

Feedlot Performance, Serum and Wool Mineral Analysis of Marecha (*Camelus dromedarius*) Calves Fed Different Dietary Regimes

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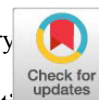
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Authors' Contribution

AF conducted research and wrote the paper. AW helped in Statistical analysis. NAT helped in write up. MSN helped in experimental work.

Key words

Growth, Blood, Biochemicals, Wool minerals, Camel calves

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ABSTRACT

The aim of present study was to evaluate the growth performance, blood biochemical and wool mineral profile of Marecha camel calves kept under intensive management system by feeding two different dietary regimes. The study was carried out at Camel Breeding and Research Station, Rakh Mahni Tahsil, Mankera District Bhakkar Punjab, Pakistan. Twelve male calves around one year of age were raised in stall-fed conditions by feeding two different diets. In roughage proportion lucerne and gram straw were fed. Daily feeding allowance was offered as 3% body weight. Water was provided twice a day. Non-significant daily weight gain (DWG) was observed as 948 ± 40 and 991 ± 30 g/d while dry matter intake (DMI) of concentrate, fodder and gram straw was 2.9 ± 0.15 , 3.0 ± 0.16 and 1.5 ± 0.08 ; 2.9 ± 0.07 , 3.0 ± 0.07 and 1.3 ± 0.03 kg/d with diet 1 and 2, respectively. Haemoglobin concentration ($P < 0.05$) was found to be 16.4 ± 0.14 and 16.8 ± 0.09 (g/dl) with diet 1 and 2, respectively. Cu and Mn concentrations in wool also differed significantly ($P < 0.05$) between two groups and were found to be 7.4 ± 0.3 , 8.1 ± 0.19 and 48.4 ± 1.1 , 54.0 ± 1.5 mg/dL with diet 1 and 2, respectively. The results indicate that Marecha has a good growth potential which can be manipulated by modern husbandry practices.

INTRODUCTION

Pakistan is well known for its camel population and ranks 8th in the world with 1.1 million heads (FAOSTAT, 2019; GOP, 2019-20). Camels in Pakistan are very well adapted to their native environment and can sustain life in hot and harsh deserts. The dromedary camel is the best source of milk and meat, especially for areas where production performance of other animals is adversely affected by the harsh environmental conditions (Faraz *et al.*, 2019). This is due to the dromedary camel's unique physiological characteristics that enable to tolerate higher temperatures, solar radiations, water scarcity, poor vegetation and rough topography.

In arid areas camels constitute the most important source of meat (Faraz, 2020). Mostly they are raised under traditional management systems as pastoralists are always moving over large areas in search of food and water for their camels (Omer *et al.*, 2008). The camel is an indigenous genetic resource; which needs to be managed and preserved properly. Different studies highlight its unique characteristics, especially under a stress environment. To meet the rapidly growing demands of an exploding population, the strategic idea is to minimize the

dependence on external food supply. There is a need to recognize the place of camel in farm animals and to get increased output from indigenous genetic resources that have not been exploited yet.

Camel plays an indispensable role in the social life and economy of the people of arid and semi-arid areas in various regions of the world. Despite its significant contribution to the livelihood of pastoral society which does not have any alternate mode of production, the camel is one of the most neglected specie. Very few attempts have been made so far to characterize the camel's production potential and related parameters. In traditional management systems, the camel productive traits are low so traditional camel husbandry has no future (Bakheit *et al.*, 2012).

