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Research article

Influence of non-genetic factors on birth and weaning weights of Friesian crossbred calves in the Sudan

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Abstract

The present study was carried out to examine the effects of calf sex, parity order and season of calving on birth and weaning weight of Friesian crossbred calves comprising weight records of animals born from 2002 to 2011. The data were arranged by dams' parity order (1st, 2nd, 3rd, 4th, 5th, 6th and 7th) calving seasons (dry summer, wet summer and winter season) and calf sex. The overall mean calf birth and weaning weights were 33.7±5.1 kg and 82.9±6.4 kg, respectively. Male calves were superior to females in birth and weaning weights. The lightest birth weight was recorded for the calves born in first parity. The calf birth weight increased with increasing parity order. The heaviest birth weight of calves was observed to dam at 5th parity after which no variation was observed among calves. The lightest weaning weight was recorded for the calves born to first parity dams. There was no variation in weaning weight for calves born to dams from 2nd to 7th parity order. Calves born during dry summer had the lighter birth and weaning weights than their fellow mates born during wet summer and winter. It can be concluded that the studied factors significantly affected birth and weaning weights of Friesian crossed calves. Since the potential for such crosses to be used as conventional dairy animals in the tropics is high, it is highly advised to pay high attention to nutrition and management during gestation and pre-weaning periods.

Keywords: Friesian; Kenana; crossbred; dams' parity order; season of calving; calves' sex

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Introduction

The indigenous cattle in the tropics are known for their tolerance to hot environment but they generally exhibit low productive and reproductive performance (Ageeb and Hiller, 1991). Crossing local cattle, which are hardy but of low milk production potentials, with exotic dairy breeds is a viable strategy for improving local milk production (Preston, 1989). In the Sudan, attempts to set up a dairy industry based on exotic cattle crossing dates back to 1925 with shorthorn breed, however, Friesian crossing was introduced in 1960 (Medani, 1996). The Friesian crossbreds were the most suitable for their good adaptability to the tropical environment in addition to their high yielding capacity.

Birth weight is of critical importance to cattle production industry since it is the initial reference point with regard to subsequent development of the animal (Akbulut et al., 2001). Whereas, weaning weight expresses the mothering ability of the cow, so the change of weaning weight is an important factor at selection (MacNeil, 2005). Knowing the weaning weight of individual calves can help in selecting replacements and in culling cows which consistently

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wean light weight calves. Environmental factors such as dams' age and weight at calving, gestation length, nutritional conditions of dam, calving year, season and geographical region and altitude may influence birth and weaning weights (Holland and Odge, 1992). Consistently, Kocak et al. (2007) reported that birth weight of Holstein calves (overall mean of 38.79±0.17 kg) is moderately heritable (heritability estimate of 0.115±0.0023), however, some environmental factors such as calving year, season, parity, and calf's sex had significant effects on birth weight and they should be considered when calves are evaluated. Sazbo et al. (2006) found that the weaning weight of calves born in summer was the highest while the lowest value was observed in winter. El-Fagir (2007) reported that age of dams at calving exerted a significant effect on weight at weaning, because the mothering ability of cows developed with age. Similarly, Gunawan and Jakaria (2011) showed that effect of dams' parity order had significant effect on calves' weaning weight. In Southern Ethiopia, Lemma et al. (2010) reported that overall weaning weight of Jersey calves was 108.88±0.67 kg, and it was influenced by year of birth, season of birth, sex of calf and parity order. The current study was conducted to examine the effect of dams' parity order, season of calving and calf's sex on birth and weaning weights of Friesian crossbred cattle in the Sudan.

Materials and Methods

Sources of data and animals

The birth and weaning weights records of 1333 calves (500 males and 833 females) of Friesian crossbred cattle (Friesian × Kenana) were extracted from the records of Kenana Sugar Company Dairy Farm (KSCDF) for the period between 2002 and 2011.

Study area

The farm is 300 km south of Khartoum on the eastern bank of the White Nile in the low rainfall savannah region at approximately 13° N latitude and 33° E longitude and 410 meters above sea level. The Kenana region is located in a semi-arid zone. However, there are three marked season, winter (November-February); summer (March–June) and Wet Summer (July–October).

