



Research Paper

Effect of management system on camel calves growth rate and daily gain

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The effect of Management system on growth rate and daily gain in one humped Sudanese camels calves were investigated, twenty four (24) camel calves (12 males and 12 females) at the first day of birth were selected, from the Sudanese Arabi Kababish bred. Camels' calves with their dams were maintained under semi-intensive and Traditional management system for 18 successive months. Calves in semi-intensive system in addition of their suckling of their respective dams they take supplementation diets (one kg of concentrate/head/day), *ad libitum* watering, health care and spraying weekly against ticks and external parasite. The live body weight of camel calves were obtained through direct weighing in 6 months interval, through four periods including birthday, 6 month, 12 months and 18 months. The results indicated that there was non-significant difference ($P>0.05$) in Birth weight of calves raised under semi-intensive and traditional system. In both systems the male (39 ± 0.31 kg) is significantly ($P<0.05$) heavier than the female (36 ± 0.34 mkg). The body weight of the calves under semi-intensive system during six, 12 and 18 months of age are 123 ± 2.21 , 221 ± 2.17 and 326 ± 2.40 kg respectively, and on the other hand the body

weight of the camel calves under traditional system during six months, 12 and 18 months are 96 ± 1.59 , 159 ± 2.35 and 208 ± 2.50 kg, respectively. The results showed highly significant difference ($P<0.01$) between systems of management, The over all mean daily gain of camel calves under semi-intensive and traditional system were 535 ± 9.83 gram and 317 ± 5.46 gram, respectively. The average daily body gain from birth to six months, six - 12 month and 12 -18 month of age in semi-intensive system were 477 ± 10.94 , 542 ± 8.25 and 585 ± 8.37 gram/day, respectively. On the other hand the results showed that the average daily body gain form birth to six months, six - 12 moth and 12 - 18 months of calves managed under traditional system were 352 ± 10.55 , 272 ± 15.98 and 316.71 ± 5.46 gram/day, respectively. We concluded the farming system effect significant on calves' daily gain growth rate, intensification management system will be improved camel meat production, and also the male was heavier than female on birth weight in all management system.

Key words: Camel Calves, Growth, Daily Gain, Farming system, kordofan, Sudan.

INTRODUCTION

Camel population in Sudan ranks the second in the world after Somalia with 4.5 millions heads (Faye et al., 2011). North Kordofan state only has the highest camel

population with more than one million heads (Sahal, 2015). In west Sudan, camels are traditionally reared in extensive system. However, the intensification of the

production system is starting efficiently (Bakheit, 2003). Calves is the main Products of Camels which reared under traditional or semi-intensive systems in Sudan as well as in many others African and Asian countries. Camel productivity was low due to the low calving rate, which is lower than 45%, per female per year, also the high rate of calving loss mainly during dry seasons (Ismail, 1990; Faye, 1997). Camel calves growth rate were determined by sex, genetic potential and mainly affected by nutrition and health status of the animals. The growth rate varies according to the availability of food and may be altered seasonally; especially in the camel outdoor feeding is a popular husbandry regime.

The average birth weight of the dromedary camels is about 35 kg (Wilson, 1978), but it varies widely between regions, breeds and within the same breed. Reports on camel birth weights range between 27 and 39 kg, which is comparable with that of tropical cattle breeds. For instance, reports of birth weights include 26–28 kg for Somali camels (Field, 1979; Ouda, 1995; Simpkin, 1983); 27 kg for Tunisian camels (Hammadi et al., 2001) and 39 kg for Indian camels (Bissa, 1996). Several studies conducted under various conditions have indicated that the potential of rapid growth rate during the early months of camel life (Degen *et al.*, 1987; Ismail, 1990). Efficient daily weight gain in the young animal is governed by the individual's genetic makeup, but needs to be developed by adequate feeding and proper management.

Ismail, (1990) reported that birth weight of Saudi Arabia camel calves both male and female doubled in 64 days and average birth weight of camel calves doubled at age 2.5 months. El-Badawi, (1996) also reported that the calves averaged 15 kg live weight at 180 days and the average daily gain to that age was 0.68kg (680 gram/day).

Turki *et al.* (2007) study the daily gain of Sudanese camel calves and recorded that the average daily gain were 0.591, 0.678 and 0.815 kg in the three different level and types of diets. On the other hand the authors mentioned that the body weight of camel calves of two years old were 175.75 ± 0.25 kg. However, some studies reported very promising average daily gain from 810 to 840 gram for 2-3 year old of camels raised under different intensive feeding system (Degen *et al.*, 1987; Bakkar *et al.*, 1998; El-Badawi and Yacout, 1999; Yacout and El-Badawi, 2001). Data of growth rate in dromedary calves has been reported extensively by many researchers (Bhargava *et al.*, 1965; Fazil, 1977; Knoess, 1977 and Lakoza, 1962) they reported that the fast Bhargav growth of camel calves occurred during the first seven months after birth and the daily weight gain was at its highest at the third month with an average of 0.782 ± 0.349 kg. The present study was aimed to determine and compare the efficiency of body weight gains in camel calves raised under traditional system and semi-intensive management in western Sudan.

