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Research article

Parity effect on some minerals content of camel milk under traditional and intensive management systems in Butana Area, Sudan

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Abstract

A total of 90 camel milk samples from healthy she-camels (Camelus dromedaries) in different (parity numbers (one to fifth), different breeds and seasons) were randomly collected to investigate the effect of parity order on some minerals content of camels milk from intensive and traditional management systems in Butana area. Data obtained were analyzed with SPPS version 21 software using analysis of variance and independent-sample- T. Test. Results revealed that season had significant effect (P>0.05) on minerals content of camel milk that were collected from intensive management system. Wherein, all studied minerals (Ca, Mg, Cu, P, Fe and Zn) were markedly affected by season. Furthermore, season had significant affect on minerals content of camel milk under traditional management system particularly (Ca, Mg, Cu, Fe and P) values. Season interaction effects showed significant differences (P>0.05) between systems in values of Ca, Cu and Fe during autumn, summer and winter season. The study concluded that parity order had significant effect on some minerals content of camel milk under traditional and intensive management system in Butana area of Sudan.

Keywords: Camel;milk analysis; parity;system

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Introduction

Camels occupy a very important niche in the desert ecosystem. The ability of camels, especially one-humped camels or dromedaries (*Camelus dromedarius*) to adapt to extreme heat and aridity of the environment is unique amongst other domestic animals. In harsh environment, where water and feed availabilities are scarce and ambient temperature is very high, the dairy camel not only can survive but can benefit the desert inhabitants, producing milk for longer periods and in greater quantities than any other domestic animals, such as goats, sheep or cows, thanks to its particular physiology and browsing habits. The composition of its milk is of prime importance both for the young suckling camel and for the man who drinks it. In fact, in many deserts of the globe, camel's milk plays a central role in the diet of the population, often representing the only source of high quality protein for human consumption (Danata et al., 2004). Considering the important role of minerals in human health, the aim of this study was to determine the effect of parity order on some minerals contents in camel milk in Butana Area, Sudan under traditional and intensive management systems.

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Materials and Methods

Study area

Camel milk samples were obtained from the intensive system (Tumbool Camel Research Center) and traditional system system (open pastures of Butana area). The Butana plain is a semiarid clay mostly flat region. It covers most of the present Kassala and Gedaref States in Eastern Sudan. It is located between Latitude 13 40' and 17 50' North and Longitude 32 40' and 36 00' East. It is bounded by the Main River Nile on its northwestern border, the Blue Nile on its southwestern edge, the Atbara River in the northeast and by the railway connecting Kassala and Sennar in the south (Ali and Majid. 2006).

Vegetations

Two vegetation zones are existing in the area, namely the semi desert *Acacia* shrub and short grasslands of North Central Sudan and the low woodland savannah of central Sudan. The vegetation of Butana is constantly changing as a result of annual rainfall, accidental fire outbreaks and expansion of agriculture and grazing, which depleted most of the highly palatable species such as *Blepharis persia (Elsiha)* and *Ipomoea cordofana (Eltabar)* (Saint-Martin., *etal* 1992). Trees commonly found in the study area consist of *Acacia mellifer* (Kiter) as the most common tree, *Acacia nubica* (Loat) which indicates overgrazing areas and *Acacia nilotica* (Sunut). Grasses that dominate in the area are *Cymbogon nervatus* (Nal), which is fairly a non palatable grass, *Aristidia Funicunlata* (Gaw), *Impomoea cardisepala* (Hantot), *Ipomoea cordofana* (Taber) and *Blepharispersica* (Siha),which are good forage plants with high protein contents. The latter two species are becoming less abundant in recent years (Agab 1993).

Farming systems

There are three types of farming system: crop and livestock, pastoral production system and the recent semi intensive system. From the total land area 12% are suitable for crop production. This shows that the area is mostly of a rangeland where livestock rearing is the major activity. The area receives a bimodal rainfall where small rains occur between May and June while the main rains occur between July and September. During the main rains farmers plant sorghum, this takes about 5 months (July to November) to harvest (Abbas. Et al., 1992).