The camel husbandry system is in a state of flux as pastoralists are deviating from their traditional management system to semi-intensive and intensive management system. This rapidly changing scenario needs overall evaluation and there is an urgent need to undertake multi-disciplinary studies (Khan *et al.*, 2003). In Pakistan, most of the research work on production potentials of camel has been done under traditional management systems, without consideration of production systems

(Iqbal *et al.*, 2001). Research work done so far is mostly on moving herds, a lot of work has been based on survey studies under traditional management system. The need for intensive study was realized to obtain the primary data on Pakistani camels. Their production potential exploration is necessary to build a country's database for future studies and to explore export potentials. Realizing this, the present study, with the objective of exploring the growth performance of Marecha camel under intensive management system, was conducted to describe the growth rate, blood biochemicals and wool mineral status. This study provides a pioneer work considering the management system and it will pave the way for further investigations on Marecha camel that could be helpful in improving the life of pastoralists as well as the people of arid and semi-arid areas in Pakistan.

MATERIALS AND METHODS

Meteorological conditions of study area

Most of the area of Camel Breeding and Research Station lies in the desert plain of Thal. The climate is arid to semi-arid subtropical continental and mean monthly highest temperature goes up to 45.6 °C, while in winter it goes from 5.5 to 1.3 °C. Mean annual rainfall in the region ranges from 150-350 mm, increasing from South to North (Rahim *et al.*, 2011).

Animal management

Before the start of experiment, the Marecha calves were marked for identification by color demarcations on neck region and were dewormed with Ivermectin at the rate of 1ml/50kg bodyweight to reduce the parasitic load. Calves were housed in semi-open pens throughout the trial. Initial body weights of the camel calves were recorded before shifting them to the respective treatment groups and thereafter all the experimental calves were weighed fortnightly before their morning feeding. The trial was of 120 days with two weeks as adaptation period.

Experimental animals and feeding plan

Twelve male camel calves (*Camelus dromedarius*) around one year of age were used in 120 days trial to study their growth rate. They were raised in two groups with six calves each under stall-fed conditions (intensive management system, IMS). Calves were offered roughage+concentrate at the ratio of 60:40. In 60 proportions the ratio between lucerne (*Medicago sativa*) and gram crop straw (*Cicer arietinum*) was 70:30. The dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), neutral detergent fiber (NDF), acid detergent fiber (ADF) and crude ash values of gram straw and lucerne were 93.53, 18.2; 9.72, 22.5; 2.60, 1.7; 44.4,

24; 68.7, 42.4, 47.6, 29.6 and 7.83, 12.4 %, respectively. They were watered twice daily and fed two different diets and the composition of diets is mentioned in Table I. Daily feeding allowance (@ 3% body weight) was calculated and adjusted according to fortnightly live weights.

Table I. Ingredients and chemical composition of experimental diets.

Ingredients (%)	Diet-I	Diet-II
Maize grain	9	14
Rice polishing	-	15
Wheat bran	24	15
Cotton seed cake	25	14
Rape seed cake	6	6
Corn gluten 30%	20	17
Cotton seed meal	-	5
Molasses	14	12
DCP	1	1
Salt	1	1
Chemical composition %		
DM	90.32	91.19
CP	18.06	22.09
TDN	66	70.06
ME (Mcal/kg DM)	2.41	2.56
NDF	29.09	20.57
ADF	14.41	11.63

ADF, acid detergent fiber; CP, crude protein; DM, dry matter; ME, metabolizable energy; NDF, neutral detergent fiber; TDN, neutral detergent fiber.

Data collection

The growth rate of the calves was calculated. The calves were weighed at 15-day intervals before morning feeding. The feed intake of stall-fed animals was calculated. The average dry matter values of feed were measured and the DMI was then determined. At the end of experiment, blood samples were collected from all calves for haematological analysis by jugular puncture in two sets. One contained EDTA as anticoagulant and the other without EDTA for serum separation. Hair samples were collected from shoulder, neck, hump and mid region of the body of camel calves. The hair was cut with stainless-steel scissors into pieces of approximately 1 cm length from each region and mixed well to ensure homogeneity.

