

EFFECT OF IMPROVING MANAGEMENT SYSTEM ON CAMEL MILK PRODUCTION

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ABSTRACT

Twenty four lactating she-Camels of the Sudanese *Kabbabish* breed and were divided into two equal groups of 12 animals. The first group was managed in a semi intensive system by offering concentrates and roughage, free access to water and veterinary care. The other group was served as a control and managed traditionally within the experimental site. The milk sampling started at 10 days postpartum and continued for 12 successive months in biweekly intervals. The she-camels were hand milked twice a day, approximately 12-hours interval. To control suckling *Sorar* technique was used. Daily milk yield was determined using graded cylinders. The data were analyzed using SIGMA- STAT. computer software as described by Analysis of Variance (ANOVA). The results indicated that the average daily milk yield for the two management systems were 6.85 ± 1.32 lit/day and 3.14 ± 0.66 lit/day for semi-intensive and traditional system, respectively with highly significant ($P < 0.001$) differences. This differences could be attributed to the management system and to the times of lactation from post-partum ($P < 0.05$). The increase in average daily milk yield amounted to 53% under semi-intensive system compared to those under traditional system. The maximum average daily milk yield 8.7 ± 0.94 lit/day and 4.30 ± 0.59 lit/day was recorded in the 3rd month post-partum in semi-intensive and traditional system, respectively. A sharp decrease in daily milk yield in the traditional system after reaching the peak was observed in contrast to the semi-intensive system with a good persistency or stability after reaching to the peak of production. The results indicated that the trend of daily milk yield seemed to increase significantly ($P < 0.05$) from the first day post-partum till reaching the peak in the 3rd month and then declining gradually through the lactation period. The minimum average daily yield was 5.1 ± 0.76 and 2.32 ± 0.39 lit/day in semi-intensive and traditional system, respectively with a range of 3.7 lit/day and 10 lit/day in semi-intensive system and 1.8 lit/day under and 5.2 lit/day for lowest and highest milk production of the groups.

Keywords: Camel, Improving Management, Daily Milk, Milk Production, Kordofan

INTRODUCTION

According to FAO statistics, Sudan is ranked second in camel population after Somalia with 4.5 millions heads (Faye *et al.*, 2011). North Kordofan State has the highest camel population with more than one million heads (Faye, 2009). In some regions of Sudan camel milk is one of the main components of the diet (Bakheit *et al.*, 2004). The dromedary produces more milk and for a longer period of time than any other species in the same environment (Farah and Younan, 2005). It is difficult

to estimate the daily milk yield of camel under pastoralist conditions due to the inconsistency of milking frequency (Mukasa, 1981). Milk yield also varies with breed, stage of lactation, feeding status and management conditions (Farah and Fischer, 2004). Camels can produce milk under different environmental conditions and gives most milk near the beginning of lactation period (Bakheit *et al*, 2008). Many studies monitoring the camel milk yield, e.g. Field (1979) estimated the daily yield at 21 liters in the 2nd week of lactation and 4.8 liters by the 16th week. The potential lactation yield of camels on irrigated pastures was calculated as 2847 Kg from results given by Knoess (1976). In Sudan, Bakheit (1999) studied the daily and total milk yield under traditional conditions and recorded that the daily milk ranged between 1.39–3.30 liters and the total milk yield during lactation on 365 days varying between 507–1204 liters. The present study was initiated to study the effects of keeping Sudanese she-camels under semi-intensive system with veterinary care on milk production and persistency as opposed to traditional management.

MATERIAL AND METHODS

Study area

North Kordofan State lies between latitudes 11° 15' and 16° 30' N and longitudes 27° and 32° E at an altitude of 560 meters above sea level. Maximum temperatures range between 30 and 35°C, with peaks of above 40°C during the months of April, May and June. Rainy season extends from July to October and highest monthly mount of precipitation is received in August. The study area can be categorized into two major soil groups, sandy and sandy loamy soils. The dominant tree species in the study area are composed of Acacia species, grasses and herbs are dominated as the under storey vegetation (Technoserve, 1987).