Concentrate rations used in intensive system at Tumbool Camel Research Center (TCRC)

The concentrate ration was formulated based on sugar cane by-products (molasses & bagasse) and urea salt in maximal of 2%. Crushed sorghum grain, ground nut cake and wheat bran were added at low percent (5-15 %), in addition to lick mineral stone, normal salt (1.5%) and bicarbonates (1-2%) were also provided. The metabolizable energy (ME) and protein were around 9.2 MJ and 11-13 % respectively on dry matter-bases. The meal was given twice a day. The animals were grouped fed (lactating, pregnant, growers and mature bulls). The basic grass fodders were Abu-70 (*Sorghum bicolor*), Pioneer (*Sorghum bicolor x Sorghum sudanense* hybrid), Clitoria (*Clitoria ternate*) and Berseem (*Medicago sativa*).

Collection of camel milk samples

A total of 90 camel milk samples from healthy she-camels were collected from intensive and traditional management systems in Butana area. One sample of 50 ml from each she-camels (90) was taken (with different systems, seasons and parity numbers). The raw camel milk samples were collected in the early morning and immediately labelled, stored in an ice box and transferred within 2-3 hours to the laboratory of the Department of Dairy Production, Tumbool Camel Research Center. At the laboratory, the samples were stored in freezer (-20ºC) until they were analyzed.

Determination of minerals

Mineral contents like Calcium (Ca), manganese (Mn), Copper (Cu), Iron (Fe) and Zinc (Zn) were measured by an atomic absorption apparatus (Thermo-Tarrell, Ash, Smith-Hieftje (1ooo) in the digested form solutions according to AOAC (2002). Phosphorous (P) was estimated calorimetrically in the ash form (AOAC. 2002) at Environment & Natural resources and Desertification research institute, National Center for Research.

Statistical analysis

Different statistical tools were employed based on the available data obtained such as simple descriptive statistics, analysis of variance and independent-sample-T-Test. The computer software Excel was used for data managing and most of the data were analyzed with SPPS version 21 software.

Results and Discussion

Minerals content of camel milk in intensive system (mg / L) as influenced by parity

Zn content in 2nd, 3rd and 4th parity was significant high (P<0.01) when compared to 1^{rst} and 5th ones. The Zn content of this study ranged from 8.3-21.6 mg/L equivalent to 0.83-2.16 mg/100g with an average of 1.495 mg /100g. The findings of this study are higher than reported by other authors i.e., 0.44 mg/100g by (Abu-Lehia 1987), 0.59 mg/100g (Mehaia et al 1995) and 0.58 mg/100g (Haddadin et al., 2008). Moreover, Cu content in 3rd parity was significantly (P<0.01) high when compared with other parities. The copper content of this study ranged between (6.9-11.3 mg/L) equivalent to 0.69-1.13 mg/100g with an average of 0.91. The findings of this study are higher than reported by other authors i.e., 0.49 mg/100g (Ahmed et al 1977), 0.15 mg/100g (Abu-Lehia, 1987) and 0.14 mg/100g (Mehaia et al 1995). The higher Zn contents in our findings could be related with the composition of the soil. Further study is needed to know the correlation of the nature of the soil and the Zn contents of the milk. In general, there was no significant affect of the parity on the mineral composition of the camel's milk except Zn and Cu, where the mineral was higher in the 3rd parity than the later parities. There were no significant differences observed in minerals throughout other parities (Table 1). This may be attributed to sufficient nutrient supplementation and limitation of animal health care in intensive system as reported by Sawaya et al. (1984).

Minerals content of camel milk in traditional system (mg / L) as influenced by parity

Cu and P content in 1rst parity recorded was highly significant (P<0.01) when compared to 2nd, 3rd, 4th and 5th parity. Moreover, Zn content in 1rst parity was significantly (P<0.01) high when compared with other parities (Table 2). This result agreed with Raziq et al. (2011) who reported that Cu was higher in the later parities than the earlier parities. They mentioned that the cause of this variation could be correlated with the age of the animal. The camel need minerals in their growing stage for growth and in the later stages for the compensation of the loss occurred due to increased wear and tear process. The variation in mineral reflects many genetic and environmental factors such as the system of feeding and browsing of different plants.

