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Effect of grazing period management on growth performances of camel in climate change condition

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ABSTRACT

In order to decide the optimum time of grazing for camels during hot summer months, 10 growing camel calves were divided into 2 equal groups. First group was sent for grazing during 10:00 h to 16:00 h daily and second group allowed for grazing during thermo neutral period. The climatic variables were recorded daily (April 2012 to March 2013). The average daily gain and total body weight gain in calves sent for grazing during relatively cool parts of day (group 2) was significantly higher as compared to group 1 calves sent as per routine farm schedule. The average intake of fodder and water from manger was higher in group 1 calves. The average DMI from manger for group 1 calves was higher as compared to group 2 calves. The comparative biometrics of camel calves in different grazing management practices revealed that body length, heart girth, height at wither, neck length were significantly ($P<0.01$) higher in group 2 calves as compared to group 1 calves. After 180 days of experimentation, hump circumference vertical and hind leg length were significantly ($P<0.05$) increased in group 2 as compared to group 1. Analysis of recorded data of climatic parameters revealed that average maximum temperature was higher during June 2012. The values of THI also were higher in monsoon and post monsoon months hence the practice of sending camel calves during relatively comfortable part of hot and hot humid months was successful in getting good growth. The relative humidity was significantly higher during morning as compared to evening period for all months. The THI was significantly lower during morning as compared to evening hours for all months in different climate for whole year. Economic analysis reveals that the cost of feed per kg body weight gain was quite less in group 2 as compared to group 1. So the practice of grazing of camel calves during cool hours of day remain profitable for farmers by looking at the body weight gain and better body conformation in climate change condition.

Key words: Biometrics, Camel, Climate change, Economics, Farmers

Recently in climate change conditions, camel face problem of hyperthermia along with humidity hazards in desert ecosystem. It is mainly due to harsh environment, high temperature, solar radiation and continuously increasing humidity level. Heat stress negatively impacts on growth and general health of camels and thus affects profitability of farmers. Sudden hyperthermia or heat strokes often result in loss of precious animals. Wide variation in thermo adaptability of camel in harsh desert climate is a limiting factor for optimum growth performances. The knowledge about grazing management practices to ward off heat stress will help in timely intervention by farmers, which can save loss in terms of camel life and help in sustaining animal's performance. The alternate grazing management practices should be aimed at achieving higher growth performance, suitable biometrical attributes and good health status requiring lower economic intervention and which should be socially acceptable and economically viable for effective use of camel's bio energy. Accordingly, the present study was conducted for grazing period management of camel calves which is very necessary for estimation of growth performances, biometrical attributes and economics of management practices in climate change scenario.

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MATERIALS AND METHODS

The experimental groups: Camel (*Camelus dromedarius*) calves (10), aged about 9 to 24 months, belonging to National Research Centre on Camel, Bikaner were allotted randomly into two comparable groups on the basis of body weights. To maintain hetero breed and sex combination, 3 animals each of Bikaneri and 1 animal each of Jaisalmeri and Kachchhi breed camels were kept in each group and sex wise each group was having five female camel calves.

Management practices: During experimental period of 180 days, two different management practices were offered as common /routine management practice for grazing between 10:00hrs to 16:00 hrs daily for 6 hrs (group 1) and grazing during thermo neutral period between 4 hours early morning (06:00 to 10:00h) and 2 h late evening (18:00 to 20:00 h) for about 6 h (group 2). After the grazing, manger

Table 1. The comparative growth performance of camel calves in different grazing management practices

Parameters	Unit	Group 1	Group 2
Average initial body weight ^{ns}	kg	219.60 ± 12.40	223.80 ± 10.11
Average body weight ** after 180 days	kg	274.20 ± 12.36	291.20 ± 9.98
Total gain	kg	54.60	67.40
Average growth rate **	g / day	303.34 ± 69.18	374.45 ± 77.26
Average fodder ^{ns} intake(manger)	kg / day / animal	4.87 ± 1.65	3.61 ± 1.92
Average water ^{ns} intake(trough)	Lt / day / animal	10.72 ± 1.68	10.11 ± 1.93
Economic analysis			
Total feeding cost for 180 days for each practice	₹ / group	35064	25992
Total feeding cost for 180 days	₹ / animal	7012.8	5198.4
Total feeding cost	₹ / day / animal	38.96	28.88
Cost / unit benefit (BCR)	₹ / kg gain	128.44	77.12

** Significant at 1%; NS, nonsignificant.

feeding with groundnut haulms *(Arachis hypogaea)* mixed with guar crop residue *(Cyamopsis tetragonoloba)* in 50:50 ratio was done and daily once watering was done for all camels in both the groups as *ad lib*.

