Parity Effect on Camel Milk Composition 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 parity on some chemical components of camels milkfrom 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 parity had significant effect (P > 0.05) on camel milk components that were collected from intensive management system. Wherein proteins, lactose, free fatty acid (FFA) and solid not fat (SNF) were markedly affected by parity.Parity interaction effects showed significant differences (P > 0.05) between systems in values of protein, lactose, Fat, total solid contents and acidity during second parity up to successive parities. Primiparous seemed to have no significant effect (P > 0.05) on camel milk components that collected from the two management systems. The study concluded that parity had significant effect on some chemical components of camel milk under traditional and intensive management system.***

Keywords: Camel, milk analysis, parity, system

1. Introduction

The milk composition of dairy animals has been widely studied throughout the world and thousands of references are available especially with regard to milk consumed by humans. The literature data mainly concerns cow milk, which represents 85% of the milk consumed in the world and, to a lesser extent, goat and sheep milk. Studies on other dairy animals like camel are rather scarce, inspite of their nutritional interest and medicinal properties. In addition, unlike other milk-producing animals, camels can thrive under extreme hostile conditions of temperature, drought, and lack of pasture, and still produce milk[35]. For that in this context, the effect of parity number on chemical composition of camel milk need to be further investigated.

2. Materials and Methods

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].

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)*[31].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 [1].

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*).

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 laboratory, the samples were stored in freezer (-20ºC) until they were analyzed.

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) according to the manufacturer's instructions [19]. The analysis of milk was conducted at Dal Dairy Factory (DDF), Khartoum-North, Sudan[12]. 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.

Statistical analysis

Different statistical tools were employed based on the available data obtained such as simple descriptive statistics, Dairy Production, Tumbool Camel Research Center. At the

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

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

Parity had no effect (P > 0.05) on camel milk components that were collected from intensive management system (Table 1). This may be attributed to sufficient nutrient supplementation and limitation of animal health care in intensive system as reported by [32]. Titratable acidity in primiparous and 5th parity recorded highly significant differences (P < 0.01) in comparison to milk from camels in the other parities. No explanation was found for this result.

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

Parity Number	Fats	Proteins	Lactose	FFA	SNF	TS	Acidity
1	3.33±1.2	2.89±0.8	4.85±0.7	1.03±0.3	8.49±1.5	12.3±1.6	5.72±0.7^{a}
2	3.85±0.6	3.11±1	4.58±0.5	1.06±0.2	7.39±1.5	11.07±1.2	5.5±0.53^{b}
3	3.8±1	3.07±1.2	4.45±2.2	0.89±0.3	8.29±2.1	13.62±4.6	4.02±0.32^{b}
4	3.42±0.6	2.65±0.5	4.46±0.8	0.91±0.3	7.92±1.3	12.7±1.19	4.23±0.25^{b}
5	3.53±0.4	2.59±0.9	4.94±0.3	0.82±0.2	8.28±1.2	12.51±0.1	6.32±0.68^{a}

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

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

Parity had significant effect (P > 0.05) on camel milk components that were collected from intensive management system (Table 2). Wherein proteins, lactose, free fatty acid (FFA) and solid not fat (SNF) were markedly affected by parity.Protein content in 2nd parity recorded highly significant differences (P < 0.01) when compared to 5th one.Our study results are not in agreement with the finding of [36] who reported that parity had significant effects on daily composition of protein and milk protein was significantly higher in parity 3, as compared to other parities. Moreover, lactose content in 3rd parity recorded significantly (P < 0.01) more values when compared with 5th parity.The findings for lactose in our study are well in the range of 5.0% by [21], 4.88% by [27], 5.43% by [20], 4.21% by [26], 4.6% by [34], 5.8% by [13], 4.4% by [32], 4.59-5.33% by [22], 5.61% by [2], 5.24% by [16], 4.16% by [14], 4.47% by [15] 4.6% by [24], 4.81% by [17], 4.1% by [23], 4.4% by [11] and 4.67% by [36]. While, The findings of the following studies are reported with the lower lactose contents than our study i.e. 3.36% by [8], 3.9% by [6], 3.4% by [22], 3.30% by [18], 3.4% by [10] and 3.8% by [29]. Similarly to protein, SNF content in 2nd parity recorded highly significant differences (P < 0.01) when compared to 5th one.This result is similar to those found by [30].Free fatty acids in 2nd parity recorded highly significant differences values among other parities. Meanwhile, fat content in first and second parities were distinguished with high mean values among other successive parities.This finding is agreed with the findings of [36] who mentioned that the effect of parity on fat content of camel milk was statistically significant. While the other scientists reported that the number of lactation (parity) had no effect on fat [5]; [4]. It noticeable that, most of camel milk samples collected in 5th parity under traditional management system recorded the lowest values among other parities.