Experimental Animals Identification

Twenty four lactating she-camels of Sudanese Arabi *Kabashi* breed were used in this study. The animals were taken at late pregnancy randomly from nomadic herd. Each animal was ear-tagged for identification during treatments. The she-camels were divided into two equal groups of 12 she-camels each. Group one (G1) was managed in a semi intensive system where all animals were herded during night in closed pen and set free during the midday. Supplements consisted of concentrates (2kg/day) and roughages (5kg/day) were made available for this group. Water was provided continuously at sufficient quantity. Veterinary involved external and internal parasite and treatment of infections when necessary. Experimental animals in group two (G2) served as a control and were managed traditionally but within the experimental site, on traditional system the animals were brought to grazing areas where

they selected the feed by themselves from the available plants without being supplemented exception offering salt as brine or dry during rainy season and watering regime every (6-7) days was applied.

Data collection

Milk samples collection commenced after 10 days postpartum on biweekly interval period and continued for 12 successive months in all experimental animals in traditional and semi-intensive systems. The animals were hand milked; where the milker used to approach she-camel from the left side, during milking he stood on his right leg and balanced the milking bowl on his left bent and used all hands for milking. The camels were Milked twice a day, approximately 12-hours interval; usually two teats were milked and leaving the remaining two for to be suckled by calf. *Sorar* technique was used to prevent the calf from suckling; two teats were tied up with a soft tape of cloth that was removed only at milking time. The data on of milk yield were obtained from yield intervals for the whole year viz. 12 monthly yield were secured. Daily milk yield were measured using graded measuring cylinders of different volumes (50 ml, 500 and 1000 ml). The milk yield was registered in milk production record sheet.

Statistical analysis

Data were statistically analyzed using a Computer software Package SIGMA STAT programme. Analysis of Variance (ANOVA) according to Snedecor and Cochran (1967) and Duncan Multiple Range Test was used for means separation.

RESULTS

Camel's milk production

The average daily milk yield for both farming systems were 6.85 ± 1.32 liter/day and 3.14 ± 0.66 L/day for semi-intensive and traditional systems, respectively (Table 1). The total milk was 2633.37 liter and 1204.05 liter on semi-intensive and traditional systems, respectively (Table 2). The average means from the analysis of variance for daily and monthly milk yield were highly significantly ($P < 0.001$) affected by the farming system which was adopted for camel husbandry. It was also affected significantly ($P < 0.05$) by the time of lactation from post-partum (Table 3). The maximum average daily milk yield was attained at the third month post-partum in both systems, or in 13th week after calving, which were 8.7 ± 0.94 L/day and 4.30 ± 0.59 L/day in semi-intensive and traditional systems, respectively (Table 1). There was a sharp decrease of daily yield in traditional system after it reached the peak, in contrast to that in semi-intensive system which had a good persistency for longer time after it reached the peak. The trend of daily milk yield seed to increase significantly ($P < 0.05$) from the first day post-partum till reach the peak in third month and then declined gradually through the lactation

period, the minimum average daily yield was 5.1 ± 0.76 and 2.32 ± 0.39 liter/day in semi-intensive and traditional system, respectively (Fig. 1). The results indicated that daily milk production ranged between 3.7 -10 L/day in she-camel reared under semi-intensive system. On the other hand the daily milk production of the camels reared under traditional management ranged between 1.8 – 5.2 L/day. These for she-camels reared without supplementation (Table 2). It was evident that farming system and management had positively significant impact on the daily camel milk yield and milk yield which obtained from the camels under semi-intensive system was 53% greater than obtained from camels managed under traditional system.

DISCUSSION

The camel is one of the most neglected domestic animals in the Sudan with regard to research pertinent to its milk production potential under different types of management systems. The average annual milk yield in this study in general irrespective of systems of management, complied with findings of Knoess (1979) who reported that the total milk production varied between 1050 – 3600 liters. The present data also were within the range that was obtained by Mariam (1988) and Spencer (1973) who mentioned that the daily milk yield under traditional management varied from 1.4 to 5 liters and total milk production ranged from 800–1200 liters during a lactation period of 9–18 months. The results of this study were in agreement with the findings of Ali and Majid (2006) and Eisa (2006) who studied the productive and reproductive characteristics of camels raised in Butana area in Eastern Sudan and reported that the daily milk yield was highly variable among seasons in a range of 1.0–6.7 L/day. On the other hand the same authors reported that the amount of milk decreases to be 1.38 liters per day. The average lactation curve of the present she-camels started at an initial weekly yield scale of 45.4 ± 20.76 kg/week and increased at a rate of 0.304 ± 0.238 kg/week to reach a peak yield of 63.5 ± 24.25 kg/week after 7.6 ± 2.92 weeks post calving (Zayed *et al.*, 2014). Enaam *et al.* (2015) reported that averages total milk yield, daily milk yield and lactation length of Sudanese camel were 1378.00 litter, 3.89 litter and 347.45 days, respectively. The mean daily milk off take of camels was 4.1460.04 kg/ day and the highest off take recorded was 13.75 kg/day by one camel in the 13th week of lactation (Bekele *et al.*, 2002).

