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Short Communication

Impact of Parity Order on Nutritional Values of Camel Milk in Modern System

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ABSTRACT

Camel milk has important role in human nutrition in desert and semi-desert regions; this milk provides the man with all essential nutrients in addition to its medicinal properties. A study was conducted to determine the impact of parity order on nutrition values of camel milk overall four months postpartum under modern system. Eight she-camels were selected immediately after calving and assigned to two equal groups, early lactation (GY) and mid lactation (GD). Both groups were managed together at the same environmental conditions under intensive system. Collection of milk samples started at second week postpartum and continued biweekly interval up to end of 4th month postpartum. The total fat, protein, lactose, solid non-fat (SNF) and density percentages were determined by automatic milk analyzer device (lactoscan Model-90, Europe). Results elucidated that there was no significant difference of lactose and fat content between two groups throughout experiment period. Where the significant difference ($P<0.05$) of protein, SNF and density contents of milk were detected during lactation stages throughout four months. Otherwise, the levels of fat, lactose, protein and SNF were increased significantly ($P<0.05$) with advancement of lactation stage, beside fluctuation of density values during experiment period. The current study revealed that milk produced by young is slightly richer in fat content, whereas milk of old camel is richer in protein content. The variation of nutrition values of milk should be attributed to parities, calve number and physiological factors.

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Authors' Contributions
AMB and BF designed and formulated plan of study and supervised the work. AMB and AEE collected data, performed field experiments and lab work. AE and MB statistically analyzed the data. AA and AF helped in manuscript writing.

Key words
Dromedary camel, Lactation, Milk, Nutrition, Parity.

Camel produces milk in arid and semi-arid region where other animals fail to produce (Faraz *et al*., 2019a). Camel milk is an essential food for pastoral community and it may be the only milk available in places where other milking animals cannot be reared (Faraz *et al*., 2019b). In pastoral conditions, milk is always consumed either fresh or in varying degrees of sourness (Abdelrahman *et al*., 2011). A lot of information is still to be generated about camel milk as a source of food. Camel milk is a component of fat, protein, lactose, minerals, and vitamins and miscellaneous constituents dispersed in water (Iqbal *et al*., 2001; Faraz *et al*., 2019c).

The parity order, season and physiological state play important role in variation in constituents of camel milk (Konuspayeva *et al*., 2009). Camel milk composition was found to be less stable than bovine milk. Wide variations had been detected in camel milk constituents, which may be attributed to some factors such as analytical procedures, geographical location, feed formulation, environmental variables and breed in addition to others factors such as lactation stage, camel age and number of calving (Khaskheli *et al*., 2005). In Saudi Arabia, no significant effect of parity, gestation length or calf birth weight was recorded on milk constituents (Abdelgadir *et al*., 2013). Camel milk was found to contain 86.94% moisture, 3.67% protein, 5.78% lactose, 0.66% ash and 5.76% fat during 1st month, 6.59% during 3rd month and 6.08% during 6th month (Sohail, 1983). Sawaya *et al*. (1984) reported 11.7% total solids, 3.0% protein, 3.6% fat and 0.13% acidity in camel milk. Substantial variation in camel milk was therefore observed in fat (2.1 to 4.7%), protein (2.20 and 2.59%) and lactose (4.59 and 5.33%) contents. Fat content of dromedary camel milk ranged between 1.2 and 6.4%. A strong positive correlation was reported

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between fat and protein contents by Haddadin *et al*. (2008) and Konuspayeva *et al*. (2009). This study was aimed to elucidate the impact of parity order, lactation period, postpartum and age on nutritional value and camel milk composition under modern system.

Materials and methods

The study was carried out at Alzakiat Camel Farm, in Ezba area close to Bahri City, Khartoum from June to December 2013. Two clinically healthy groups, each of eight lactating she-camels at 2nd week postpartum, 6-17 years, average mean body weight 477.13±32.291 kg were chosen from the mixed herd of camels. All selected camels belonged to Arabi Kenana breed from Alzakiat Farm. Group of early lactation (GY) included she-camels in first and second parity, whereas group of mid lactation (GD) included she-camels in third, fourth and fifth parity. All experimental animals were herded in closed pen and provided ration feed, which consisted of concentrates in addition to roughages feed. Water source was available daily *ad libitum*.

