American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

http://asrjetsjournal.org/

Seasonal Effect on Camel Milk Composition (Camelus dromedaries) Under Traditional and Intensive Management Systems in Butana Area-Sudan

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Abstract

A total of 147 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 season on some chemical components 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 camel milk components that were collected from intensive management system. Wherein lactose, free fatty acids (FFA) and titratable acidity values were markedly affected by season. Furthermore, season had significant effect on camel milk content under traditional management system particularly in fats, proteins, lactose and total solid values. Season interaction effects showed significant differences (P > 0.05) between systems in values of protein acidity during autumn and winter seasons. While, summer season had no effect on camel milk components in both intensive and traditional management system. The study concluded that season had significant effect on some chemical components of camel milk under traditional and intensive management system.

Keywords: Camel; milk; analysis; season; system.

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1. Introduction

In hot and dry environments, camels are the most preferred livestock species, as they can well adapt and withstand the aforementioned limitations. By virtue of their adaptability in arid and semi-arid areas, camels play a significant role as a source of milk for the inhabitants who have little alternative source of food. Their contribution as dairy animals is more substantial, especially during the dry season of the year when milk from cattle and small ruminants becomes scarce. Nevertheless, there is a paucity of information regarding environmental factors limiting the milk production potentials and the composition of camels milk under Sudanese pastoral and intensive management conditions [1]. Geographical root and seasonal variations are factors which influence most changes in composition of camel milk. Camel milk contains 2.9 to 5.5% fat, 2.5 to 4.5% protein, 2.9 to 5.8% lactose, 0.35 to 0.90% ash, 86.3 to 88.5% water, and 8.9 to 14.3% solid-non-fat (SNF) [2]. However, limited information is available on camel milk composition under traditional and intensive management systems in Sudan. Therefore the objective of this study is to elucidate the effect of seasonal changes on camel milk component under traditional and intensive management systems in Butana area-Sudan.

2. Materials and Methods

2.1 Study area

Camel milk samples obtained from the intensive system (Tumbool Camel Research Center) which located at the central part of Butan 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 [3].

2.2 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 *BlepharisPersia (Elsiha)* and *Ipomoea cordofana (Eltabar)* [4]. 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 [5].

2.3 Farming systems

There are three types of farming system found: crop and livestock, pastoral production system and recently 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 [6].

2.4 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%). The metabolizable energy (ME) and were kept 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). These allowances were at the rate of 56-58 % out of the total daily feed intake. The basic grass fodders were Abu-70 (*Sorghum bicolor*), Pioneer (*Sorghum bicolor x Sorghum sudanense* hybrid), Clitoria (*Clitoria ternate*) and Berseem (*Medicago sativa*).

2.5 Collection of camel milk samples

A total of 147 camel milk samples from 147 healthy she-camels were collected from intensive and traditional management systems in Butana area. One sample of 50 ml from each she-camels (147) was taken (with different systems, seasons and parity numbers). The raw camel milk samples were collected in the early morning and immediately labeled, 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 (-20^{o}C) until they were analyzed.

2.6 Chemical composition of camel milk

Chemical component of milk as percentages of fat, protein, solids not fat, total solids, lactose content and density, were measured twice using Lactoscan milk Analyzer (Milkotronic LTD, Europe) [7] according to the manufacturer's instructions. The analysis of milk was conducted at Dal Dairy Factory (DDF), Khartoum-North, Sudan [8]. Twenty five ml of the samples were taken in the sample holder after mixed gently 4- 5 times. The sample holder was put in the analyzer in the recess position and the analyzer sucks the milk and makes the measurement. When the measurement is finished, the sample returns in the sample holder and the digital indicator shows the specified result.

2.7 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.

3. Results and discussion

3.1 Camel milk components of intensive system (%) as influenced by season

Results in Table (1) revealed that, season had significant affect on content of lactose, free fatty acids (FFA) and titratable acidity values in intensive management system. Wherein, at autumn, lactose content recorded highly significant differences ($P < 0.01$) when compared with summer season. This result supported by [9] who stated that the increases of lactose could be attributed to the availability of good pastures resources during the rainy season, but disagree with [10] who reported that the lactose content was the only component that almost remained unchanged by season and under hydrated or un hydrated conditions. An opposite trend to lactose, titratable acidity recorded significantly ($P < 0.01$) more values at autumn when compared with winter season. [11] attributed this to the high temperature during autumn and summer seasons. The increase in titratable acidity during summer may be due to bacterial activity [12,13]. However, variations in pH and acidity for the same source of milk could be due to differences in hygiene level and the total bacterial count of milk [14]. Free fatty acids content recorded highly significant differences ($P < 0.01$) when compared with both summer and winter seasons (Table 1). Availability of good feed resources during the rainy season [9] could be the cause for the higher content of free fatty acids.