MATERIALS AND METHODS

Study area

North Kordofan State lies between latitudes $11^{\circ}15'$ and $16^{\circ}30'$ 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 an August is greatest monthly rainfall. The study area can be categorized into two major soil groups, sandy and loamy soils. The dominant trees species in the study area are composed of Acacia species, grasses and herbs are dominated as the under story vegetation in the study area (Technoserve, 1987).

Experimental animals identification

Twenty four camel calves (12 males and 12 females) at the first day of birth were selected, from the Sudanese Arabi kabashi breed. The camels-calves with their dams were maintained under semi-intensive and Traditional management system in western Sudan (North Kordofan State). Each of the experimental selected animals was identified by plastic numerical tags which placed in ear of the animal, the experimental camel calves in the both system were pointed by the different colour of the ear tags. The twenty four mentioned camel calves were divided randomly with consideration of sex into two equal groups' 12 calves (6 male and 6 female) with their dams. Group (I) was managed under semi intensive system. All animals were herded during night in closed pen and set free during the midday; Calves in semi-intensive system in addition of their suckling of their respective dams had supplementation diets (1 kg of concentrate/head) at third months of age, addlibitum watering was practiced, health care and external parasite ticks were controlled by spraying weekly. The other group (G2) was served as a control under traditional system which was managed traditionally but within the site of the experimental work. In addition of suckling the camel calves were brought to grazing areas where they select food by themselves from the available plants, calves start nibbling almost at six weeks of age and no supplementing diet was offered, salt as brine after 4 months old was granted, watering regime every (6-7) day with their dams.

Data collections

The birth weight of twenty four (twelve calves for both male and female) was recorded at the beginning of the experiments using a static weighing scale balances for birth weight only and were continued for 18 successive months to study their growth rate and daily gain, calves'

weights were determined every six months using advance balance afforded by special designed table, all calves suckled milk from their respective dams ad libitum, but sorar techniques were used as milking control after three month post-partum. The calves start nibbling almost at five weeks of age. Plants for grazing/browsing mainly the natural rangeland components which includes trees, bushes, grasses and herbs. All calves were kept on milk plus available grazing/ browsing during the day with their herd companions, calves in Group (1) had supplementation diets after the third month of age; common salt were provided as brine biweekly or separately during wet season in each system. Water was also provided adlibitum.

Camel calves handling

The restraining of the calves demonstrated to be highly efficient without causing any stress on the experimental animals while affording maximum security for the workers and used soft Strong ropes made of cloths were used for calves' restraint, sometimes undergraduate students had experience in camels' husbandry were help in weighing in the farm.

Statistical analysis

The data were ranked and subjected to statistical analysis program, Sigma Stat. 3.5 (2003), paired T. test was used to find out the variation between calves growth rate in traditional and semi-intensive system and compare the daily gain within two sort of management.

RESULTS AND DISCUSSION

The changes in live body weight of camel calves with age in two farming system were presented in (Table 1) and (Figure 1). The results indicated that the birth weight of calves reared under semi-intensive and traditional system were $(37.45 \pm 0.57 \text{ kg})$ and $(37.60 \pm 0.53 \text{ kg})$ respectively, and they showed non-significant different ($P>0.05$), and on the other hand the live body weight of the camel calves showed highly significant different ($P<0.01$) through the age groups and within the type of farming system. The body weight of the calves under semi-intensive system during six, 12 and 18 months of age were 123.42 ± 2.21 , 221.04 ± 2.17 and $326.26 \pm 2.40 \text{ kg}$ respectively, and on the other hand the body weight of the camel calves under traditional system during six months, 12 and 18 months were 96.42 ± 1.59 , 159.70 ± 2.35 and $208.62 \pm 2.50 \text{ kg}$, respectively. The overall mean daily gain of camel calves at semi-intensive and traditional system were $534.84 \pm 9.83 \text{ gram}$ and $316.71 \pm 5.46 \text{ gram}$, respectively (Table 2). The results of the

present study indicated that the camel calves daily gain were highly significant ($P<0.001$) between the farming system and within the age groups. Therefore, The average daily body gain (DBG) from birth to six months, six – 12 month and 12 -18 month of age under semi-intensive system were 477.61 ± 10.94 , 542.33 ± 8.25 and $584.57 \pm 8.37 \text{ gram/day}$, respectively. On the other hand the results showed that the average daily body gain form birth to six months, six – 12 moth and 12 – 18 months of calves managed under traditional system were 351.55 ± 10.55 , 271.79 ± 15.98 and $316.71 \pm 5.46 \text{ gram/day}$, respectively (Table 3). The results in demonstrated that the male calves was significantly ($P<0.05$) higher in birth weight ($38.85 \pm 0.31 \text{ kg}$) than female ($36.20 \pm 0.34 \text{ kg}$) (Table 4). The results showed that the daily body gain between male and female was non-significant ($P>0.05$) (Table 4).