Laboratory analysis

The concentrate, crop residues and fodder samples of the grazing/browsing material were analyzed for % DM (Method 930.15), % crude protein (Kjeldahl

Method 955.4), % crude fiber (Method 962.9), % ether extract (Soxhlet Method 920.39), % ash (Method 942.5) as described in AOAC (1990). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) was determined by the method of Van Soest *et al.* (1991). The blood samples were studied for haematological and biochemical analysis i.e. haemoglobin (Hb), cholesterol, triglycerides, urea, concentration of total protein, albumin, calcium and phosphorus. 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% per-chloric acid were added to it and again digested, until white fumes emanated and the volume was reduced to 0.5 ml. The digested sample was cooled and diluted to 50 ml with distilled water. Calcium and phosphorus concentrations were determined by using atomic absorption spectrophotometer (Method 965.9A) as described in AOAC (1990). Haemoglobin (Hb) in blood sample while cholesterol, triglyceride, urea, total protein and albumin in serum samples were estimated by using standard kits (Spin-react, Spain) method in haematology analyzer (BC 2300, Mindray Germany) and biochemistry analyzer (DL 9000, Italy), respectively.

The skirting of hair sample was done accordingly. Samples were washed with acetone, filtered and rinsed with water. These were dried in hot air oven and 0.5 g of dried mass was taken for further processing. 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 taken out and cooled. Concentrated per-chloric acid (2 ml) was added and again the sample was kept until half of the total volume evaporated. After this procedure, distilled water was added to make a total volume of 10 ml. The solution was used for determination of important macro-minerals and micro-minerals. The concentration of macro (Ca, Mg, Cu) and micro (Zn,

Fe, Mn) minerals was determined by atomic absorption spectrophotometer (Method 965.9A) as described in AOAC (1990).

Statistical analysis

Data collected on different parameters was analyzed statistically by applying *t*-test (Steel *et al.*, 1997) using Statistix software version 8.1.

RESULTS AND DISCUSSION

Growth rate and feed intake

Overall weight gain (kg) and daily weight gain (g/d) of male camel calves fed with different diets is presented in Table II. The growth rate of 948 and 991 g/d over 120 days was achieved in Marecha calves. Dry matter intake (DMI) of concentrate, fodder and gram straw was found to be 2.9, 3.0, 1.5 and 2.9, 3.0, 1.3 kg/d with diet 1 and 2, respectively (Table II). The relationship between weight gain and dry matter intake was positively correlated as reported by Singh *et al.* (2000) while Tandon *et al.* (1993) found that dry fodder intake and water intake was also positively correlated.

Current growth rate findings agree with the reported range for average daily weight gain in camel calves of different ages and breed by many workers (500-1500 grams in Pakistan). Growth rate in male and female calves were found to be 1400 and 950 g (Knoess, 1977), 1500 and 1000 g (Qureshi, 1986) in Pakistani male and female camel calves, respectively of different ages and breeds. In Pakistan the growth rate in government and private farmer's camel calves at 7 days age was 750 and 820 g (Iqbal *et al.*, 2001). Present findings are supported with the results of El-Badawi (1996) who reported 830-970 g daily weight gain from birth to 180 days in Egyptian dromedary calves.

Present results are not in line with the findings of Wilson (1992) who reported that in Kenya under proper

Table II. Overall weight gain (kg), daily weight gain (g/d) and dry matter intake (kg/d) of male camel calves (n=12) fed with diet 1 and 2.

Parameter	Diet-I			Diet-II		
Overall weight gain (kg)	85.8±4.21			89.6±3.2		
Daily weight gain (g/d)	948±40			991±30		
Parameter	Diet-I			Diet-II		
	Concentrate	Fodder	Gram straw	Concentrate	Fodder	Gram straw
Dry matter intake (kg/d)	2.9±0.15	3.0±0.16	1.5±0.08	2.9±0.07	3.0±0.07	1.3±0.03

nutrition average daily weight gain in camel calves was 870 and 570 g from birth to 30 days and from birth to 180

days, respectively. Average daily weight gain was 740 g during 90 days in Saudi camel calves when they were fed

75% concentrate and 25% hay (Al-Saiady *et al.*, 2006). Turki *et al.* (2007) reported average daily gain as 810, 590 and 670 g/d and dry matter intake as 4.53, 3.99 and 4.42 kg with Kenana pellets, cotton seed cake and ground nut cake-based diets, respectively.

