Research Article

Analysis of Minerals in Hair of Marecha Camel (*Camelus dromedarius*) in Pakistan

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Abstract | A trial was carried out at Camel Breeding and Research Station (CBRS) Rakh-Mahni to investigate selected minerals in hairs of Pakistani dromedaries reared in traditional system. A total of 12 (equal males and females) Marecha camels housed in half-open pens were studied. They were fed gram straw *adlibitum* with 8 to 10 hours grazing/browsing along with twice watering on daily basis. In hair minerals analyses, the levels of minerals including calcium, magnesium, copper, zinc, iron and manganese were determined via standard lab procedures. Data collected was analyzed statistically by applying *t* test (α=0.05). The average mean values of macro minerals (Ca, Mg) and trace elements (Cu, Zn, Fe, Mn) were found to be 521.6±11.1, 82.3±4.9; 5.6±0.2, 55.0±2.9, 292.7±4.8, 30.5±1.0 in male camels while 486.0±5.8, 77.6±4.4; 4.3±0.2, 43.9±1.6, 235.9±9.3, 24.3±1.5 for female camels respectively. The results showed significant difference between male and females for macro and trace minerals except magnesium. The results will be used as a primary database for future studies of this field.

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Introduction

The dromedary camel is of great importance as it provides milk, meat, fiber and transportation (Faraz *et al*., 2019a). They can sustain life along with excellent performance in hostile deserts by fluctuation of body temperature (Wu *et al*., 2014; Faraz *et al*., 2019b). The dromedary population of world is almost 94% located in horn of Africa, South Asia and Middle East (Bernstein, 2009). The 70% of Asian population reside in India and Pakistan (Rosati *et al*., 2005).

Generally, the health and nutritional condition of animals could be assessed by hair mineral analyses. All minerals are available to study in camel hairs through easy collection process and may be resampled (Faraz *et al*., 2019c). In economics and public health considerations, the camel herd health has specific key role as the camel is an integral part of socio-economics of the pastoralists. Extracellular fluid, blood and lymph form the basis of hair formation in camels just like other animals. Nutrient intake is reflected by accumulation of constituents in hair tissues so mineral deficiency or toxicity can easily be judged by mineral concentration in hairs.

Minerals play vital role in metabolism process, being fundamental constituents of skeletal structures are involved in adaptation to desert environments as electrolytes actively participate in cycles of dehydration

and rehydration (Faye and Bengoumi, 2018). These mineral levels are indicators of metabolic disorders and different diseases like milk fever, osteoporosis, rickets, sway back, pica, anemia, grass tetany, ketosis and nutritional deficiencies can be detected in camels as well as other animals by hair mineral profile efficiently (Pathak *et al.*, 2007).

In Pakistani scenario, hair minerals detection in camels is relatively new concept and may be used as primary guide for studying the health generally (Faraz and Waheed, 2019). On the other hand, the studies related hair mineral analyses are very scanty in literature data and very few works have been reported. The camel hairs are not taken up for mineral estimation so far in Pakistan. Hence, the current study was attained to investigate the hair mineral status of some macro mineral included Ca and Mg along with selected trace minerals that included manganese, copper, Iron, and Zinc in Marecha dromedary camel reared in traditional management system in desert adobes.

Despite of the well-documented role of camel in economy of marginal areas of world; it is still one of the most ignored species in Pakistan (Faraz *et al.*, 2013, 2019d). Being valuable genetic resource, initiative has been taken to illustrate production potential and related parameters of camel husbandry in natural milieus (Faraz, 2020). Previous studies did not validate penetrating requirements of the subject about mineral profile in camel hair tissue. This study will not only condense the thirst of scientific community by plotting footprints to develop database line but will also go a long way to reconnoiter novel and unmapped areas of camel production.

Materials and Methods

Study area

This study was carried out at Camel Breeding and Research Station (CBRS) Rakh-Mahni which is located in Thal desert (Figure 1). The climate is arid to semi-arid subtropical continental with mean monthly highest temperature up to 45.6 ºC, while during winter, it is from 5.5 to 1.3 ºC. Mean annual rainfall in the region ranges from 150-350 mm, increasing from South to North (Rahim *et al.*, 2011).

Animals husbandry and feeding plan

Twelve dromedary Marecha camels including 6 non-rutting males and 6 non-pregnant females of three years old were used for this trial. Standard husbandry management protocol was adopted for rearing these experimental camels. They were dewormed by 1% Ivermectin at the rate of one milliliter for 50 kg live weight and sprayed with Cypermethrin solution at the rate of 1cc/liter water on animals and 2cc/liter water for sheds. The Trypamedium vaccine was used against Trypnosomiasis on three months interval. The animals were housed in half-open pens and sent for grazing and browsing for 8-10 hours. The *Cicer arientinum* was fed as manger feeding *adlibitum* with twice a day watering. The conditions described are referred to traditional/extensive management system.