Mineral content of camel milk in two studied systems (interaction) (mg/L) as influenced by parities

Primiparous seemed to have significant affect (P>0.05) on Cu and Zn content of camel milk samples collected from the traditional system compared with that of intensive system. Dowelmadina et al. (2014) stated that although, improved husbandry practices and management oriented towards milk production in the semi intensive system, the minerals content of she camels kept in traditional nomadic system was better than those in semi-intensive. In second parity, Zn content in traditional system also have significant affect (P>0.05) when compared with that of intensive system. Similarly, previous reports showed variations of camel milk due to parity number and calving number (El-Amin et al., 2006). Alwan et al. (2014) stated that the reason for higher amount of minerals in drought conditions in comparison to fattening conditions is generally accumulation of minerals in desert plants. They also reported that most of the milk factors' variety is due to differences in analytical methods used, geographical location, diet, race and lactation period. This could be attributed to seasonal changes which markedly affected the vegetation cover and hence, the availability and content of minerals under traditional management system. Zn in 5th parity have an opposite trend, which recorded significantly (P>0.05) more values in intensive system than in traditional system (Table 3). It was observed that improved husbandry practices and management oriented towards milk production in the intensive system has positively influenced the compositional quality of camel milk in Sudan (Babiker and El Zubeir, 2014; Shuiep et al., 2014). This may also attributed to the sufficient and balanced rations (minerals supplementation) provided to lactating camel under intensive management system. Third and fourth parities had no effect on mineral content of camel milk in both intensive and traditional management system. This result was supported by Sheiup et al. (2008) who found that the ash content of camel milk samples collected from the traditional and semi intensive system were similar (0.073±0.12% and 0.073±0.14%, respectively). Al Haj and Al Kanhal (2010) declared that the differences in the amount of minerals are related to the differences in race,

Table 1: Minerals content of camel milk in intensive system (mg / L) as influenced by parity

Parity number	No	Ca	Mg	Cu	Fe	Zn	P
1	6	111.4±57.3	120±88	6.9±2.2b	9.3±5.3	8.3±3.4c	383.3±170
2	6	81.1±22.3	63.8±46.5	11.3±6.1a	11.7±9.2	21.6±15.7a	328.3±133.6
3	6	114.7±56.5	114.2±84.5	6.1±2.9c	11.3±6.6	20.6±4.7a	348.3±174
4	6	84.4±40.1	102.2±71.3	7.8±3.8b	9.2±5.6	21.2±9.9a	335±94.6
5	6	119.9±55.1	123.1±88.5	4.6±1.8c	12.7±10.9	16.2±6.7b	381.7±209.2

Means followed by the same superscripts do not differ significantly (P< 0.05).

Table 2: Minerals content of camel milk in traditional system (mg / L) as influenced by parity

Parity number	No	Ca	Mg	Cu	Fe	Zn	P
1	6	129.4±63.2	118.7±88.3	a11.4±8	7.3±4.5	b16.6±9.7	a515±184.6
2	6	101.6±50.2	103.8±70.1	b7.5±4.5	13.2±7.2	a25.3±15.3	b451.7±86.3
3	6	120.5±76.4	90.8±59	b6±4.3	8.5±6.9	b13.7±7.8	c346.7±94.4
4	6	107.8±63	85.7±58.3	c4.7±1.4	6.8±3.3	b19.5±7.6	b380±130.8
5	6	112.9±57	85.4±52.8	c5.3±1.7	6.8±3.7	c11.8±3.7	c356.7±49.6

Table 3: Minerals content of camel milk in two studied systems (interaction) (mg / L) as influenced by first, second and third parities