Nagpal *et al.* (2012) reported very low values of growth rate as 402.8 g/d in weaned camel calves (weaned at 9 months age) fed *ad lib* with dry chaffed *Cyamopsis tetragonoloba*, weighed quantity of *Cynodon dactylon* grass and concentrate mixture. Khanna *et al.* (2004) reported average daily gain (ADG) as 700 and 770 g in Jaisalmeri and Bikaneri Indian camel breeds from birth to 3 months of age, respectively. While Chibsa *et al.* (2014) defining the weaning age of camel calves in eastern Ethiopia concluded that weaning calves at 8 months of age and supplementing with concentrate to the age of 12 months resulted in good post weaning growth rate and survivability of calves.

Current findings are supported by those of Mohamed (2007) who randomly divided 12 Maghrebi camels into 2 equal groups (6 in each) with 2 dietary treatments. The first group was offered complete rations at 3% body weight containing mainly corn 20%, wheat bran 20%, soybean meal 15%, groundnut hay 40% and the second group was offered ration containing black cumin seed-cake (35%), mixture of different straws (45%) and molasses (18%) at 3% body weight. Camels fed on experimental ration were superior in average weight gain compared to the control ration (930 g vs. 880 g) while the DMI did not differ significantly among the two groups (8.97 kg and 8.95 kg/animal daily, respectively). Eltahir *et al.* (2011) studied growth performance of Sudanese camel fed molasses and sorghum grain-based diets and found non-significant differences regarding daily weight gain between the two feeding systems. Reported daily gain was 620 and 610 g/d in camels fed molasses and sorghum grain-based diets, respectively. It was concluded that the molasses is a cheaper source that can substitute sorghum grains while reducing the competition between humans and animals regarding grains. Saini *et al.* (2014) studied the impact of feeding on growth performance of pre-pubertal camels under pastoral management in western Rajasthan and reported that higher total and average daily gain in stall fed camels than grazing group.

In Sudan Mohamedain *et al.* (2015) studied growth performance in dromedary camels under two feeding regimes. Camels were divided in two groups. First was zero browsing group (15 Darfuri and 10 Butana) fed complete ration (sorghum 50%, groundnut cake 15%, wheat bran 5%, molasses 10%, dura husk 5%, bagas 12%, urea 2% and common salt 1%) to provide ME @ 11 MJ/kg DM and 16% CP. Second was free browsing group (11

Darfuri and 9 Butana) without any supplement. The trail was of 120 days with two weeks as adaptation period. The average total weight gain was almost double in zero browsing group (96±17.3 kg) than free browsing group (42±19.5 kg). ADG was 800 g in former as compared to 350 g in later group.

In recent studies, Faraz *et al.* (2018) compared the intensive management system (IMS) with semi-intensive management system (SIMS) regarding growth rate of Marecha camel calves and found higher growth rate about 674 g/d in male calves of 11-12 months age reared under IMS and 419 g/d in SIMS. In another study, in Marecha camel calves of 11-12 months age reported values are 397 g/d in SIMS and 539 g/d in extensive management system (EMS) by Faraz *et al.* (2017). Faye *et al.* (2018) studied the effect of date-urea blocks as supplementary feeding on growth of young camels and reported daily weight gain 509 g/d in control group and 414 g/d in treated group in 3 years old camels.

Blood biochemicals

The blood constituents like haemoglobin, cholesterol, triglycerides, total protein, albumin, urea, creatinine, glucose, calcium and phosphorus were determined in this experiment (Table III).

Table III. Blood biochemicals of male camel calves fed with diet 1 and 2.