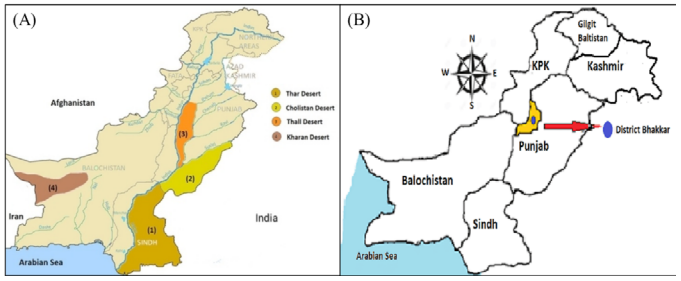

Figure 1: *Sandy deserts (A) and political map (B) of Pakistan showing research area CBRS in District Bhakkar (Source: Google Maps).*

Sample collection and lab analysis

Hair tissue was attained from different parts like neck, shoulder, hump and center regions of camel. Since season have great impact on the wool production in camel, the camel shed more wool in summer season, and this study was conducted during the June-July of 2015. The hair collection was carried out under proper SOP's/hygiene or adopting personal protective equipments (PPE). Stainless steel scissor was used to cut hair into pieces of 1 cm length. The skirting was done properly and hairs were homogenously mixed. The samples were washed with acetone to remove wax and then water rinsed. About 0.5 g dried sample was taken and digestion was performed in animal nutrition lab University of Agriculture Faisalabad. Two milliliter nitric acid solution was added and hair samples were kept at 100 °C to evaporate half volume. After cooling, two milliliters per chloric acid solution added and again heated to half volume. Then volume of ten milliliter was made by adding distilled water (Bhakat *et al.*, 2009). These macro minerals (Ca, Mg) and trace elements (Cu, Fe, Mn, Zn) were estimated by atomic absorption spectrophotometry (AOAC, 1990) at High Tech Lab, University of Agriculture Faisalabad. Wool collection, digestion and mineral analyses of Marecha camels is shown in (Figure 2a, b, c).

Figure 2: *Wool collection and mineral analysis of Marecha camels.*

Statistical analysis

Collected data was analyzed statistically by applying *t* test at 5% levels of significance using Statistix software (Steel *et al.*, 1997).

Results and Discussion

The mean values of macro and trace minerals of male and female camels reared in traditional management system are shown in Table 1. The average mean values of Ca, Mg, Cu, Zn, Fe and Mn were 521.6±11.1, 82.3±4.9, 5.6±0.2, 55.0±2.9, 292.7±4.8 and 30.5±1.0 in male camels while 486.0±5.8, 77.6±4.4, 4.3±0.2, 43.9±1.6, 235.9±9.3 and 24.3±1.5 in female camels, respectively. All the values ($P<0.05$) negated sexual dimorphism for these variables except magnesium as the sex has clear effect on the hair mineral composition in camels. The values were found higher in males than females may be due to the growth factor as the males found to be heavier than females (Murphy, 2014).

Table 1: *Hair mineral analyses of male and female Marecha camels at CBRS.*

Parameters (mg/dl)	Male (n=6)	Female (n=6)
Calcium	521.6±11.1 [a]	486.0±5.8 [b]
Magnesium	82.3±4.9	77.6±4.4
Copper	5.6±0.2 [a]	4.3±0.2 [b]
Zinc	55.0±2.9 [a]	43.9±1.6 [b]
Iron	292.7±4.8 [a]	235.9±9.3 [b]
Manganese	30.5±1.0 [a]	24.3±1.5 [b]

CBRS: Camel Breeding and Research Station; Means having different superscript in columns are significantly different (P<0.05).

Determination of hair mineral status is an accumulative mineral nutrition gauge for assessment of health condition generally. The seen differences reflect the better mineral nutrition in camels. Only the work reported about hair mineral concentrations in intensive kept calves from Pakistan by Faraz *et al.* (2019c). Contrary to these findings, Bhakat *et al.* (2009) postulated higher concentrations in semi-intensive kept Indian calves. The established mineral values were as Ca: 549.6±74.5, 434.4±60.2 and 719.7±78.6, 476.0±128.0); Mg: 88.9±2.4, 67.6±6.3 and 77.5±3.7, 69.8±3.2; Cu: 6.7±0.7, 4.3±0.4 and 7.4±0.7, 5.7±1.0; Zn: 66.0±4.4, 57.6±2.3 and 64.3±2.0, 54.8±1.5; Fe: 285.7±26.6, 216.0±30.9 and 319.4±27.9, 261.9±33.4; Mn: 21.6±3.7, 20.6±1.0 and 45.8±1.8, 32.9±4.4 mg/dL in semi-intensive and intensive kept Indian dromedary calves with *Cyamopsis-tetragonoloba* and *Phaseolus-aconitifolius* feeding, respectively.

Moreover, relationship between chemical, industrial and physical characteristics of dromedary camel hair type was studied by Helal (2015) who reported higher concentrations of B, Co, Cd, Cr, Fe, Mn, Ni and S in fine hairs of Maghrebi camels whereas Mo, Pb and Zn were higher in coarse fibers. Furthermore, the similar studies were 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. Or *et al*. (2004) studied about Fe, Cu and Zn minerals in tail hairs of horses and concluded that the mineral levels change with the nutrition programs without causing any disease. The mineral values could be used as reference for elemental distribution in hairs (Chattergee *et al*., 2005).

Conclusions and Recommendations

The current study demonstrated the level of certain macro mineral (Ca, Mg) together with trace minerals (Cu, Zn, Fe, Mn) of both male and female Marecha (*Camelus dromedarius*) camel in Pakistan ecology that might be utilizes as a gauge for assessment of health in this important genetic resource and serves as primary database for further studies in camel heath and husbandry management. As this will be a pioneer work regarding camel mineral estimation in Pakistan as no work is reported in literature data about Pakistani camels. This will serve as a guide and could be used in future studies.

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Ethical approval
The procedures adopted are in compliance with the ethical standards of the Animal Welfare Committee of University of Agriculture Faisalabad.

Novelty Statement

The mineral estimation in camel hairs/wool is totally a newer concept which has not been practiced in Pakistan yet. These measures could be used as health witness in camels. This very new study will provide the guide and primary database line for further studies of camel field.

Author's Contribution

Asim Faraz: Performed study trial.
Abdul Waheed and Nasir Ali Tauqir: Helped in analysis and write up.

Conflict of interest
The authors have declared no conflict of interest.

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