Table 1: Camel milk components of intensive system (%) as influenced by season

Season	No	Fats	Proteins	Lactose	SNF	TS	FFA	Acidity
				a			a	a
Autumn	40	3.62±0.3	2.71±0.5	5.05±0.3 b	8.59±0.5	12.53±0.6	1.21±0.2 b	5.79±1.3 ab
Summer	40	3.94±1.2	2.95±0.7	4.02±1.0 ab	7.55±1.9	12.27±0.5	0.9±0.002 b	4.96±0.0 b
Winter	40	3.39±0.7	2.90±1.1	4.79±1.3	8.09±1.6	12.24±3.3	0.83±0.26	4.11±2.0
Sig		NS	NS		NS	NS		

NS, No significant differences, means followed by the same superscripts do not differ significantly ($P< 0.05$).

3.2 Camel milk components of traditional system (%) as influenced by season

As shown in (Table 2) season had significant affect on camel milk content under traditional management system particularly in fats, proteins, lactose and total solid values. It was attributed to the fact that the green fodder and pushes are readily available in Butana area of the Sudan during rainy season. 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 [5]. Supplementary feeding of camels is not common in most camel herding societies in Sudan under semi-wild conditions, browsing and grazing throughout the year without any supplementary feeding. Generally, camel milk content at autumn recorded high values among other seasons. Fats content recorded highly significant differences ($P < 0.01$) during autumn when compared with summer season. This result supported by [15] who reported a minimum fat content in camel milk at the hot season. Total solid content

was highest (P<0.05) in the wet season, which was in agreement with [16] who stated that total solid recorded significantly (P < 0.01) more values at autumn and decreased significantly during the dry season. This might be attributed to the reason that camels during hot seasons provides milk with lower total solid because the calves needs more fluids [17]. Or might be due to the different management systems and variation in quality and quantity of feed available between the systems. lactose content recorded significantly (P < 0.01) more values during both autumn and winter seasons. This result resemble the findings of [18] who found that lactose was significantly affected by season. Protein content recorded significantly (P < 0.01) more values during both autumn and summer seasons. Our finding were concordance with the work of [19] who reported that camel milk had higher (P<0.01) fat, crude protein and total solid contents (%) during the wet season. Previous finding pointed out that the variation in camel milk composition could be attributed mainly to geographical origin and seasonal variations [20;21;22].

Table 2: Camel milk components of traditional system (%) as influenced by season

Season	No	Fats	Proteins	Lactose	SNF	TS	FFA	Acidity
		a	A	a		A		
Autumn	45	3.66±2.6 b	2.92±0.7 A	4.59±0.7 b	8.18±0.8	12.37±2.6 ab	0.798±0.27	5.59±0.6
Summer	45	2.32±0.2 ab	2.86±0. 5 B	3.99±0.7 a	7.41±1.3	11.45±0.4 B	0.788±0.004	5.5±0.5
Winter	45	2.8±0.8	2.33±0.3	4.73±0.5	7.34±1.1	10.69±1.6	0.778±0.276	5.68±0.8
Sig					NS		NS	NS

NS No significant differences, means followed by the same superscripts do not differ significantly (P< 0.05); No: number of observations

3.3 Camel milk components in two studied systems (interaction) (%) as influenced by Season

Protein content samples in traditional system reported higher significantly (P ≤ 0.05) differences during autumn when compared with that taken from intensive system. Although camels in intensive system always have high protein rations in their feed, the protein content of their milk was lower to that obtained from traditional one. This could be explained by that camels were good selectors of rich protein browsers. During winter season, an opposite trend was observed, wherein protein recorded significantly more values in intensive system compared to that of traditional one. This could be explained by seasonal changes that affect the vegetations status (poor pastures) in Butana area and most of the semiarid zones of the country during the winter season [23]. There were no significant differences of constituents values between samples taken from the two management system during all season. Except the mean of titratable acidity of samples collected from traditional system at winter which was found to be significantly higher (P ≤ 0.05) when compared with that taken from intensive

management system. Variations in pH and acidity for the same source of milk, regardless of season, could be due to differences in hygiene level and the total bacterial count of milk [14].

