EFFECTS OF NON-GENETIC FACTORS ON REPRODUCTIVE EFFICIENCY OF WHITE FULANI CATTLE IN SOUTHWESTERN, NIGERIA

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ABSTRACT

This study was carried out to determine the effects of sex of calf, age of cow and season of calving on calf birth weight in a herd of white Fulani cattle. The breed is dual purpose and trypano-tolerant. Data on 148 calves comprising of 66 males and 82 females were taken into account in this analysis. Average birth weight recorded for the calves was 23.82kg. Sex of calves significantly (P < 0.05) influenced birth weight with male calves having superior values than females. The mean values were 24.54 ± 0.51kg and 23.19 ± 0.48kg for males and females, respectively. Season of calving and age of cow had no significant (P > 0.05) effect on birth weight. Low repeatability estimate (R = 0.28 ± 0.01) was reported for birth weight in this herd. This implies that more records will be required per cow before any culling could be done in order to improve the herd's future performance. The reproductive efficiency of this breed could be improved also by giving supplemental feeds during drought and mating with exotic breeds which have superior genetic potential for better birth weight and milk production.

Keywords: Fulani cattle, Season, Age, Sex, Birth weight, Repeatability, Reproductive efficiency

INTRODUCTION

The reproductive efficiency of a diary cow can be evaluated based on the weight of her calf at birth. Calf birth weight is a useful selection criterion for increased production and for reproductive efficiency. Plasse and Koger (1967) reported that average milk production and mature live weight of animals with a higher birth weight was higher than those animals with a lower birth weight. The weight of an animal at birth is taken within 24 hours of life (Roy, 1980). According to Jain *et al*. (1996), birth weight of an animal is a phenotypic expression of its genotype and it could be used as indicator of superior germplasm and thus aid in the selection of high productive animals just after birth. All the available evidence indicates that birth weight is a definite breed characteristic with a wide range of variation depending on the size, weight and physiological constitution of the dam, and on the environmental conditions on which she lives (Mahadevan, 1966). Calf birth weight is one of the most important factors influencing calf performance (Phillipson, 1976), weaning weight (Balahanov *et al*., 1970) and provides first information on the growth potential of the animal (Jain *et al*., 1996). Robertson *et al*. (1986) and kemp *et al*. (1984) reported that some non-genetic factors such as age of dam, sex of the calf, gestation length, parity and cow weight influenced birth weight in cattle. The authors also observed positive effect of some genetic factors including breed, maternal and sire effects on birth weight. However, Suttan *et al*. (1987) reported no significant effect of age of dam or parity on calf birth weight but Magana and Segura (1997)

observed the reverse trend. On the effect of sex of calf, Suttan *et al*. (1987) and Carew *et al*. (1986) reported that male calves were heavier at birth than female mates. In sheep, Balogun *et al*. (1993) and Bemji *et al*. (1996) observed that the weight of lambs at birth affected their survival and subsequent growth. In addition, several authors have reported significant effect of sex (Oshinowo *et al*., 1990), parity (Bemji *et al*., 1996), breed (Das *et al*., 2000), season and year (Khombe, 1985) on lamb's birth weight. In cattle, Reynolds *et al*. (1980) reported significant differences in birth weight of Angus and Brahma calves, while (Magana and Segura (1997) observed no positive effect of breed on calf birth weight. The year and season of calving are also known to directly or indirectly influence the calf birth weight. The indirect effect is based on the availability of pasture at any particular season while the direct effect is based on the efficiency of the cow to utilize the feed subject to the stresses of her environment. Orunmuyi *et al*. (2001) reported no significant effect of season on birth weight of N'Dama cattle and in sheep, Togun (2005) observed non-significant effect of sex and season on birth weight of West African dwarf sheep. In dairy cattle, the measure of repeatability estimate refers to the correlation between records of the same cow in the same herd, and this may be utilized to assess the real producing ability of individual cows in a population. Oni *et al*. (1989) reported repeatability estimate (R = 0.12 ± 0.09) of birth weight in white Fulani cattle. The present study was undertaken to determine the effects of non-genetic factors on birth weight in white Fulani cattle. In addition, the repeatability estimate of the trait was computed in order to suggest ways of improving the future performance of the breed.

