FACTORS AFFECTING BIRTH WEIGHT AND GROWTH RATE IN FRIESIAN X BUNAJI CALVES

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ABSTRACT

Calving records from 1984 - 1989 were studied to determine the influence of rearing method, sex of calf, season of birth, dam breed and year of birth on body weight at birth, 3, 6 and 12 months of age in Friesian x Bunaji calves. The mean weights of calves at birth, 3, 6 and 12 months of age were 22.0, 68.2, 96.7 and 137.4 kg, respectively. Sex of calf had a significant effect, with male calves being heavier than the females by 1.2, 5.9 and 9.7 kg at birth, 3 and 6 months of age respectively. The effect of season of birth on calf body weights was not significant except at 6 months of age, when calves born during the wet season were heavier ($P < 0.01$) than those born in the harmattan period by 9.5 kg. Year of birth had a highly significant effect ($P < 0.01$) on calf weights from birth to yearling. Method of rearing and dam breed had no significant influence on all the weights. The results suggest the need to develop correction factors for standardisation of weight records when comparing dams on the basis of body weights of their calves.

Key words: Birth weight; Growth rate; Friesian-Bunaji; Calves.

INTRODUCTION

The future of any dairy operation depends to a large extent, upon a successful programme for raising calves for replacement purposes. It is therefore desirable that dairy calves have a sustained rate of gain. In the traditional pastoral system of dairy production, calves graze with their dams and obtain milk directly through suckling. However, when the indigenous cattle are crossed with exotic dairy breeds for milk production, it is usually

advocated that calves are separated from their dams within a few days of birth and bucket-fed. Several workers have reported higher growth rates in calves suckled by their dams as compared with drinking from a bucket (Avarez *et al*, 1980; Fernandez *et al*, 1977; Gaya *et al*, 1977; Preston, 1989).

Inadequate feeding is a major factor influencing calf growth rate in Nigeria. Environmental factors which affect the nutritional status of calves would influence calf growth performance. Thus, calves born during the wet season have been found to have higher preweaning growth rates (Alaku, 1982; Oni *et al*, 1988), while depressed feed intake during the dry season has been found to reduce growth rate and increase calf mortality (Otchere, 1986).

The objective of the present study was to examine the factors affecting body weights of Friesian x Bunaji calves at birth, 3, 6 and 12 months of age.

MATERIALS AND METHODS

The data used in this study were derived from records of Friesian x Bunaji calves kept at the National Animal Production Research Institute, Shika, situated between latitudes 11° and 12° N at an altitude of 640m above sea level. The area which lies within the Northern Guinea Savannah zone, has an average annual rainfall of 1100mm with about 90% falling during June to September (wet season). The wet season is followed by a period of dry, cool weather known as 'harmattan', lasting from October to January. The harmattan is followed by dry, hot weather from February to May. Mean daily temperatures range from

about 15°C during harmattan to 36°C during dry season while mean relative humidity values during harmattan and wet season are 21 and 72% respectively.

The data consisted of birth weight, 3, 6 and 12 months body weight record of 281 Friesian x bunaji calves born between 1984 and 1989. The calves which were 1/2 Friesian crosses born to either Friesian x Bunaji, or pure Bunaji dams were raised either by the bucket feeding or suckling method. In the bucket feeding system, the calves remained with their dams for 4 to 5 days postpartum to obtain colostrum. Thereafter, they were separated from their dams and fed fresh whole milk from an open bucket at the rate of 2.0 kg/head/day. In addition, the calves received concentrate diet and legume hay *ad libitum*. The concentrate consisted of 57% maize, 40% cottonseed cake, 1.5% bonemeal, 1% salt and 0.5% vitamin premix. The milk allowance was given twice daily at 9.00 a.m. and 4.00 p.m. until the calves reached 3 months of age. They were then moved to an outdoor herd, where concentrate and hay rations were supplied free choice until they attained 6 months of age.

In the suckling system, calves were allowed to run with their dams and were suckled until they were weaned at 6 months of age.

The cows and weaned calves were kept mainly on unimproved rangeland. During the wet season, the animals were raised exclusively on pasture. In the dry season, they were fed grass hay or maize silage *ad libitum* supplemented with cottonseed cake at the rate of 0.5 to 1.0 kg/head/day for calves and 1.5 to 2.0 kg/head/day for cows, depending on the quality of available roughage.

Routine deworming of calves with flukazole was carried out at the beginning and end of the wet season. Spraying of all animals against ectoparasites was done weekly during the wet season and every two weeks in the dry season. All the animals were inoculated against rinderpest, brucellosis and contagious bovine pleuropneumonia.

