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MILK PRODUCTION POTENTIAL OF SOME SUDANESE CAMEL TYPES

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ABSTRACT
The objective of this study was to study the milk production traits and lactation curve parameters of three types of Sudanese dromedary she-camels. Six Bushari, 6 Arabi and 5 Anafi she-camels of the same parity order and at late pregnancy were selected from herds of two farms of the same management and feeding systems. The studied milk production traits included total milk yield, lactation period, observed peak yield, persistency index, offspring body weight, she-camel total body change during lactation. The weekly milk yield was regressed on lactation period according to the formula $y_n = an^b e^{-cn}$ to estimate the lactation curve components. Taking the farm and the period from start of experiment to calving as covariates, the obtained data were subjected to analysis of covariance to test the significance of effect of she camels' type. The she camels of Bushari, Arabi and Anafi types were similar for offspring birth weight as % of dam weight (7.2 ± 1.20%), total milk yield (1932 ± 955 kg) and lactation period (53.3 ± 14.2 weeks). For the milk yield persistency index (66. 8 ± 14.4%), Bushari she camels excelled their Arabi and Anafi fellow mates those were similar. Regarding lactation curve components, Bushari, Arabi and Anafi types of camels had similar initial yield scale (45.4 ± 20.8 kg/week), rate of increase to the peak yield (0.304 ± 0.238 kg/week), week of peak yield (7.6 ± 2.92 week), predicted peak yield (63.5 ± 24.3 kg/week) and persistency of peak yield (4.6 ± 1.17 weeks). Anafi she-camel had lower rate of decrease from the peak yield (0.021 kg/week) than Bushari and Arabi camels (0.037 and 0.052 kg/week, respectively) those were similar. The study concluded that the three types of camels had the same potential for milk production; however Anafi type showed more persistent lactation curve.

KEYWORDS: lactation curve, persistency index, Arabi, Anafi, Bushari camels.

INTRODUCTION

The Sudan has a camel population of 4.6 million heads (Ministry of Animal Resource and Fisheries, 2010). Despite this large population, the camel production appears very low. Faye *et al*. (2011) concluded that camel production is far away back from the potential since the annual meat and milk production were 49880 and 120000 tons, respectively. Camel can be put at the top of the list of the prospective livestock to be harnessed as milk producing animal. The future of this animal is bright since it can thrive and produce efficiently under harsh environmental conditions (Yaqoob and Nawaz, 2007). The level of milk productivity of camels in Sudan was reported to be poor. Faye (2004) reported a production range between 820 and 2400 litres/ 12 and 18 months range of lactation period. Ismail and Al-Mutairi (1991) studied camels' milk yield under traditional conditions in Saudi Arabia and they found that the daily milk yield range between 6 and 7 kg per day with a total milk yield of 2300 kg per season. Bakheit *et al*. (2008) reported total milk production per lactation of 2633 and 1204 liters in semi-intensive and extensive management systems, respectively. They added that the management system had a high impact on the productivity. As a typical production curve, milk yield increases gradually until a peak yield, persists on this peak for a time and thereafter steadily decreases for the remainder of lactation (Wood, 1967). The steady decline in milk yield after peak leads to reduced productivity and efficiency through the remainder of lactation (Knight and Wilde, 1993). Clearly, persistency of lactation which is ability of maintaining milk production at high level for extended periods is the main indicator of milking efficiency. Tekerli *et al*. (2000) noted that for cows with flatter lactation curves, the incidence of metabolic and reproductive disorders that originated from the physiological stress of high milk yield would be low, and the proportion of roughage in the ration could be increased, thus reducing production costs. Knowledge of the probable shape of the lactation curve makes feeding trials more efficient because differences between treatments are more easily detected when the animals are grouped according to the expected curve shape. Probably the best known mathematical model of the lactation curve was proposed by Wood (1967): $y=an^be^{(-cx)}$, where y is the milk yield on week n, a is a scaling factor to represent yield at the beginning of lactation, b and c are factors associated with the inclining and declining slopes of the lactation curve and e is the base of the natural logarithm. Tekerli *et al*. (2000) added that the important features of the lactation curve are the peak yield and persistency (the extent to which the peak yield is maintained). The aim of this study was to examine the body performance and

milking efficiency of she-camels of Arabi, Anafi and Bushari types kept under intensive management conditions.

MATERIALS & METHODS

The study was conducted at Khartoum North during January-2010 - August 2011 at two farms raising different Sudanese camel breeds in a closed system. 6 Bushari, 6 Arabi, and 5 Anafi late stage pregnant she-camels of the same parity order were selected from the herd of the two farms. Each of the selected females was identified by a plastic numbered tag placed around the neck. The camels of the two farms were raised intensively on similar feeding and management systems. The calving date and date at milk let down stop was registered. Chest girth measurement of She- camel at calving and end of lactation and that of calf at birth were used to estimate body weights using the formula of Wilson (1984). Daily milk yield was measured for all animals until they stopped milk let down. The data of she-camels weights at calving and lactation end, calves weight at birth, total milk yield, lactation period, observed peak milk yield and persistency index were then obtained. Persistency index was calculated according to following formula:

$$\text{Persistency index} = \frac{\text{total milk yield per lactation (kg)} \times 100}{\text{weekly peak yield (kg/week)} \times \text{lactation period (weeks)}}$$

Regression of weekly milk yield on lactation period according to the formula: $y_n = a n^b e^{-cn}$ was calculated (StatSoft, 2011) to estimate the following lactation curve components (Cobby and Le Du, 1978 and Tekerli *et al*., 2000):

1. Week of peak yield = b/c.
2. Predicted peak yield (kg) = a $(b/c)^b \times e^{-b}$.
3. Persistency of lactation curve peak (weeks) = -(b+1) ln c, where ln c is the antilog of the constant c.