Parameter	Diet-I	Diet-II
Haemoglobin (g/dL)	16.4±0.14 ^a	16.8±0.09 ^b
Cholesterol (mg/dL)	46.7±3.3	49.3±2.4
Triglycerides (mg/dL)	39.0±1.9	40.4±2.4
Sugar (mg/dL)	128.6±4.5	150.2±9.5
Urea (mg/dL)	36.9±0.6	37.4±0.8
Creatinine (mg/dL)	1.94±0.1	2.2±0.2
Total Protein (g/dL)	6.3±0.2	6.6±0.2
Albumin (g/dL)	1.3±0.1	1.4±0.1
Calcium (mg/dL)	9.6±0.7	10.4±0.6
Phosphorus (mg/dL)	4.7±0.3	4.8±0.2

Means having different superscript in columns are significantly different (P<0.05).

Haemoglobin

Haemoglobin was found to be significantly varied (P<0.05) between the two groups fed diet 1 and 2. As the animals were in their active fattening state, all the values were found to be slightly higher but within the normal range. Al-Busadah and Osman (2000) determined haematological values in camels of Saudi Arabia and

reported mean value for haemoglobin as 13.3 ± 0.6 , 12 ± 0.2 and 10.1 ± 0.8 g/dl in dry-adult, lactating and calves, respectively. Reported range values for haemoglobin was 8.9-15 g/dl (Hassan *et al.*, 1968), 7.8-15.9 g/dl (McGrane and Kenyon, 1984), 11.4-14.2 (Higgins and Cock, 1984) and 11.5 g/dl on average (Omer *et al.*, 2006).

Omer *et al.* (2008) studied haematological profile of Sudanese camel calves and reported significantly higher haemoglobin concentration in suckling calves as 11.42 ± 1.20 compared to their lactating dams as 10.69 ± 0.62 g/dl. In Pakistan, Farooq *et al.* (2011) studied the normal reference haematological concentration of one-humped camels in Cholistan desert and reported a range for haemoglobin as 7-17 and 8-17 g/dl in male and females, respectively. The reported concentration of haemoglobin was found to be varied in majority of the references between 9.3 and 15.5 g/dl (Faye and Bengoumi, 2018).

Energetic parameters

The findings of cholesterol, triglycerides and sugar were found to be non-significantly different between groups fed with diet 1 and 2. Glucose level in camels was found to be higher than other ruminants which could be the reason for reported higher lactic acid contents in the blood of camels (Osman and Al-Busadah, 2003). Contrary to our findings, Indian scientist Bhakat *et al.* (2008) determined blood biochemicals in camel calves under different management systems and reported significant differences for triglycerides as 34.8 ± 3.7 , 19.1 ± 2.9 mg/dl in camel calves in intensive and semi-intensive system of management, respectively. While in another study, Saini *et al.* (2014) found significantly lower glucose values in grazing pre-pubescent camels than stall fed group under pastoral management in arid western Rajasthan.

In a different study, Osman and Al-Busadah (2003) investigating normal concentrations of serum biochemicals of she-camels in Saudi Arabia, determined glucose (134.4 ± 11), cholesterol (58.4 ± 8.6) and triglycerides (31.4 ± 3) mg/dl. In Sarwar *et al.* (1992) and Al-Busadah (2007) reports on blood values in Saudi camels cholesterol range was 1.9-4.2 mmol/L. Nagpal *et al.* (2012) determined serum profile of weaned Indian camel calves and reported glucose as 110.5 ± 3.7 , 105.5 ± 0.8 mg/dl; cholesterol as 35.8 ± 3.4 , 28.0 ± 1.4 mg/dl and triglycerides as 28.3 ± 1.3 , 48.4 ± 2.8 mg/dl in weaned calves at 6 and 9 months age, respectively. Reported normal plasma glucose concentration varied between 60-140 mg/dl (Faye and Bengoumi, 2018).