The actual amount of milk secreted was higher than the recorded figures presented in this study, because the calves shared the milker when the milk was let down and they suckled faster than the milker. Moreover, milk yield was calculated from only twice milking per day, with consideration that she-camel can be milked four times or more in some areas. The results of the present study were in agreement with the findings of Chaibou and Faye (2003) who reported that the lactation peak was

observed at the 3rd month of lactation with the mean value of 4.11 kg of milk for animals followed up without weighing the young camel before and after milking. Also the results of this study in the traditional system (3.14 ± 0.66 lit./day) were in agreement with results reported by the same authors in the daily milk yield which they reported that the mean daily milk production was assessed 3.20 ± 0.10 kg, when the consumed milk by the camel calf was added, the mean production was assessed to be 5.20 ± 0.15 kg for milk per day though their findings were lower than the daily milk yield under semi-intensive management. The results of the present study are similar to the findings of Bakheit (1999) who reported that the she-camel in western Sudan reared under nomadic management produced 2.36 liters of milk per day, and with Eisa (2006) who mentioned that the daily milk yield varied between 2.2 liters and 3.5 L/day in the Sudanese she-camel in Butana area. But the results were in disagreement with the findings of El-Amin (1979) who reported that the average of Sudanese milk production was 5-10 kg per day. The data in Table (1) showed that there was highly significant differences ($P < 0.01$) within the daily milk yield started from the 8th month of lactation and that might be attributed to the impact of pregnancy in most of the animals reared under semi-intensive system. According to the results of this study the daily and monthly milk yield of camels under traditional system was significantly ($P < 0.01$) lower than milk production of the camels raised under semi-intensive system and that might be due to some reasons that included having camels in traditional management that were dependent on the natural pastures and not supplemented when forage was scarce that could lead to decreased milk yield. There was little or no diseases control in particular mastitis since a lot of cases were reported during the experimental periods., The camels owners under traditional management kept the animals for subsistence rather than commercial purposes, hence there has been little quality control because quantity rather than quality of she-camel was important in their communities. The data presented in the tables on this study demonstrated that and according to the results of the present study it was observed that the supplementation of the lactating she-camel had significant increase in daily, monthly and total milk production. The results were in line with the findings of Schwartz and Dioli (1992), Farah and Fischer (2004). The authors mentioned that the camels produced more milk and for longer period of time than any other milking animal held under the same harsh conditions. Daily yields between 3 to 10 kg in a lactation period of 12 to 18 months were common. Camel milk is one of the main components of the pastoral community's basic diet, which contributes up to 30% of the annual caloric intake.

CONCLUSION

The study reflects clearly the significant contribution of improving systems on camel daily and total milk production. Camels raised under semi-intensive system were able to produce more milk than those reared under traditional system and that may be attributed to the forage availability and the supplementary diets, water availability and veterinary care that were given to the camels in the semi intensive system. Further studies on camel milk production potential under different farming conditions and controlled environmental factors are recommended to elucidate the potential of camel.

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Table 1. Average Daily Milk Yield/litre (N= 240) through months of lactation (starting ten days post-partum).