It noticeable that, summer season had no affect on camel milk components in both intensive and traditional management system. This could be attributed to feedstuff shortage during summer season in entire parts of the country (Table 3).

Table 3: Camel milk components in two studied systems (%) as influenced by Season

Season	Components	System	N0	Mean ± SD	Sig
Autumn	Fat	Intensive	10	4.64±1.84	NS
		Traditional	10	2.64±1.11	NS
	Protein	Intensive	10	2.78±0.75	
		Traditional	10	2.85±0.37	*
	Lactose	Intensive	10	4.60±0.69	NS
		Traditional	10	5.04±0.31	NS
	SNF	Intensive	10	8.18±0.77	NS
		Traditional	10	8.59±0.54	NS
	TS	Intensive	10	13.23±2.25	NS
		Traditional	10	11.67±0.98	NS
	Acidity	Intensive	10	5.69±1.32	*
		Traditional	10	5.68±0.54	
	FFA	Intensive	10	1.13±0.26	NS
		Traditional	10	0.88±0.34	NS
Summer	Fat	Intensive	10	3.31±1.43	NS
		Traditional	15	2.74±1.22	NS
	Protein	Intensive	10	3.05±0.59	NS
		Traditional	15	2.79±0.60	NS
	Lactose	Intensive	10	4.20±0.79	NS
		Traditional	15	3.87±0.84	NS
	SNF	Intensive	10	7.85±1.51	NS
		Traditional	15	7.21±1.57	NS
	TS	Intensive	10	11.77±0.71	NS
		Traditional	15	11.78±0.53	NS
	Acidity	Intensive	10	5.37±0.35	NS
		Traditional	15	5.24±0.55	NS
	FFA	Intensive	10	0.835±0.61	NS
		Traditional	15	0.835±0.58	NS
Winter	Fat	Intensive	19	3.44±0.73	NS
		Traditional	20	2.8±0.85	NS
	Protein	Intensive	19	2.87±1.11	*
		Traditional	20	2.33±0.32	
	Lactose	Intensive	19	4.74±1.33	NS
		Traditional	20	4.73±0.53	NS
	SNF	Intensive	19	8.05±1.64	NS
		Traditional	20	7.34±1.1	NS
	TS	Intensive	19	12.15±3.39	NS
		Traditional	20	10.69±1.58	NS
	Acidity	Intensive	19	4.05±2.09	*
		Traditional	20	5.68±0.77	
	FFA	Intensive	19	0.810±0.25	NS
		Traditional	20	0.778±0.27	

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

4. Conclusion

The present study showed variations in camel milk components as affected by season under traditional and intensive management systems. Wherein, protein, lactose, Fat, total solid and acidity values were markedly affected by season. Season interaction effects showed significant differences ($P > 0.05$) between systems in values of protein and acidity during autumn and winter seasons. However, more work is needed to study the effects of parity and breed differences on camel milk composition.

5. Recommendations

- Develop and implement appropriate rangeland management systems.
- Enhance the genetic makeup of farm animals through selection and crossbreeding for dairy production in locations where it is feasible with improved feeding, veterinary care and proper management systems.
- The international scientific community has to turn its attention to a good performance control of dairy production in camels.
- Seriously deal with conflicts over resources in the studied and similar areas.

References

[1] Faye B. Dairy productivity potential of camels. Proc. of the 34th meeting FAO/ICAR (International Committee for Animal Recording). Session on camelids. 28 mai-3 juin 2004, Sousse (Tunisie), pp 93-105.

[2] Khan, B. B. and A. Igbal. 2001. Production and composition of camel milk: A review. Agric. Sci. 38(3-4):64-68.

[3] Ali, M.S. and Majid, A.A. Productive and reproductive characters of camels raised in Butana area in eastern Sudan. Proceedings of the International Scientific Conference on camels. 10 – 12 May, 2006. Qassim, Saudi Arabia. (2006). pp. 2339 – 2348.