Protein parameters

The mean values of urea, creatinine, total protein and albumin was found to be non-significantly different between calve groups fed with diet 1 and 2. Urea and creatinine

are the indirect tests for the proper kidney functioning and excretion. Creatinine which is an anhydride of creatine phosphate results by the muscle synthesis, a routine product formed due to muscle metabolism and excreted on regular basis (Brar *et al.*, 2000). Being in active fattening condition, the levels of total protein and albumins were also higher as the animals showed increased growth rate. Moreover, the serum electrolytes were also found to be higher as their ratio relates with the age factor being higher in early and growing age. Both energetic and protein parameters testify the highest protéo-energetic value of camel diet in intensive system.

Bhakat *et al.* (2008) determined blood biochemicals in Indian camel calves under different management systems and reported significant differences for total protein as 6.3 ± 0.3 , 4.7 ± 0.4 g/dl in camel calves in intensive and semi-intensive system of management, respectively while non-significant differences were found regarding urea and albumin. In another study, Saini *et al.* (2014) found significantly higher urea values in grazing pre-pubescent camels than stall fed group under pastoral management in arid western Rajasthan.

In their study, Osman and Al-Busadah (2003) investigating normal concentrations of serum biochemicals of she-camels in Saudi Arabia, determined urea (49.8 ± 5.5), creatinine (1.5 ± 0.1) mg/dl, total protein (7.1 ± 0.3) and albumin (3.7 ± 0.3) g/dl. Reported value for albumin was 2.5-5.2 g/dl (McGrane and Kenyon, 1984); 3-4.4 g/dl (Higgins and Cock, 1984); 3.3 g/dl (Omer *et al.*, 2006); 4.5 g/dl (Osman and Al-Busadah, 2000). In addition to this, Sarwar *et al.* (1992) and Al-Busadah (2007) determined blood values in Saudi camels and reported creatinine as 0.16-0.5 mmol/L. In another study, Nagpal *et al.* (2012) determined serum profile of weaned Indian camel calves and reported total protein as 5.7 ± 0.2 , 5.1 ± 0.2 gm/dl; albumin as 3.7 ± 0.1 , 3.7 ± 0.1 gm/dl and urea as 20.0 ± 1.1 , 25.4 ± 1.7 mg/dl in weaned calves at 6 and 9 months age, respectively. Reported range of normal urea concentration in blood varied between 5-40 mg/dl, creatinine 0.8-2 mg/dl, serum albumin concentration 25-45 g/l in camels (Faye and Bengoumi, 2018).

Blood minerals

The values of calcium and phosphorus were found to be non-significantly different between groups fed with diet 1 and 2. The importance of calcium and phosphorus losses in lactating or pregnant adult camels to milk or fetus explains obviously the sex difference in those minerals' status. Regarding the young camel calves, the growth of males being globally higher than for females, calcium metabolism under hormonal regulation of thyroid and parathyroid is more active in male than in female (El-

Khasmi *et al.*, 2000). Bhakat *et al.* (2008) determined blood minerals in camel calves under different management systems and reported non-significant differences regarding calcium and phosphorus. Sarwar *et al.* (1992) and Al-Busadah (2007) determined blood values in Saudi camels and reported calcium as 7.6-13.1 mg/dl. Nagpal *et al.* (2012) determined serum profile of weaned Indian camel calves and reported calcium as 10.9 ± 0.3 , 11.1 ± 0.5 mg/dl and phosphorus as 8.7 ± 0.4 , 7.0 ± 0.6 mg/dl in weaned calves at 6 and 9 months age, respectively. Reported reference values of calcium and phosphorus varied between 8.4-12.4 and 4.8-8.4 mg/dl, respectively in camels (Faye and Bengoumi, 2018).

Table IV. Wool mineral analysis (mg/dL) of male camel calves fed with diet 1 and 2.

