and Nagpal (1992).

Table 4. The economic analysis for camel calf rearing in different management practices.

Parameters	Group	
	I	II
1. Total Feed cost (Rs):		
a) Group	20104	15328
b) Per animal	5026	3832
c) Per head per day	29.05	22.15
2. Cost per kg body weight gain (Rs / Kg)		
	98.37	62.19

Economics of management practices: During experimental period the cost of feeding of camel calves intensively in group-I was higher (INR 20104) as compared group-II (INR 15328) calves managed under semi-intensive system which on an average comes to Rs. 5026 and Rs. 3832 per calf for group-I and group-II, respectively (Table 4) however the quantity and cost of feed intake during grazing was not taken into account in group II. The average feeding cost per day per calf for group-I was higher (Rs. 29.05) as compared to group-II calves (Rs. 22.15) but because of better gain in group II, the cost of feed per kg BW gain was quite less in (Rs 62.19) as compared to group-I (Rs 98.37). This is mainly because of saving of feed on account of grazing / browsing which although was not accounted but because animals were sent for grazing the nutritional supplement provided to group-II calves was required in less quantity. Hence looking into the advantage of rearing the camel calves under the management of grazing plus supplement practice, it would be economical for camel farmer in the region to provide nutritional supplements for faster gains and acceptable conformation than feeding camels either alone in extensive or intensive system of management.

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