The data were analysed using the least-squares procedure according to Harvey (1960). The model used was:

$$Y_{ijklmn} = U + B_i + SX_j + R_k + S_l + YR_m + E_{ijklmn}$$

where

Y_{ijklmn} = the observation of the n^{th} animal born in the m^{th} year, with the 1st season of the k^{th} rearing method of the j^{th} sex belonging to the i^{th} dam breed.

U = overall mean

B_i = fixed effect of the i^{th} dam breed ($i = 1,2$)

SX_j = fixed effect of the j^{th} sex ($j = 1,2$)

R_k = fixed effect of the k^{th} rearing method ($k = 1,2$).

S_l = fixed effect of the l^{th} season ($l = 1,3$).

YR_m = fixed effect of the m^{th} year ($m = 1,6$).

E_{ijklmn} = random error associated with each record.

Season of birth was classified as dry (February - May), wet (June to September) or harmattan (October - January). Phenotypic correlations between dependent variables birth weight, body weights at 3, 6 and 12 months were computed.

RESULTS AND DISCUSSION

The analysis of variance indicating the source of variation in calf birth weight and body weight at 3, 6 and 12 months is given in Table 1 while Table 2 shows the estimated least-square mean (S.E.) for calf weights at the four stages. The weights were 22.0 ± 0.2 , 68.2 ± 0.8 , 96.7 ± 1.1 and 133.4 ± 1.9 kg at birth, 3, 6 and 12 months of age, respectively.

Method of rearing had no significant effect on calf growth rate (Table 1). However, bucket-fed calves were heavier by 5.0 kg (8%) at 3 months and 5.6 kg (4%) at 12 months of age than the calves which were suckled by their dams probably because of higher intake of nutrients from milk, concentrate and legume hay.

TABLE 1: ANALYSIS OF VARIANCE FOR CALF WEIGHT AT BIRTH, 3,6 AND 12 MONTHS OF AGE.

Source of Variation	DF	Mean squares for weight at:			
		Birth	3 months	6 months	12 months
Rearing method	1	29.0	480.4	76.7	578.5
Sex of calf	1	46.6**	1995.1***	5382.7***	1316.8
Season of birth	2	3.4	19.7	1779.1**	335.2
Dam breed	1	1.8	89.1	343.3	52.0
Year of birth	5	78.4***	1183.9***	2387.1***	1777.5**
Error ⁺	270				
	(262)	11.9	192.4	358.8	475.0

* (P<0.05)

** (P<0.01)

*** (P<0.001)

+ value in bracket is for 12 months of age

Sex of the calf had a significant ($P<0.05$) effect on body weight at birth, with the males being heavier than the females by 1.23 kg or 5.6% of the mean body weight (Table 2). The difference in birth weight between male and female calves observed in this study is in close agreement with values reported for Bunaji calves (Otchere, 1986; Oni *et al.*, 1988) and crossbred calves (Sacker *et al.*, 1971 and Carew *et al.*, 1986). Male calves were significantly heavier ($P<0.001$) at 3 and 6 months of age by 5.9kg (9%) and 9.7 kg (10%), respectively. The superiority in body weights exhibited by the male calves is probably due to anabolic effects of androgens which are known to stimulate synthesis of cellular proteins and increase body weights (Turner and Bagnara, 1976).

Season of birth had no significant effect on birth weight of calves (Table 1). However, calves born during the harmattan had the highest mean birth weight (22.2 ± 0.5 kg). Oni *et al.* (1988) obtained similar results with

Bunaji calves. The possible reason for this observation could be that the requirements of the dam for rapid growth of the foetus at the last trimester coincided with the availability of good quality forage (Hafez and Jainudeen, 1975). The effect of season of birth on calf growth rate was not significant except at 6 months of age when calves born during the wet season were significantly heavier ($P<0.01$) than those born during the harmattan by 9.5kg (Table 2). The effect of season of birth on later body weights are usually related to the stage in the wet season and dry season cycle at which an animal reaches a given age (Carew *et al.*, 1986). Thus the significantly higher body weight at 6 months of age observed for calves born during the wet season might have been due to high milk production by dams from good quality forage available at the time. There was no significant difference between dam breed in calf body weight at birth, 3, 6 and 12 months of age (Table 1).

Year of birth had a highly significant effect

TABLE 2: LEAST SQUARES MEANS (LSM) $\pm$ S.E. FOR CALF WEIGHTS (kg) AT BIRTH, 3, 6 AND 12 MONTHS OF AGE.