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

Parity number	Fats	Proteins	Lactose	FFA	SNF	TS	Acidity
1	3.35±0.95	2.56±0.42^{ab}	4.63±0.6^{ab}	0.79±0.25^{b}	7.15±1.32^{ab}	11.32±1.72	5.78±0.7
2	3.5±0.7	3.03±0.70^{a}	4.47±0.87^{ab}	0.99±0.25^{a}	8.13±0.99^{a}	12.36±2.80	5.9±0.53
3		ab	a	b	ab		

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	2.66±1.1	2.67±0.53	4.74±0.4	0.71±0.19	3.93±0.74	10.83±1.35	5.69±0.32
4	2.19±0.8	2.6 ± 0.5^{ab}	4.39 ± 0.64^{ab}	0.71 ± 0.8^{b}	7.63 ± 1.18^{ab}	10.8±0.5	5.29±0.25
5	2.83±1.5	2.32 ± 0.36^{b}	4.01 ± 0.75^{b}	0.72 ± 0.15^{b}	6.89 ± 1.14^{b}	12.51±0.62	5.32±0.68

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

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

Primiparous seemed to have no significant effect (P > 0.05) on camel milk components that collected from the two management systems (Table 3). In second parity, protein content in intensive system was markedly affected (P > 0.05) when compared with that of traditional system. Lactose and acidity of camel milk collected from traditional management system recorded significantly (P > 0.05) more values when compared with that of intensive system.Fat and total solid contents of camel milk samples that were collected from intensive system during 3rd parity recorded high significant differences (P < 0.05) when compared to traditional one. Those results were concordant with [7] who stated that parity seemed to have no effect (P < 0.05) on milk fat content. But disagree with [36] who mentioned that the effect of parity on fat content of camel milk was significant. On the other hand, titratable acidity in 3rd parity of traditional system recorded high significant differences (P < 0.01) in comparison to camel milk samples collected from intensive system. But there were no significantly differences observed in other camel milk components of both intensive and traditional management system in 3rd parity.[35] attributed this to the high temperature or may be due to bacterial activity [25] and [33]. 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 [24].In fourth parity, lactose had an opposite trend in 2nd , which significantly (P > 0.05) recorded more values in intensive system compared with that of traditional management system (Table 4).Similarly to fourth parity, lactose content in fifth parity, significantly (P > 0.05) recorded more values in intensive system compared with that of traditional management system. But there were no significantly differences observed in other camel milk components of both intensive and traditional management system in 5th parity (Table 5). This may be attributed to sufficient nutrient supplementation and limitation of animal health care in intensive system as reported by [32]. Or maybe attributed to the daily exercise of camels and continuous mobility for grazing as supported by [28].