Statistical analysis

Taking the farm and the period from day of start of the experiment to day of calving as covariates, the data were subjected to analysis of covariance (StatSoft, 2011) to test the significance of effect of camel's type on she- camel milk production traits as well as the lactation curve components.

RESULTS & DISCUSSION

The lactation performance of the studied Bushari, Arabi and Anafi she-camels was shown in Table (1). The similarity of the three she- camels groups in the average estimated calving body weight indicated that it was not a source of variation in the lactation performance. The birth calf weight percentage of dam's calving weight was similar for the three groups and it was comparable to 8.3% that stated by AFRC (1993) as the maximum gestation output in term of kg offspring born/ kg calving dam. This indicated that the management and feeding level is sufficient to allow the she- camels to produce their maximum. Also there were no differences between the three she- camels groups in the total milk yield, lactation period and she-camel weight at end of lactation.

TABLE 1: Milk production traits of the studied camel's breeds

Milk Traits	Bushari	Arabi	Anafi	SEM	P-value	Overall mean	Std. Dev.
Observations' Number	6	6	5				
Total yield, kg	2369	2054	1263	360	0.133	1932	955
Lactation period, weeks	64.3	56.5	47.7	7.48	0.497	53.3	14.2
Observed peak yield, kg/week	72.9^{a}	58.2^{ab}	44.1^{b}	7.19	0.048	59.2	22.2
Persistency index, %	79.1^{a}	60.2^{b}	60.0^{b}	5.03	0.026	66.8	14.4
Calf weight, kg	33.3	36.3	36.1	2.42	0.631	35.2	6.88
Calf weight % of dam weight	7.04	7.33	7.19	0.520	0.922	7.2	1.2
She- camel calving weight, kg	473.4	496.1	502.9	15.6	0.398	490.1	46. 6
She- camel lactation end weight, kg	481.9	498.1	460.4	19.2	0.418	481.3	49.9
Lactation body change, kg	7.58^{a}	2.08^{a}	-41.6^{b}	13.5	0.046	-8.8	37.1

In this table and the following,
SEM = standard error of means
P-value = probability of error, P-value < 0.05 means the effect of camel's breed is significant
^{ab} means in the same row with different superscripts are significantly different at P<0.05
Std. Dev. =standard deviation

The obvious discrepancies among the present observations of total milk yield (coefficient of variation was 49.4%) may be the reason for the absence of treatment's effect although the mean of Bushari group is about double of the mean of Anafi group. The overall mean of total milk yield was comparable to that mean reported by Musaad *et al*. (2013) for multibreed dairy camel herd in the Sudan. They reported 1970 ± 790 kg. Higher value (2300 kg/season) was reported by Ismail and Al-Mutairi (1991). Comparable yield for longer lactation period was reported in Ethiopia by Belay and Getahun (2002). They noted that the lactation milk yield per dam in the Jijiga Site was 2000 kg with an average lactation length of 15 month. The present lactation period was comparable to 12.5 months that reported by Musaad *et al*. (2013) and to the range (12.0 – 16.8 months) reported by Gebrehiwet (1998) in

Eritrea. The present weekly peak yield was comparable to 50.7 kg milk /week but persistency index was lower than 94.7% those reported by Musaad *et al*. (2013). The Bushari she- camels had the highest weekly peak yield and persistency index. However, Anafi she- camels were those milked their back and lost weight during lactation. The Bushari, Arabi and Anafi she camels (Table 2) did not differ in all of the lactation curve components. 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. This peak persisted for 4.6 ± 1.17 weeks before decreasing at a rate of 0.038 ± 0.020 kg/week to the end of lactation period. However the Anafi she-camel had the lowest rate of decrease from the peak yield (0.021kg/week) than the Bushari and Arabi groups (0.037 and 0.052 kg/week, respectively) those were similar, indicating the flatter lactation curve of Anafi she-camels (Tekerli *et al*., 2000).

TABLE 2: Lactation curve parameters of the studied camel's breeds

Breeds	Bushari	Arabi	Anafi	SEM	P-value.	Overall mean	Std. Dev.
Observations' Number	6	6	5				
a	57.2	41.1	36.5	7.27	0.145	45.4	20.8
b	0.31	0.40	0.18	0.100	0.326	0.304	0.238
c	0.037^{ab}	0.052^{a}	0.021^{b}	0.007	0.019	0.038	0.020
week of peak	7.71	7.28	8.06	1.39	0.950	7.6	2.92
peak yield, kg/week	77.6	61.5	49.2	7.98	0.079	63.5	24.3
persistency of lactation curve, weeks	4.37	4.13	5.45	0.466	0.154	4.6	1.17

CONCLUSION

The study concluded that the three types of camel had the same potential for milk production; however the Anafi type showed more persistent lactation curve. This study documented for the milking trend of these camel types, however, further studies on larger sample size are recommended.

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