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

Biometrical parameters: The biometrical parameters were recorded by measuring tape at monthly 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 and due care was taken to avoid any kind of error. Body length of camel measured as the distance between shoulder to pin bone and heart girth was measured as circumference of thorax just behind the point of elbow. The height was measured with the help of height measuring stand (Higgins and Kock 1984) as distance from ground level to top end of third thoracic vertebra. Leg length, fore measured as the distance between point of elbow to foot pad and hind was measured as distance between hip joint to food pad. Hump circumference horizontal measured as circumference of base of hump where as hump circumference vertical was the distance from lateral base of hump over it's highest point to the base on opposite side. Neck length was measured as distance between base of neck to posterior ventral aspect of lower mandible.

Climatic parameters: The climatic variables were recorded from April'12 to March'13 daily, morning and evening time period at camel keeping place. Observations recorded of some important parameters like maximum temperature, minimum temperature, dry bulb temperature, wet bulb temperature and relative humidity. The Temperature Humidity Index (THI of McDowell 1992) was worked out with the help of dry bulb and wet bulb temperature which was recorded daily at 9:00–10:00 h and 15:00–16:00 h for 12 months covering all climatic conditions.

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

Statistical analysis: The experimental data were analyzed by paired t-test according to Snedecor and Cochran (1989). The paired t-test was also applied to find out the difference between morning and evening relative humidity and Temperature Humidity Index for whole year.

RESULTS AND DISCUSSION

The growth variables: During period of experimentation the average body weight (kg) and growth rate (g/d) were significantly ($P<0.01$) higher in calves sent for grazing during relatively cool parts of day (group 2) (291.20 ± 9.98, 374.45 ± 77.26, respectively) as compared to group 1 (274.20 ± 12.36, 303.34 ± 69.18, respectively) calves sent as per routine farm schedule as common management practice. The average total gain (kg) during the experimental period was higher in group 2 (67.40) than group 1 (54.60) (Table 1). The average intake of fodder from manger was higher in group 1 calves as compare to group 2 calves. It may be due to the group 1 calves compensated their less intake from rangelands which might have been hot during part of the grazing activity done during day hours and while these animals were housed and were manger fed the group 1 calves during cooler part had higher intake of fodder than group 2 calves. The group 2 calves sent for grazing during cool hours of day might have had sufficiently high intake from rangelands and obviously had less intake from mangers. 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 g, respectively (Sahani *et al*. 1992). The present data is consistent with the earlier reports. Patil *et al.* (2006) reported that Ciliaris and top feeds loong (*P.cineraria* leaves) were used in weaner kids found to provide marketable body weights at 9 months age and were found to be economical.

The average DMI from manger for group 1 calf was 4.38 kg/animal/day whereas the average DMI from manger for group 2 calf was 3.24 kg/ animal/day. During whole experimental period the average DMI from manger in group 2 animals was found comparatively less than group 1 as the group 2 animals seemed to have fulfilled the feed

Table 2. The average ± SE of biometrics (cm) of camel calves in different grazing management practices