Milk samples were collected in sterile glass bottles (40 ml) by manual milking four times a day (7:00 am, 12:00 noon, 5:30 pm and 11:00 pm). The collection of samples was started in second week postpartum and continued biweekly interval up to 4th month postpartum. These samples were delivered to dairy laboratories in University of Khartoum within 24 h for laboratory analysis. During experiments, one case each of mastitis and internal parasites were observed. Therefore, the dams in this case were discarded from experiment.

Major fat, protein, lactose, solid non-fat (SNF) and density percentages were determined biweekly for 16 weeks postpartum by automatic milk analyzer device (lactoscan Model-90, Europe).

All data were subjected to General Linear Model using Statistix8 version-2 software program; variations of means regarding treatments and weeks were calculated. Least significant differences (LSD) test used for means separations (Free Software Foundation, Boston, MA 02110, USA).

Results and discussion

Table I shows the effect of parity order on milk constituents and nutritional values, and fat content (%) of milk produced by young camel group versus old camel group camel under intensive farming system. There is no difference in fat content among two groups, but the fat content continue to increase regularly from week 2 to 8 postpartum. It ranged between 3.46±0.85 and 6.34±0.85% in GY compared to that of GD which ranged between 3.46±0.70 and 3.92±0.70%. The results also indicated that there was no significant (P>0.05) effect of parity and age on lactose content. The lactose level in milk fluctuated during the first 8 weeks, but thereafter it increased stably.

Table I.- Variations of milk fat, lactose, protein, SNF and density contents of milk during experiment period.