Routine herd management

The farm has a modern open housing system, and the animals were distributed according to their physiological status into separate groups, namely, lactating, pregnant dry cows, calves, fattening stock and cows with udder infection or with fertility problems. Animals were usually vaccinated against major epidemic livestock diseases in the Sudan e.g. anthrax, black quarter, hemorrhagic septicemia and contagious bovine pleuropneumonia. Other diseases such as mastitis, theileriosis and ecto-parasites were controlled through drug therapy and preventive measures. The calves were separated from their dams one hour after parturition; all calves were ear tagged. They were fed on colostrum during first three days at the rate of 3-5 litres a day. They were also given fresh milk till 21 days and then a mixture of fresh milk and powdered skim milk. The amount of skim milk powder was increased gradually at the expense of fresh milk till two months. In the third month they were given powder milk with dry grass and a ration composed of ground nut cake, wheat bran and sorghum. By the end of the third month of age, liquid feeding was stopped and this age (90 days) was assigned as the weaning age. Calves were weighed within 24 hours after birth and then at weaning age.

Statistical analysis

The data were arranged to test how they were affected by dams' parity order, season of calving and sex of born calves. To test the effect of dams' parity the data were grouped into 7 groups as 1st, 2nd, 3rd, 4th, 5th, 6th and 7th parities. To test the effect of season of calving, the data were grouped according to the month of calving into three calving seasons: March to June was taken as the dry summer, July to October represented the wet summer, whereas, November to February was considered as the winter season. For the test of the effect of the sex of born calf on the examined traits (birth and weaning weights) the data were grouped into two groups of males and females. The data were subjected to analysis of variance using the Factorial ANOVA of the ANOVA module of the *STATISTICA* computer software to test the significance of effects of dams' parity order, season of calving and calf's sex on birth and weaning weights. Where the factor effect was significant, the differences between means were examined using Duncan's multiple range test (StatSoft, 2011).

Results and Discussion

The overall means of birth and weaning weights of crossbred Friesian × Kenana calves at KSCDF for the period between 2002 and 2011 were 33.7±5.1 kg and 82.9±6.4 kg respectively. The birth weight of pure Kenana calves was reported to average 25.2 ±2.1 kg (Ageeb and Hillers, 1991) and 24.2±2.8 kg (Khalifa and Khalafallah, 1979). Crossbreeding, therefore, increased the Kenana calves' birth weight by over 30%. In Ghana, Karikari et al. (1996) reported that crossing with Friesian increased the birth weight of N'Dama calves by over 60%. The current weight at weaning was within the range reported in Egypt for the Friesian crosses at

Table 1: The effect of dams' parity order, season of calving and calves' sex on birth and weaning weights of Friesian crossbred cows in KSCDF during the period from 2002 to 2011

Factor	No. of observation	Birth weight (kg)	Weaning weight (kg)
Dams' parity order			
1	275	31.0[a]	80.8[a]
2	265	32.5[b]	82.6[b]
3	253	33.3[bc]	83.5[b]
4	233	34.4[c]	83.9[b]
5	134	35.2[d]	84.2[b]
6	101	34.5[cd]	82.7[b]
7	72	35[cd]	83.9[b]
SEM		0.4	0.6
L.S		**	***
Season of calving			
Dry summer	325	32.4[a]	82.0[a]
Wet summer	505	33.7[b]	83.6[b]
Winter	503	33.3[b]	82.8[ab]
SEM	-	0.3	0.3
L.S	-	**	**
Calves' sex			
Female	833	32.1[a]	81.3[a]
Male	500	35.0[b]	85.4[b]
SEM	-	0.2	0.3
L.S	-	**	**

KSCDF = Kenana Sugar Company Dairy Farm; SEM= Standard Error between means; LS= Level of Significance; [a,b,c,d]= Means with different superscripts were significantly (P<0.05) different; **, ***= The factor effect was significant at P<0.01 and P<0.001, respectively.