In this study the results showed that the average birth weights of the camel calves were no-significant difference between the two management systems. This may be attributed to the similarity of the management that the dams were obtained when they had been pregnant, so all the experimental animals which entered the experiments were at the late pregnancy during twelve months and were coming from the same environment and managed under nomadic system. The results of the present study were in line of the findings of Al-mutairi, (2000) in Saudi, Burgmeister, (1975) in Tunisian and Bhargava *et al.* (1965) in India. On the other hand these findings of the present study were disagreement with the findings of Iqbal *et al.* (2000) and Khanna *et al.* (2004) in India and Hammadi *et al.* (2001) in Tunisia. These differences in Camel Calves birth body weight may be attributed to the different of farming system of the dams before parturition and their nutritional status and may be due to the camel breeds. The results of this study showed that the calves birth weight of males are significantly ($P<0.05$) higher than females birth weight which are $38.850 \pm 0.307 \text{ kg}$ for male and $36.200 \pm 0.337 \text{ kg}$ for females. These results are on line of the findings of Bhargava *et al.* (1965) who study the birth weight of Bikaneri camels in India and reported that the average birth weight for males was 38.19 kg and for females 37.19 kg , with a pooled average of 37.23 kg . The results of this study showed that the birth weight of male and female calves were less than that reported by Khanna *et al.* (2004) who revealed that the birth weight of male and female of Indian camel calves were 42.15 ± 0.77 and $38.82 \pm 0.64 \text{ kg}$. This may be due to the variation of camels breed or to the farming system. The birth weight of the calves recorded in this study was higher than the findings of Zhao *et al.* (2000) who studied the postnatal growth and development pattern of camel calves and recorded that the birth weights averaged $34.55 \pm 7.17 \text{ kg}$ and the birth weight varied according to the sex and found $36.17 \pm 8.7 \text{ kg}$ and $32.92 \pm 6.5 \text{ kg}$ for male and female, respectively. In this study the daily body gains varied and depending on the

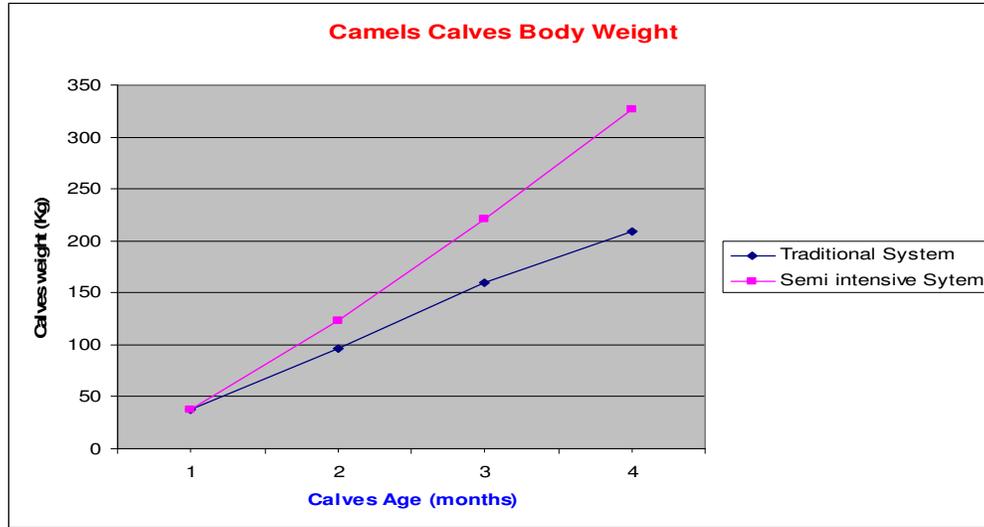


Figure 1. Camel calves live body weight during experimental period.

Table 1. Camels Calves body weight during 18 months of age.

System	Camel calves weight at			
	Birth	Six Months	12 Months	18 Months
Semi-intensive Average Body Weight /Kg ± SE	37.450 ± 0.565	123.420 ± 2.206	221.040 ± 2.170	326.260 ± 2.398
Traditional Average Body Weight /Kg ± SE	37.600 ± 0.527	96.420 ± 1.594	159.700 ± 2.345	208.620 ± 2.501

Table 2. Camel calves growth rate during experimental period.