Para-meters	Fat (%)			Lactose (%)			Protein (%)			SNF (%)			Density (%)		
	GY	GD	Overall	GY	GD	Overall	GY	GD	Overall	GY	GD	Overall	GY	GD	Overall
2nd week	3.46± 0.85^{b}	3.46± 0.70^{b}	3.46± 0.54^{A}	4.15± 0.31^{c}	3.93± 0.26^{c}	4.04± 0.2^{C}	3.02± 0.23^{e}	2.91± 0.18^{e}	2.97± 0.14^{C}	7.75± 0.59^{e}	7.41± 0.48^{e}	7.58± 0.37^{C}	27.23± 4.54^{ab}	25.33± 3.71^{ab}	26.28± 2.87^{AB}
4th week	4.91± 0.70^{ab}	3.97± 0.70^{b}	4.44± 0.5^{A}	4.98± 0.26^{ab}	4.50± 0.25^{b}	4.74± 0.18^{AB}	3.66± 0.18^{abcd}	3.29± 0.18^{cde}	3.47± 0.13^{AB}	9.36± 0.48^{abcd}	8.44± 0.48^{cde}	8.9± 0.34^{AB}	32.61± 3.71^{ab}	29.5± 3.71^{ab}	31.1± 2.62^{AB}
6th week	5.04± 0.60^{ab}	5.54± 0.61^{ab}	5.29± 0.4^{A}	5.23± 0.22^{a}	4.98± 0.22^{ab}	5.11± 0.16^{A}	3.83± 0.16^{ab}	3.69± 0.16^{abc}	3.76± 0.1^{A}	9.82± 0.41^{ab}	9.4± 0.41^{abc}	9.61± 0.29^{A}	34.08± 3.21^{a}	32.2± 3.21^{ab}	33.15± 2.27^{A}
8th week	6.34± 0.85^{a}	3.92± 0.70^{b}	5.13± 0.54^{A}	4.66± 0.31^{ab}	5.07± 0.26^{a}	4.87± 0.0^{AB}	3.5± 0.22^{abcde}	3.69± 0.18^{abcd}	3.6± 0.14^{AB}	8.86± 0.58^{abcde}	9.49± 0.48^{abc}	9.17± 0.37^{AB}	29.71± 4.54^{ab}	33.52± 3.71^{ab}	31.6± 2.87^{AB}
10th week	5.05± 0.85^{ab}	4.33± 0.70^{ab}	4.69± 0.54^{A}	4.18± 0.31^{c}	4.97± 0.26^{ab}	4.58± 0.2^{BC}	3.11± 0.23^{de}	3.64± 0.18^{abcd}	3.37± 0.14^{BC}	7.9± 0.58^{de}	9.33± 0.48^{abcd}	8.62± 0.37^{BC}	26.87± 4.54^{ab}	23.83± 3.71^{b}	25.35± 2.87^{B}
12th week	5.06± 0.70^{ab}	4.51± 0.61^{ab}	4.79± 0.46^{A}	4.56± 0.25^{b}	5.01± 0.22^{ab}	4.78± 0.18^{AB}	3.37± 0.18^{bcde}	3.66± 0.16^{abcd}	3.51± 0.12^{AB}	8.59± 0.48^{bcde}	9.40± 0.41^{abc}	8.99± 0.31^{AB}	29.46± 3.71^{ab}	26.20± 3.21^{ab}	27.83± 2.42^{AB}
14th week	5.13± 0.70^{ab}	4.50± 0.54^{ab}	4.82± 0.43^{A}	4.61± 0.26^{ab}	5.28± 0.19^{a}	4.94± 0.15^{AB}	3.64± 0.18^{abcd}	3.86± 0.14^{a}	3.77± 0.11^{A}	9.29± 0.48^{abcd}	9.91± 0.37^{a}	9.6± 0.29^{A}	32.06± 3.71^{ab}	34.71± 2.87^{a}	33.39± 2.27^{A}
16th week	4.08± 0.70^{b}	4.26± 0.54^{b}	4.17± 0.43^{A}	5.02± 0.26^{a}	4.56± 0.19^{b}	4.79± 0.15^{AB}	3.65± 0.18^{abcd}	3.34± 0.14^{cde}	3.5± 0.1^{AB}	9.39± 0.48^{abcd}	8.56± 0.37^{cde}	8.97± 0.29^{AB}	33.03± 3.7^{ab}	29.9± 2.87^{ab}	31.4± 2.27^{AB}
Overall	4.88± 0.25^{A}	4.45± 0.22^{A}	4.66± 0.24	4.67± 0.09^{A}	4.79± 0.08^{A}	4.73± 0.09	3.47± 0.07^{A}	3.51± 0.06^{A}	3.49± 0.06	8.87± 0.17^{A}	8.99± 0.15^{A}	8.9± 0.16	30.6± 1.39^{A}	29.38± 1.17^{A}	30.01± 1.27

Different letters in same column and row indicates significant difference (P<0.05). GY, young group (early lactation); GD, old group (late lactation).

The protein content had lower values in the beginning of lactation in both groups but later increased significantly ($P<0.05$) throughout the lactation stage with higher value at week 14 (3.77±0.11%). The content of SNF likewise increased significantly ($P<0.05$) with advancement in lactation stage during four months postpartum. There was no difference in milk density during the first eight weeks after calving but it decreased during week 10 and 12 and later increased till the end of experiments.

The results of this study revealed that milk of young camel is slightly richer in fat content compared to that of old camel. These findings are similar to those who stated that parity seemed to have no effect on milk fat content (Bakheit *et al*., 2008; Aljumaah *et al*., 2012; Mustafa *et al*; 2014). In contrast, the effect of parity on fat content of camel milk was significant as reported by Zeleke (2007) and milk yield was also reported to be affected significantly by parity (Raziq *et al*., 2010).

High value of milk lactose content during four months postpartum was recorded. These findings are close to previous studies, who mentioned that high lactose content were recorded during first lactation. This is justified by general herders who think that camel milk is sweeter in first lactation (Zeleke, 2007; Aljumaah *et al*., 2012; Wafa and El-Zubeir, 2014; Elagba *et al*., 2016). The results of current study showed no significant difference of milk lactose, fat and density content between two groups during experiment period. These findings are in agreement with those who show insignificant differences of fat, lactose, SNF and density contents of milk camel after calving (Bakheit *et al*., 2008; Wafa and El-Zubeir, 2014). The variation in protein content recorded in current study is close to studies reported in Sudan and Ethiopia (Zeleke, 2007; Mustafa *et al*., 2014). There are many limitations of working with camels since the owners look for trade benefits rather than scientific researches. Moreover, camels are expensive in modern farm.