Table 3: Camel milk components in two studied systems (%) as influenced by first and second parities

Parity	Components	System	N0	Mean ± SD	Sig
1	Fat	Intensive	12	3.47±1.2	NS
		Traditional	4	3.16±0.5	NS
	Protein	Intensive	12	2.73±0.7	NS
		Traditional	4	2.50±0.2	NS
	Lactose	Intensive	12	4.56±0.7	NS
		Traditional	4	5.05±0.4	NS
	SNF	Intensive	12	8±1.4	NS
		Traditional	4	6.79±1.8	NS
	TS	Intensive	12	11.9±1.5	NS
		Traditional	4	10.89±0.5	NS
	Acidity	Intensive	12	5.58±1.2	NS
		Traditional	4	6.39±0.5	NS
	FFA	Intensive	12	0.93±0.22	NS
		Traditional	4	0.75±0.39	NS
2	Fat	Intensive	13	4.05±2	NS
		Traditional	4	2.39±1.2	NS
	Protein	Intensive	13	3.23±0.9	*
		Traditional	4	2.54±0.06	
	Lactose	Intensive	13	4.34±0.74	
		Traditional	4	5.11±0.2	*
	SNF	Intensive	13	7.63±1.41	NS
		Traditional	4	8.29±0.07	NS
	TS	Intensive	13	12.02±2.35	NS
		Traditional	4	10.92±1.88	NS
	Acidity	Intensive	13	4.27±1.68	
		Traditional	4	6.32±0.71	*
	FFA	Intensive	13	1.01±0.22	NS
		Traditional	4	1.06±0.26	NS

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

Table 4: Camel milk components in two studied systems (interaction) (%) as influenced by third and fourth parities:

Parity	Components	System	N0	Mean ± SD	Sig
3	Fat	Intensive	6	3.84±0.8	*
		Traditional	11	2.84±1.4	
	Protein	Intensive	6	3.38±1.28	NS
		Traditional	11	2.58±0.52	NS
	Lactose	Intensive	6	4.96±2.43	NS
		Traditional	11	4.41±0.82	NS
	SNF	Intensive	6	9.23±1.48	NS
		Traditional	11	7.49±1.19	NS
	TS	Intensive	6	14.1±5.39	*
		Traditional	11	11.1±1.35	
	Acidity	Intensive	6	3.7±1.8	
		Traditional	11	5.56±0.41	*
	FFA	Intensive	6	0.887±0.33	NS
		Traditional	11	0.750±0.195	NS
4	Fat	Intensive	4	3.25±0.74	NS
		Traditional	13	2.62±0.96	NS
	Protein	Intensive	4	2.59±0.37	NS
		Traditional	13	2.64±0.51	NS
	Lactose	Intensive	4	4.5±0.35	*
		Traditional	13	4.4±0.78	
	SNF	Intensive	4	8.18±1.41	NS
		Traditional	13	7.65±1.21	NS
	TS	Intensive	4	11.47±1.45	NS
		Traditional	13	11.36±1.38	NS
	Acidity	Intensive	4	3.54±1.13	
		Traditional	13	5.18±0.65	*
	FFA	Intensive	4	0.67±0.09	NS
		Traditional	13	0.85±0.27	NS

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

Table 5: Camel milk components in studied systems (%) as influenced by fifth parity

Parity	Components	System	N0	Mean ± SD	Sig
5	Fat	Intensive	4	3.61±0.52	NS
		Traditional	13	2.77±0.89	NS
	Protein	Intensive	4	1.87±0.11	NS
		Traditional	13	2.63±0.64	NS
	Lactose	Intensive	4	4.78±0.02	*
		Traditional	13	3.35±0.83	
	SNF	Intensive	4	7.41±0.57	NS
		Traditional	13	7.59±1.52	NS
	TS	Intensive	4	12.88±0.13	NS
		Traditional	13	11.55±1.2	NS
	Acidity	Intensive	4	7.16±0.31	NS
		Traditional	13	5.36±0.63	NS
	FFA	Intensive	4	0.68±0.23	NS
		Traditional	13	0.796±0.17	NS

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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 parity order under traditional and intensive management systems. Camel milk samples obtained from the intensive system (Tumbool Camel Research Center) and traditional system system (Butana area) revealed highly significant variations between these systems in values of protein, lactose, Fat, total solid contents and acidity

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