System	Camel calves growth rate during			
	Birth – 6 Months	6 – 12 Months	12 – 18 months	Over all DG/g means
Semi-intensive Average Daily Gain/g ± SE	477.610 ± 10.94	542.330 ± 8.251	584.570 ± 8.368	534.836 ± 9.831
Traditional Average Daily Gain/g ± SE	326.780 ± 8.338	351.550 ± 10.549	271.790 ± 15.979	316.706 ± 5.46

Table 3. Male and female camel calves birth weight.

Sex	Male and female birth weight within two systems		
	Birth Weight/kg	SD	SE
Male	38.850	0.971	0.307
Female	36.200	1.067	0.337

Table 4. The male and female camel calves daily gain.

Age	Camel calves daily gain at		
	6 Months	12 Months	18 Months
Male: Average daily gain/g ± SE	337.000 ± 9.837	484.000 ± 10.467	531.120 ± 14.684
Female: Average daily gain/g ± SE	316.560 ± 12.800	471.220 ± 20.220	553.540 ± 5.280

type of management. It varied between 477.610 ± 10.943 and 584.570 ± 8.368 gram in semi-intensive system and significantly (P<0.01) highest than the daily gain in

traditional system which varying between 271.790 ± 15.979 and 351.550 ± 10.549 gram, these findings were agreement with the results of Turki *et al.* (2007) who

studied the daily gain of Sudanese camel calves and recorded that the average daily gains were 0.591, 0.678 and 0.815kg in the three different level and types of diets, and on the other hand the authors mentioned that the body weight of camel calves of two year old was 175.75 ± 0.25 kg. On the other hand the results of the present study were less than the findings of Iqbal *et al.* (2000) studied the growth performance of camel calves kept under station and farmers conditions, and found that the daily growth rates of camel calves at the station and farmer were 750 and 820 gram, respectively. Elsewhere the overall daily gain on sixth month was 760 gram/day this variation may be due to the nutrition status. The results of the present study under semi-intensive were in line of the findings of Khorchani *et al.* (2005) who study the camel calves' growth rate in Tunisia and revealed that the artificial nursing technique safeguards calves and ensures comparable mean daily gain compared to those of suckling calves 593 g and 607 g respectively. The results of the present study under traditional system were in line of the findings of Nagpal *et al.* (2005) who postulated that body weights of camel calves are varying between 241 – 276 kg at age between 10 and 12 months and reported the daily gain is varying from 377.6 to 420.9 g/day. The results of this study showed that there were non-significant differences ($P > 0.05$) between male and female on daily gain, but in contrast the birth weight of male and female showed significant differences ($P < 0.05$). These variations may attributable to the combined genotypes of the dam, foetus, followed by intra-uterine foetal environment, maternal environment, parity, nutrition, sex and maternal age. The exact role of these factors in the camel has not been investigated. The nutritional status of the dam may also have a direct bearing on foetal growth, a factor which would seem to be important in the camel: poor nutritional levels during gestation may lead to increased prenatal mortality. The farming system on this study have significant effect ($P < 0.01$) on calves daily gain between two examined system and this due to the nutritional status of the calves. Also the supplemented diet for the dam may increase milk production according to the satisfaction requirements and due to that the calves got enough of the milk from their dams. Our results in this study were agree with the findings of Sahani *et al.* (1998) whose reported that the camel calves body weights and average daily gain from birth to 12 months of age were recorded at 3 month intervals and from 12 to 36 months of age at 6 monthly intervals. The average daily gain from birth to 3 months varied from 0.594 ± 0.02 kg to 0.715 ± 0.09 kg /day with overall gain of 0.605 ± 186 kg /day. Males showed a significantly higher gain than females. The mean daily gain from 3 to 6 months of age ranged from 0.567 ± 0.024 to 0.700 ± 0.04 kg/day with overall gain 0.627 ± 0.014 kg. The average daily gain from 6 to 9 months varied from 0.355 ± 0.033 to 0.401 ± 0.02 kg and 0.208 ± 0.03 kg/day, respectively. The daily gain from 18 to 24

months of age ranged from 0.111 ± 0.015 to 0.219 ± 0.24 kg/day, respectively. The results of the present study were in line of the findings of Bissa *et al.* (1998) reported that The shape of the curves from birth to one year estimated after increasing the time unit at an interval of 3 months showed fast growth from birth to six months. The rate of growth was slow from 6 - 9 months and further slowed down from 9 - 12 months.

Conclusion

The study reflects clearly the significant contribution of improving farming systems on camel calves' growth rate and daily gain which are encouraging for a future effort to establish optimal feeding schedules for maximum growth rates and to develop feedlot for camel calves fattening. Further and deep studies on camel calves growth rate under different farming condition and controlled environmental factors to elucidate the potential of camel calves.

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