15 week of age e.g. 76.20 kg (El-Gaffarawy, 1979) to 96.60 kg (Ouda, 2001). The weight of the calf before weaning could be considered as a trait of the mother. Roberson et al. (1986) stated that the weaning weight expresses the calf rearing ability of cow, so the changes of weaning weight are important factors at selection.

Table 1 showed that calf's birth and weaning weights increased with the progress of dams' parity order until the 5th parity. The lightest birth and weaning weights (31.0 and 80.8 kg, respectively), were observed for the calves of 1st parity order dams and the heaviest birth (35.2 kg) and weaning (84.2 kg) weights were seen for the calves of dams at the 5th parity order. Likewise, Khalifa and Khalafallah (1979) reported that Kenana calves born to cows 2½ - 5½ years old were significantly lighter than those born to older cows. Akbulut et al. (2001), Tilki et al. (2008), Musa et al. (2004) and Abera et al. (2012) attributed this to the fact that early parity cow continued growing, so its growth competed with the growth of its foetus for the available nutrients during pregnancy. Demeke et al. (2003) reported that dam parity effects were significant sources of variation in birth weight, pre-weaning average daily gain, weaning weight and one year weight of their calves. This variation could be attributed to a good maternal environment provided by mature cows to the newly developing foetus, competition for nutrients between foetal development and maternal growth which is high in younger dams than older ones.

Similarly, Addisu and Hegede (2003) reported that calves born at first parturition were significantly lighter at weaning than those born at second to fifth parturition. Heavier weaning weight are expected in calves from older dams due to well-developed mammary tissue relative to younger dams thus better maternal environment in terms of milk for the suckling calf (Wasike, 2006).

The effect of calving season on birth weight was also significant (Table 1). Similar observations were reported by Topal et al. (2010), Shahzad et al. (2010), Dekebe et al. (2006) and Tilki et al. (2008). In the present study, the heaviest (33.7±0.3kg) and the lightest (32.4±0.3 kg) birth weight were recorded in wet summer and dry summer, respectively. Similarly, Karikari et al. (1996) noted that the season of calving affected birth weight with calves born in the wet season being heavier than their dry season born counterparts (wet = 31±1 kg; dry = 26:1:1 kg). Ndofor-Foleng et al. (2011) also reported that in Cameroon calves born in dry season had lighter birth and weaning weights than those born in the rainy season. In the current study, calves born in wet season were on average 4.0% heavier than those born in the dry season. However, Karikari et al. (1996) reported that the wet season calves exceeded their dry season fellow mates in birth weight by 16.9%. Thermal stress resulting in reduced feed intake of dams and probably a reduction in the blood flow to the uterus may be the cause of the light birth and weaning weights of calves born in the dry season (Bearden and Fuquay, 1984; Thatcher et al., 1986).

The current results (Table 1) also showed the effect of sex on birth and weaning weights of calves. Male claves recorded mean values for birth and weaning weight heavier than females. Same findings were reported by Gwaza et al. (2007), Robeya et al. (2009) and Manzi et al. (2012). Similarly, Karikari et al. (1996) noted that the calves of Friesian x N'Dama bull were significantly heavier at birth than heifer calves. In the same context, Khalifa and Khalafallah (1979) observed that the Kenana male calves were 1.3 kg heavier at birth than female-calves. In the present results the average birth weight of males was 9.0% heavier than that of females. Whereas, Karikari et al. (1996) noted that bull calves were 13.4% heavier than heifer calves. Ndofor-Foleng et al. (2011) also reported that male calves were heavier than the females in birth, 3-months, 4-months, 6-months, weaning, yearling, 18-months, 24-months, 30-months and 36-months weights. It is generally recognized that males of most species of domestic animals grow more rapidly and reach a greater mature weight than females. Lawrence and Fowler

(1997) and Gordon (1997) attributed the superiority of male animals compared to their female fellow mates to the activating effect of testosterone hormone on growth. They added that testosterone hormone appears in male animals' blood since the prenatal period.

The potential for such crosses to be used as conventional dairy animals in the tropics is high. It may be concluded that the studied factors of dams' parity order, sex of calf, and calving season were found significantly affecting birth and weaning weights of the calves and it is highly advised to pay high attention to nutrition and management of the dairy herds during the gestation and pre-weaning periods.

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