	Group 1				Group 2			
	Initial	60 D	120 D	180 D	Initial	60 D	120 D	180 D
BL**	105.2 ± 7.8	107.2 ± 7.1	109.8 ± 5.9	112.4 ± 5.7	106.8 ± 7.2	108.4 ± 6.8	114.2 ± 7.3	117.4 ± 7.4
HG**	144.6 ± 5.9	147.2 ± 6.5	151.4 ± 5.9	154.2 ± 5.3	145.4 ± 5.4	150.4 ± 5.9	156.4 ± 5.7	161.5 ± 5.2
HW**	152.8 ± 6.5	155.4 ± 6.2	158.2 ± 5.8	160.2 ± 5.7	153.4 ± 6.7	158.6 ± 5.9	163.4 ± 6.1	166.4 ± 5.2
HCV*	24.0 ± 6.3	25.2 ± 6.1	25.8 ± 5.9	28.2 ± 5.1	25.6 ± 5.5	26.8 ± 5.5	28.4 ± 5.1	31.4 ± 4.9
HCHNS	53.4 ± 7.2	55.4 ± 6.7	57.4 ± 5.5	59.8 ± 4.8	54.2 ± 7.0	58.8 ± 6.3	63.8 ± 5.6	68.6 ± 5.2
NL**	75.2 ± 4.1	76.2 ± 5.3	80.4 ± 4.1	81.6 ± 4.3	76.2 ± 4.6	78.0 ± 5.3	83.2 ± 6.7	85.8 ± 4.1
LLFNS	115.4 ± 6.9	116.4 ± 6.1	117.8 ± 5.4	119.4 ± 4.3	116.6 ± 6.9	118.6 ± 5.2	122.2 ± 5.1	124.6 ± 4.1
LLH*	123.2 ± 6.6	124.6 ± 5.4	126.6 ± 5.9	128.0 ± 4.2	123.6 ± 6.2	127.0 ± 5.1	131.2 ± 5.2	132.4 ± 4.3

** Significant at 1%, * significant at 5%, NS, non significant. 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).

requirement during grazing/browsing which was allowed during thermo neutral period daily. Actually, total heat load in a camel was a combination of climatic heat, metabolic heat (heat produced by the animal's body processes) and fermentation heat (heat produced as part of digestion). Singh *et al.* (2000) reported positive relationship between dry matter intake and growth of weaned camel calves. Champak *et al.* (2004) found different intakes in camels reared under different management conditions despite similar dry matter content of fodder. The average water intake (l/d) was slightly higher (10.72 ± 1.68) in group 1 as compared to group 2 (10.11 ± 1.93) although the variation was nonsignificant 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.

Biometrical parameters: During the period of experiment body length, heart girth, height at wither and neck length were found significantly higher (P<0.01) in group 2 as compared to group 1 (Table2) which is due to development of skeletal structure and muscular tissues mainly. There was no much variation observed in the hump circumference (horizontal) but it was comparatively increased in group 2 than group 1 after 180 days of experimentation but statistically non significant. The hump circumference (vertical) was found significantly (P<0.05) higher in group 2 as compared to group 1. Hind leg length significantly (P<0.05) increased in group 2 as compared to group 1 whereas front leg length comparatively increased in group 2 than group 1 after 180 days of experimentation but variation was statistically non significant. Development of hump circumferences of horizontal type and vertical type were mainly due to deposition of adipose tissue. A direct climatic consequence is the stimulation of neuro endocrine system, resulting in the loss of heat to maintain the body temperature within the narrow optimal range for biological activity. During climatic stress, camel makes every attempt to maintain a constant condition of entire body at the cost of it's energy available. Higher development of skeletal structure and muscular tissues in group 2 may be due to better feed utilization as compared to group 1. The heat associated with digestion of feed, peaks about 3 to 4 h after feeding. By grazing in early morning, the heat of digestion peaks at 9:00 to 11:00 h, and allows the camel to dissipate some of that heat before the day reached to its maximum temperature. The camel graze at 10:00 hrs onwards had it's peak of heat production at 14:00 h to 15:00 h when the day reached to its maximum temperature, which was undesirable. Similarly, camel graze during the evening were more comfortable to consume feed and their peak of heat production occurred during the night, when climatic temperatures became lower. 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. Choudhary and Tiwari (2010) concluded that *ad lib* feeding of moth straw supplemented with high energy concentrate mixture resulted in improved nutrients utilization and draught performances by camel without any apparent ill effect on the health.

Climatic parameters: Analysis of recorded data of desert climatic parameters during experimental months revealed that April to June months remain relatively hotter and mean value of maximum temperature (Fig. 1) was higher during June 2012 month (46.4°c). The drop in temperatures was progressive from June up to September but generally the

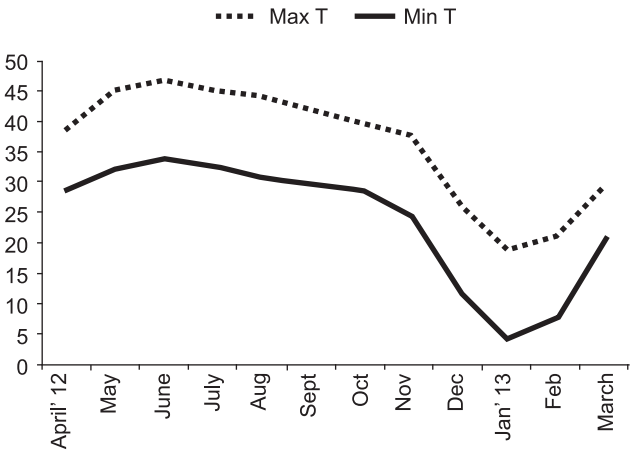

Fig. 1. Average maximum and minimum temperature (°C) of desert climate during different months.