Parameter	Diet-I	Diet-II
Calcium	677.0 $\pm$ 22.9	718.6 $\pm$ 29.5
Magnesium	107.4 $\pm$ 3.1	114.9 $\pm$ 3.1
Copper	7.4 $\pm$ 0.3 ^b	8.1 $\pm$ 0.19 ^a
Zinc	68.5 $\pm$ 1.8	74.0 $\pm$ 1.8
Iron	329.4 $\pm$ 4.9	342.6 $\pm$ 5.9
Manganese	48.4 $\pm$ 1.1 ^b	54.0 $\pm$ 1.5 ^a

Means having different superscript in columns are significantly different ($P < 0.05$).

Hair mineral status

The mean values of macro (Ca, Mg), and trace elements (Cu, Fe, Mn, Zn) of male camel calves fed with diet 1 and 2 are presented in Table IV. All values were found to be non-significantly different except copper and manganese. Determination of mineral hair composition could be an indirect tool for assessing the general health status of the animal as it is an accumulative mineral nutrition witness. The observed differences reflect the better mineral nutrition in intensive systems compared to the others. Bhakat *et al.* (2009) in India determined hair mineral status of camel calves reared under different management systems and reported higher concentrations of macro and micro minerals in calves of semi-intensive management system. They reported calcium as (549.6 $\pm$ 74.5, 434.4 $\pm$ 60.2 and 719.7 $\pm$ 78.6, 476.0 $\pm$ 128.0), magnesium as (88.9 $\pm$ 2.4, 67.6 $\pm$ 6.3 and 77.5 $\pm$ 3.7, 69.8 $\pm$ 3.2), copper as (6.7 $\pm$ 0.7, 4.3 $\pm$ 0.4 and 7.4 $\pm$ 0.7, 5.7 $\pm$ 1.0), zinc as (66.0 $\pm$ 4.4, 57.6 $\pm$ 2.3 and 64.3 $\pm$ 2.0, 54.8 $\pm$ 1.5), iron as (285.7 $\pm$ 26.6, 216.0 $\pm$ 30.9 and 319.4 $\pm$ 27.9, 261.9 $\pm$ 33.4) and manganese as (21.6 $\pm$ 3.7, 20.6 $\pm$ 1.0 and 45.8 $\pm$ 1.8, 32.9 $\pm$ 4.4) mg/dl in calves reared under semi-intensive and intensive management systems with guar phalgati (*Cyamopsis tetragonoloba*) and moth

chara (*Phaseolus aconitifolius*) feeding, respectively.

Moreover, the relationship between physical, chemical and industrial characteristics of different dromedary camels' hair types was studied by Helal (2015) who reported higher concentrations of B, Cd, Co, Cr, Fe, Mn, Ni and S in fine hairs of Magrabi camels while Mo, Pb and Zn were higher in coarse fibers. Furthermore, the similar studies done on horses (Or *et al.*, 2004) and yaks (Chattergee *et al.*, 2005) revealed that level of some mineral elements were affected by nutritional differences in horses and yaks, respectively.

CONCLUSION

Marecha calves attained almost one kg weight gain daily in stall-fed conditions in an intensive management system which is relatively higher than reported literature data. The reported weight gain in current study indicates the great potential of feedlot and becomes a good candidate for controlled systems in desert conditions. Furthermore, it shows that the feed intake was almost same with two protein levels (normal and high) and weight gain was also same but high with good potential, so it is obvious from the results that we can use 18% CP for feedlot in camel calves, before this study we don't know about this value from literature data. Now 18% CP is the optimum level for future feedlot farming in camel calves under desert conditions. It is also supportive of the fact that camels are efficient in performing reutilization of urea from its kidneys for microbial protein synthesis. Hence; it's of no use to feed very high level of protein to the camels which only add to the cost of ration. Blood metabolites and wool minerals are clear indicative of the active metabolic state of the calves so can be studied to check the growth status. Camel can play a pivotal role to overcome the needs of exploding populations in the country especially in arid and semi-arid areas. This study provides a primary data for future studies which should be done to ensure the food security.

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Statement of conflict of interest

The authors have declared no conflict of interest.

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