Parity	Mineral	System	N0	Mean ± SD	Sig
1	Ca	Intensive	6	111.4±57.3	NS
		Traditional	6	129.4±63.3	NS
	Mg	Intensive	6	120±88	NS
		Traditional	6	118.7±88.3	NS
	Cu	Intensive	6	6.9±2.2	
		Traditional	6	11.4±8	*
	Fe	Intensive	6	9.3±5.3	NS
		Traditional	6	7.3±4.5	NS
	Zn	Intensive	6	8.3±3.4	
		Traditional	6	16.6±9.7	*
	P	Intensive	6	383±170	NS
		Traditional	6	515±184	NS
2	Ca	Intensive	6	81.1±22.3	NS
		Traditional	6	101.6±50.2	NS
	Mg	Intensive	6	63.8±46.5	NS
		Traditional	6	103.8±70.1	NS
	Cu	Intensive	6	11.3±6.1	NS
		Traditional	6	7.5±4.5	NS
	Fe	Intensive	6	11.7±6.1	NS
		Traditional	6	13.2±7.2	NS
	Zn	Intensive	6	21.6±15.7	
		Traditional	6	25.3±15.3	*
	P	Intensive	6	328±133	NS
		Traditional	6	451±86	NS
3	Ca	Intensive	6	114.7±56.5	NS
		Traditional	6	120.5±76.4	NS
	Mg	Intensive	6	114.2±84.5	NS
		Traditional	6	90.8±59	NS
	Cu	Intensive	6	6.1±2.9	NS
		Traditional	6	5.97±4.3	NS
	Fe	Intensive	6	11.3±6.9	NS
		Traditional	6	8.5±6.9	NS
	Zn	Intensive	6	20.6±4.7	NS
		Traditional	6	13.7±7.8	NS
	P	Intensive	6	348±173	NS
		Traditional	6	346±94	NS

NS: No significant differences; No: number of observation; Sig: significance*significant differences at P≤0.05; **significant differences at P≤0.01.

nourishment and analysis methods. The quantity of main minerals in dromedary camel milk was different among Majaheim, Najdi, Wadah and Hjamra Hamra races. In fifth parity, Fe and P contents recorded were significantly morein intensive system compared with that of traditional management system (Table 4). Riyadh et al. (2012) reported that parity numbers showed variations in minerals content in camel milk among different management system. This result also should be attributed to breed differences; interval between milking; feeding; analytical procedures and water intake (Haddadin et al., 2008; (Mehaia et al., 1995).

Conclusion

The results of the present study clearly confirmed that minerals content of camel milk was affected by

Table 4: Minerals content of camel milk in two studied systems (interaction) (mg / L) as influenced by fourth and fifth parities

Parity	Mineral	System	N0	Mean ± SD	Sig
4	Ca	Intensive	6	84.4±40.1	NS
		Traditional	6	107.8±63	NS
	Mg	Intensive	6	102.2±71.3	NS
		Traditional	6	85.7±58.3	NS
	Cu	Intensive	6	7.8±3.8	NS
		Traditional	6	4.7±1.4	NS
	Fe	Intensive	6	9.2±5.6	NS
		Traditional	6	6.8±3.3	NS
	Zn	Intensive	6	21.2±9.9	NS
		Traditional	6	19.5±7.6	NS
	P	Intensive	6	335±95	NS
		Traditional	6	380±131	NS
5	Ca	Intensive	6	119.9±55.1	NS
		Traditional	6	112.9±57	NS
	Mg	Intensive	6	123.1±88.5	NS
		Traditional	6	85.4±52.9	NS
	Cu	Intensive	6	4.6±1.8	NS
		Traditional	6	5.3±1.7	NS
	Fe	Intensive	6	12.7±10.9	*
		Traditional	6	6.8±3.7	
	Zn	Intensive	6	16.2±6.7	*
		Traditional	6	11.8±3.7	
	P	Intensive	6	382±209	*
		Traditional	6	357±50	

NS: No significant differences; No: number of observation; Sig: significance; *significant differences at P≤0.05; **significant differences at P≤0.01.

parity order under traditional and intensive management system. However, more work is needed to verify these effects and also to study the effects of stage of lactation and breed differences on minerals content of camel milk.

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