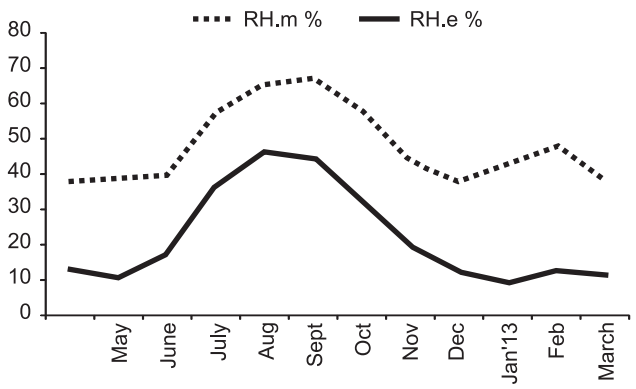

Fig 2. Average values of relative humidity (%) of desert climate during different months and periods.

maximum temperature still remains 40°C and above in September, October months. Further the values of THI also were higher in monsoon and post monsoon months hence the practice of sending camel calves during relatively cooler part of hot and hot humid months was successful in getting good growth and better body conformation. Climatic temperature drops at the lowest level during January 2013 (18.3°c) and it rises during March 2013 (29.0°C). The average value of minimum temperature was the lowest during January'2013 (4.5°C) and the highest during June 2012 (33.5°C). Dry bulb temperature and wet bulb temperature were recorded during morning and evening time and based on it relative humidity was calculated. The relative humidity of desert climate varied greatly among the different months (Fig. 2). It ranged from 37.7 to 67.0% during morning hours whereas during evening period it ranged from 8.7 to 45.3% from April'12 to March 2013. The relative humidity was significantly ($P < 0.01$) higher during morning as compared to evening period for all months.

The great variation was found for THI value during different months. Based on these variations present desert climate were categorized into 3 broad categories viz. hot dry, hot humid, cold dry climate. The THI was significantly ($P < 0.01$) lower during morning as compared to evening hours. The morning and evening variations were significant ($P < 0.01$) for all months in different climate from April 2012 to March 2013. The morning THI varied from 61.0 to 82.56 whereas evening THI varied from 67.24 to 89.24 during these months. The highest THI was during evening period of September 2012 (89.24) where as the lowest THI was during morning period of January 2013 (61.0). The heat stress condition prevailed from second week of April 2012 to fourth week of September 2012 followed by comfort period was first week of October 2012 to third week of December'12. The cold stress condition prevailed from fourth week of December 2012 to first week of February 2013 whereas comfort period was fourth week of February 2013 to fourth week of March 2013. Chandrabhan *et al.* (2013) found that significant seasonal variations in hematological parameters in all age group of cattle and buffaloes.

Economics of management practices: During experimental period the cost of feeding of camel calves in group 1 was higher (₹ 35,064) as compared group 2 (₹ 25992) calves which on an average comes to ₹ 7,012.8 and ₹ 5,198.4 / calf for group 1 and group 2, respectively (Table 1). The average feeding cost per day per calf for group 1 was higher (₹ 38.96) as compared to group 2 calves (₹ 28.88) but because of better body weight gain in group 2, the cost per unit benefit in terms of cost of feed per kg body weight gain was quite less in group 2 (₹ 77.12) as compared to group 1 (₹ 128.44). This is mainly because of saving of feed from manger on account of better grazing during cooler parts of day. So, manger feed provided to group 2 calves was required in less quantity as compared to group 1. Patil (2006) reported that the livestock rearing as the major component of arid agriculture remains an active drought proof activity as can be visualized in the state of Rajasthan.

Hence looking into the advantage of grazing of camel calves during early morning and late evening, it would be economical for camel farmer in the region to provide this grazing strategy for faster gains, better feed utilization and acceptable conformation than grazing of camels during routine /common period.

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