Conclusion

Wide variations of camel milk constituents and nutritional values have been detected in current study. These variations might be attributed to difference in parities, lactation stage postpartum, calving number, ecological and physiological variables and reproductive age of she-camel. The study findings elucidated that the camel milk production in modern system can be provided with better nutritional values with adequate amount of nutrients in desert and semi desert regions. Therefore, management practices, parity order and camel breed should be considered. In addition to, physiological adaptation to certain types of commercial feed, feed additives and milking times. However, significant intervention to improve and maintain the milk nutritional value is recommended.

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Statement of conflict of interest

The authors declare no conflict of interest.

References

Abdelgadir, M.M., Faye, B. and Al-Mutairi, S.E., 2013. *Emir. J. Fd. Agric*., **25**: 618-624. https://doi.org/10.9755/ejfa.v25i8.16095

Abdelrahman, Y.M., Eisa, M.O., Mustafa, A.B. and Salih, A.M., 2011. *Res. Opin. Anim. Vet. Sci*., **3**: 174-177.

Aljumaah, R.S., Al-Mutairi, F.F., Ismail, E., Al-Shaikh, M.A., Sami, A. and Ayadi, M., 2012. *J. Anim. Vet. Adv*., **11**: 141-147.

Bakheit, S.A., Majid, A.M.A. and Nikhala, A.M., 2008. *J. Camelid Sci*., **1**: 32-36.

Elagba, H.A.M., Mustafa, A.B. and Atti, K.A.A., 2016. *Int. J. Sci. Knowledge*, **5**: 9-12.

Faraz, A., Waheed, A., Mirza, R.H. and Ishaq, H.M., 2019a. *J. Fish. Livest. Prod*., **7**: 289.

Faraz, A., Waheed, A., Mirza, R.H., Ishaq, H.M. and Tariq, M.M., 2019b. *J. Fish. Livest. Prod*., **7**: 288.

Faraz, A., Waheed, A., Mirza, R.H. and Ishaq, H.M., 2019c. *J. Fish. Livest. Prod*., **7**: 290.

Haddadin, M.S.Y., Gammoh, S.I. and Robinson, R.K., 2008. *J. Dairy Res*., **75**: 8-12. https://doi.org/10.1017/S0022029907002750

Iqbal, A., Gill, R.A. and Younas, M., 2001. *Emir. J. agric. Sci*., **13**: 7-10. https://doi.org/10.9755/ejfa.v12i1.5197

Khanna, N.D., 1986. *Indian Farm.*, **36**: 39-40. https://doi.org/10.1177/014833318603600117

Khaskheli, M., Arain, M.A., Chaudhry, S., Soomro, A.H. and Qureshi, T.A., 2005. *J. Agric. Soc. Sci*., **2**: 164-166.

Konuspayeva, G., Faye, B. and Loiseau, G., 2009. *J. Fd. Compos. Analysis*, **22**: 95-101. https://doi.org/10.1016/j.jfca.2008.09.008

Mustafa, A.B., Mohamed, E.H.A., Haroun, K.A. and Attia, M.A., 2014. *Int. J. Adv. Pharm. Biol. Chem*., **3**: 266-271.

Raziq, A., Younas, M., Khan, M.S. and Iqbal, A., 2010. *J. Camel Prac. Res*., **17**: 1-4.

Sawaya, W.N., Khalil, J.K., Al-Shalhat, A. and Al-Mohammad, H., 1984. *J. Fd. Sci*., **49**: 744-747. https://doi.org/10.1111/j.1365-2621.1984.

tb13200.x
Sohail, M.A., 1983. *World Rev. Anim. Prod*., **19**: 38-40.
Wafa, I.A.B. and El-Zubeir, I.E.M., 2014. *Emir. J. Fd. Agric*., **26**: 333-341. https://doi.org/10.9755/ejfa.v26i4.17664
Zeleke, Z.M., 2007. *Livest. Res. Rural Develop*., **19**: 6.