System	Month												Average yield/day
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	
Semi-intensive	8.2 ^{abc}	8.5 ^{abc}	8.7 ^{abc}	8.7 ^{abc}	8.4 ^{abc}	8.0 ^{abc}	7.5 ^{abc}	6.9 ^{abc}	6.4 ^{abc}	5.9 ^{bc}	5.4 ^{bc}	5.1 ^c	6.9 ± 1.3
S.E.±	0.91	0.93	0.94	1.01	0.85	0.81	0.63	0.51	0.46	0.59	0.82	0.76	
Traditional	4.00 ^a	4.10 ^a	4.30 ^a	3.94 ^a	3.52 ^a	3.22 ^a	3.17 ^a	3.40 ^a	3.09 ^a	2.62 ^a	2.49 ^{ab}	2.32 ^{ab}	3.14 ± 0.66
S.E.±	0.66	0.67	0.59	0.56	0.50	0.47	0.47	0.47	0.44	0.42	0.42	0.39	

Means within Rows having the same superscript are not significantly different at $P < 0.05$ according to DMRT.

Table 2. Average Monthly Milk Yield/litres during experimental period (starting ten days post-Partum)

System	Month												Milk yield/liter		
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	Total	Min	Max
Semi-intensive	246.6	253.9	262.1	260.8	251.5	239.5	226.1	207.0	192.9	177.8	161.1	153.9	2633.37	3.7	10
Traditional	120.0	123.0	129.0	118.1	105.4	96.6	95.0	101.9	92.7	78.5	74.6	69.5	1204.05	1.8	5.2

Table 3. The ANOVA for milk yield during experimental period

Source of Variation	SS	d.f	MS	F	P-value	F critical
Farming System	1824.810	1	1824.810	4009.776***	9.96E-221	3.863
Weeks (times of Sampling)	416.568	23	18.112	39.798**	1.26E-91	1.554
Interaction	62.678	23	2.725	5.988*	1.55E-15	1.554
Error	196.599	432	0.455			
Total	2500.655	479				

*, ** and *** = significant at $P < 0.05$, 0.01 and 0.001, respectively.

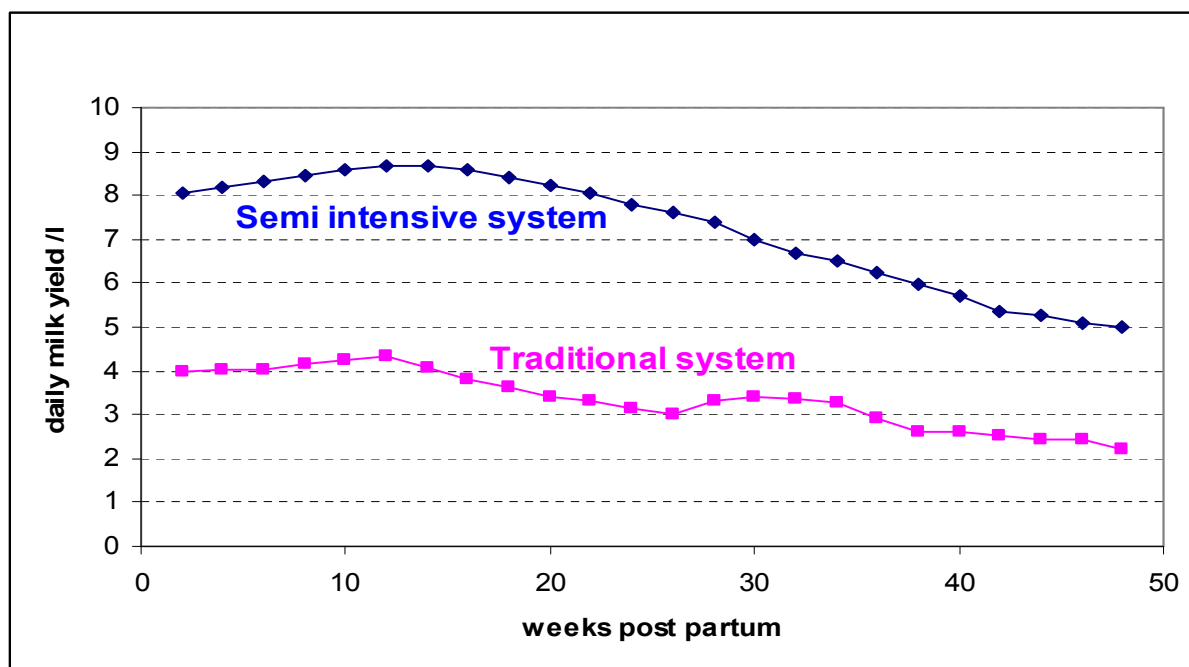


Fig. 1 Average Camel milk yield under semi intensive and traditional management (l/day).

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