MATERIALS AND METHODS

The breed is a dual-purpose type and trypano-tolerant (MacLenna, 1999). Data on birth weight of 148 calves (66 males and 82 females) of white Fulani cattle were obtained from records routinely kept at the Teaching and Research Farm, University of Ibadan, between 1980 – 1990. Ibadan is situated in the Southwest, Nigeria, and lies about $7^0 26^1$N and $3^0 54^1$E. The urban city is grouped under the rainforest vegetation zone and enjoys a two-peaked rainfall pattern for about 6 – 7 months in a year while the dry season lasts for about 5 – 6 months. The annual rainfall in the zone during the observation period was 1540.5 mm and the average minimum and maximum temperatures over the same period were 20.45^0C and 29.25^0C respectively, while the mean relatively humidity at 9.00 am was 85.2%. The section of the Teaching and Research Farm for cattle management called the Grassland unit was divided into paddocks of various sizes most of which were under permanent grass. The most abundant grasses and legumes planted were Elephant grass (*Panicum purpureum*), Guinea grass (*Panicum maximum*) and Centrosema (*Centrosema pubescens*). Rotational grazing was carried during raining season while dry season was supplemented with hay and/or brewers dried grains.

Cattle Management: The animals were dewormed regularly and vaccinated against rinderpest and other viral diseases. Pregnant cows were dried two months to calving and kept in maternity pen for "steaming-up" during which they were given concentrates. After calving, calves were allowed to suckle their dams for the first 5 days to obtain colostrums and thereafter, they were switched over to bucket feeding. Calves were weight within 24 hours of life and weekly thereafter. Male calves were castrated in order to make them easy to handle. Dehorning was also carried out to curb the aggressiveness of the "bossy" ones.

Records obtained were analyzed based on the effects studied. The effects were sex of the calf, age of the dam and season of calving. Age of the dam was subdivided into; young (3 – 5 years), mature (6 – 8 years) and adult (> 8 years). Season of calving was subdivided into; early rain (ER, May – July), late rain (LR, August – October), early dry (ED, November – January) and late dry (LD, February – April) seasons.

The appropriate statistical model used was: $Y_{ijkl} = \mu + A_k + S_j + B_i + \epsilon_{ijkl}$ where Y_{ijkl} = observation of 1^{th} population, of k^{th} age, j^{th} sex and I^{th} season, μ = common mean, A_k = fixed

effect of age (k=3), S_j = fixed effect of sex (j = 2), B_i = fixed effect of season (I = 4) and ϵ_{ijkl} = random error. Repeatability estimate computed from variance components using the method of Becker (1984) thus: $R = \sigma^2_B \div \sigma^2_B + \sigma^2_w$. The standard error of R estimate was computed using the method of Swiger *et al*. (1964) thus: $SE(R) = \sqrt{2(m-1)\ (1-R)^2\ [1+ (k_1-1)\ R]^2 \div K^2_1\ (m-N)\ (N-1)}$ Where; R = repeatability estimate, m = number of observations on each cow, N= number of individuals, σ^2_B = variance components between cows and σ^2_w = variance components within cows. Standard error estimate for unequal numbers SE(R) was estimated thus: $K_1 = 1\div N\text{-}1[m - \sum m^2_K \div m]$ where $\sum m^2_K$ = the sums of square of number of measurement per cow.

Data Analysis: Data were analyzed with analysis of variance (ANOVA) for the effects of age of dam, sex of calf and season of calving while the differences between means were determined using Duncan New Multiple Range Test (DMRT) as per SAS (2001).

RESULTS AND DISCUSSION

The effect of age of dam on birth weight indicated that there was no significant (P > 0.05) effect of age of the dam on birth weight. The mean values of birth weight of calves from young, mature and adult cows were 23.72 ± 0.63kg, 24.57 ± 0.63kg, and 23.3 ± 0.55kg, respectively (Table 1).