	Weight of calf at:							
	Birth		3 months		6 months		12 months	
	No.	LSM	No.	LSM	No.	LSM	No.	LSM
Overall Mean	281	22.0 $\pm$ 0.2	281	68.2 $\pm$ 0.8	281	96.7 $\pm$ 1.1	263	137.4 $\pm$ 1.9
Rearing Method								
Bucket feeding	93	22.6 $\pm$ 0.4	93	70.7 $\pm$ 1.3	93	95.7 $\pm$ 1.9	87	140.2 $\pm$ 2.1
Suckling	188	21.4 $\pm$ 0.2	188	65.6 $\pm$ 0.9	88	97.7 $\pm$ 1.3	176	134.6 $\pm$ 2.6
Sex								
Male	34	22.5 $\pm$ 0.4 ^a	34	71.1 $\pm$ 1.4 ^a	34	101.5 $\pm$ 1.5 ^a	31	139.9 $\pm$ 3.3
Female	247	21.6 $\pm$ 0.3 ^b	247	65.2 $\pm$ 0.9 ^b	247	91.9 $\pm$ 1.4 ^b	232	134.9 $\pm$ 2.3
Season of birth								
Dry	63	21.8 $\pm$ 0.5	63	68.0 $\pm$ 1.5	63	98.5 $\pm$ 1.9 ^a	55	135.1 $\pm$ 2.1
Wet	137	22.1 $\pm$ 0.3	137	68.7 $\pm$ 1.1	137	100.5 $\pm$ 1.5 ^a	129	139.1 $\pm$ 2.2
Harmattan	81	22.2 $\pm$ 0.5	81	67.8 $\pm$ 2.0	81	91.0 $\pm$ 2.6 ^b	79	136.8 $\pm$ 2.2
Dam breed								
Friesian-Bunaji	79	21.9 $\pm$ 0.4	79	69.2 $\pm$ 1.2	79	98.8 $\pm$ 1.8	75	136.6 $\pm$ 2.2
Bunaji	202	22.2 $\pm$ 0.3	202	67.1 $\pm$ 1.1	202	94.7 $\pm$ 1.5	206	138.2 $\pm$ 3.0
Year of birth								
1984	21	21.4 $\pm$ 0.9 ^b	21	70.9 $\pm$ 1.9 ^a	21	93.6 $\pm$ 3.9 ^b	21	145.6 $\pm$ 5.5 ^a
1985	20	21.1 $\pm$ 0.5 ^b	20	71.7 $\pm$ 3.2 ^a	21	98.9 $\pm$ 5.2 ^{ab}	20	139.6 $\pm$ 5.6 ^{ab}
1986	23	24.6 $\pm$ 0.7 ^a	23	69.3 $\pm$ 2.4 ^a	23	95.2 $\pm$ 4.1 ^{ab}	23	140.7 $\pm$ 4.1 ^a
1987	67	23.1 $\pm$ 0.3 ^a	67	58.8 $\pm$ 1.7 ^b	67	86.7 $\pm$ 2.0 ^c	67	126.1 $\pm$ 2.6 ^c
1988	58	20.9 $\pm$ 0.5 ^b	58	68.9 $\pm$ 0.1 ^a	58	104.8 $\pm$ 3.1 ^a	58	137.8 $\pm$ 2.7 ^{ab}
1989	92	20.9 $\pm$ 0.4 ^b	92	69.3 $\pm$ 1.4 ^a	92	101.0 $\pm$ 1.8 ^a	74	134.5 $\pm$ 5.1 ^b

a,b,c Values within each subclass with different superscripts differ significantly ($P < 0.05$).

on calf weights from birth to 12 months of age (Table 1). The weight differences between the two extreme years were 3.7 kg (18%), 12.9 kg (22%), 18.1 kg (21%) and 19.5 kg (15%) at birth, 3, 6 and 12 months of age, respectively. The significant difference between years in calf body weights is probably due to fluctuations in rainfall patterns as they affect the quantity and quality of forage available for cows and calves.

The phenotypic correlations between birth weight, body weight at 3, 6 and 12 months of

age are shown in Table 3. Calf birth weight was significantly ($P < 0.05$) correlated with body weight at 3 but not at 6 or 12 months of age. Correlations between body weights at age 3, 6 and 12 months were positive and highly significant (P).

The results of this study showed that body weights of Friesian $\times$ Bunaji calves were significantly affected by sex of calf, season of birth and year of birth. These results suggest the need to develop correction factors for

TABLE 3: PHENOTYPIC CORRELATIONS BETWEEN CALF WEIGHT AT BIRTH, 3, 6 AND 12 MONTHS OF AGE.

Calf weight at	Birth	3 months	6 months	12 months
Birth	1.000			
3 months	0.171*	1.000		
6 months	0.053	0.574**	1.000	
12 months	0.109	0.481**	0.698**	1.000

* ($P < 0.05$), ** ($P < 0.001$)

standardisation of weight records when comparing dams on the basis of body weights of their calves.

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