[4] Saint-Martin, G.; Delmet, C.; Zubeir, A. R. Y.; Peyre, de Fabriques, B.; Harbi, M. S. M. A.; Bagadi, H. O. (1992). Camel Project of Butana : Final Report. Maison Alfort, France, IEMVT. pp. 128.

[5] Agab, H. Epidemiology of Camel Diseases in Eastern Sudan with Emphasis on Brucellosis. M.V.Sc. Thesis. University of Khartoum. PP. 172. 1993.

[6] Abbas, B.; Chabeuf, N.; Saint-Martin, G.; Bonnet, P.; Maillaird, A.; Beshir, H. and Musa, B. E 1992. Camel pastoralism in the Butana and north eastern Sudan: an interdisciplinary study. Nomadic Peoples. 31: 64 – 84.

[7] Lactoscan milk Analyzer (Milkotronic LTD, Europe) http://www.lactoscan.com/products_MCC.html)

[8] Dal Dairy Factory (DDF), Khartoum-North, Sudan.

[9] Knoess K.H., Makhudum A.J., Rafiq M., Hafeez M., 1986. Milk production potential of the dromedary with special reference to the province of Punjab, pakistan. World Anim. Rev., 57, 11-21, FAO, Rome (Italy).

10] Haddadin, M. S. Y., S. I. Gammoh and R. K. Robinson. 2008. Seasonal variations in the composition. J. Camelid Sci. 1:32-36.

[11] Yagil, R., Etzion, Z. 1980. Effect of drought conditions on the quality of camel milk. Journal of Dairy Research, 47:159- 162.

[12] Mohamed, I.E.M., El Owni, O.A.O., Mohamed, G.E. 1999. Effect of mastitis on milk quality of Friesian cows in Khartoum State. Indian Journal of Animal Sciences,69: 733- 735.

[13] Simon, M., Hasen, A.P. 2001. Effect of dairy packing materials on the shelf life and flavor of ultra pasteurized milk. Journal of Dairy Science, 84:784- 791.

[14] Mehaia, M.A., Hablas, M.A., Abdel- Rahman, K.M., El Mougy, S.A. 1995. Milk composition of Majaheim, Wadha and Hamra camels in Saudi Arabia. Food Chemistry, 52: 115- 122.

[15] Shuiep E.S., El Zubeir I.E.M., El Owni O.A.O. and Musa H.H. (2008). Influence of season and management on composition of raw cow camel (Camelus dromedarius).Trop. Subtrop. Agroecosys. 8,101-106.

[16] Elvan O. and Sebnem S. (2008). The effect of seasonal variation on the composition of cow milk in Van province. Pakistan J. Nutr. 7,161-164.

[17] Shuiep, E. S., I. E. M. Zubeir. 2008. Raw camel (Camelus dromedarius) milk in Khartoum state, Sudan. Trop. Subtrop. Agroecosyst. 8:101-106.

[18] Bakheit, S. A., A. A. Majid and A. M. Nikhala. 2008. Camels (Camelus dromedarius) under pastoral systems in North Kordofan, Sudan: Seasonal and parity effects on milk chemical composition of camel milk in Jordan. J. Dairy Res. 75:8-12.

[19] Hamed1. H., ElFeki A., and Gargour A 2017. Influence of wet and dry season on milk composition of Dromedary camels (camelus dromedarius) from Tunisia. Iranian journal of applied animal science, March, 2017.

[20] Nagy P., Faye B., Marko O., ThomasS., Wernery U. and Juhasz J. (2013). Microbiological quality and somatic cell count in bulk milk of dromedary camels (Camelus dromedarius) descriptive statics, correlations and factors of variation. J. Dairy Sci. 96, 1-5.

[21] Konuspayeva, G., B. Faye and G. Loiseau. 2009. The composition of camel milk: A meta-analysis of the literature data. J. Food Compos. Anal. 22:95-101.

[22] Sallam A.B., Ali M.A.M. and Abdel Moneim M.A.N. (2008). Camels (Camelus dromedarius) under pastoral systems in North Kordofan, Sudan: Seasonal and parity effects on milk composition. J. Camel. Sci. 1,32-36.

[23] El Zubeir, I.E.M., Nour, E.M. 2006. Studies on some camel management practices and constrains in pre- urban areas of Khartoum State, Sudan. International Journal of Dairy Science,1: 104- 112.