Table 1: Least square means showing the effect of age of dam on birth weight of calves

Factor (Age)	N	Birth Weight
Young	47	23.73 ± 0.63
Mature	44	24.57 ± 0.63
Adult	57	23.3 ± 0.55

N- Number of observations

The obtained result agreed with the findings of Suttan *et al*. (1987) but contradicted that of Magana and Segura (1997) who observed that age of dam significantly (P < 0.05) affected the weight of calf at birth. The obtained result implies that under optimum feeding coupled with good management practices, the weight of calves born at any material time is independent of the age of the dams. The effect of sex of calf on birth weight indicated that there was significant (P < 0.05) effect of sex on birth weight. Male calves recorded the highest mean values and superior to their female counterparts. The values were 24.54 ± 0.51kg and 23.19 ± 0.48kg for males and females, respectively (Table 2).

Table 2: Least square means showing the effects of sex of calf and season of calving on birth weight

Factors	N	Birth Weight
Sex		
Male	66	24.54 ± 0.51[a]
Female	82	23.19 ± 0.48[b]
Season		
Early rain (ER)	28	23.91 ± 0.79
Late rain (LR)	25	23.44 ± 0.79
Early dry (ED)	48	23.07 ± 0.61
Late dry (LD)	47	25.05 ± 0.57

N: number of observations, a, b: means in columns with different superscripts are significantly different

The result confirmed previous findings in cattle (Jain *et al*., 1996; Suttan *et al*. 1997) and in sheep (Oshinowo *et al*., 1990). In contrast however, Orunmuyi *et al*. (2001) reported that there was no significant effect of sex on birth weight. It had been previously observed that males usually have longer gestation period that the females and this was responsible for their heavier weight at birth. The trait being an essential datum in selection experiment could however, be improved upon by mating this breed with exotic breeds but this practice must be carefully done in order not to aggravate the problem of difficult (dystocia) calving normally encountered with such exercise.

There was no significant (P > 0.05) effect of season on birth weight. The mean values for birth weight during ER, LR, ED and LD were 2.91 ± 0.79kg, 23.44 ± 0.79kg, 23.07 ± 0.61kg and 25.05 ± 0.57kg, respectively (Table 2). This result was in agreement with the findings of Magana and Segura (1997) and Orunmuyi *et al*. (2001). In contrast however, Jain *et al*. (1996) reported a significant effect of season on birth weight. According to the authors calf birth weight was generally little affected by environmental conditions unless

such conditions were extremely severe. The practice of 'steaming-up' pregnant females is believed to have evened out any fluctuation in nutrient supply that would otherwise have occurred.

The repeatability estimate for birth weight computed for cows with more than one record (0.28 ± 0.10) (Table 3) was higher than 0.12 ± 0.09 reported by Oni *et al*. (1989) for the same breed.

Table 3: Repeatability estimate of white Fulani cattle in southwestern, Nigeria

Source	df	Mean squares
Between dams	32	42.23
Within dams	87	17.63

df = degree of freedom

The computation was meant to assess the real producing ability of individual cows in the population. This low repeatability estimate implies that culling on the basis of single measurement would be inadequate for improved performance. More records would therefore, be required to be able to achieve any meaningful result in this population.

Conclusion: The obtained result indicated that male calves were significantly ($P < 0.05$) heavier than the female mates. It was also observed that age of dam and season of calf did not affect weight of calves. Therefore, in order to improve the reproductive efficiency of the breed in Nigeria, supplemental feeds should be given to pregnant cows especially during dry season when scarcity of green pastures is normally experienced. The intervention programme may also include mating this breed with highly improved exotic breeds for the upgrading of its genetic potential.

ACKNOWLEDGEMENT

The authors wish to express their appreciation to the Management and Staff of Grassland Unit, Teaching and Research Farm, University of Ibadan for their cooperation and support in the course of data collection.

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