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Genetic Parameters and Factors Affecting Reproductive Performance 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-toleramt. 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±0.51 and 23.19± 0.48kg for males and females, respectively. Season of calving and age of cow had no significant effect on birth weight. Low repeatability estimate ($R=0.28\pm0.01$) 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.

Key words: Calf · Birth · Season · Sex · Repeatability

INTRODUCTION

The reproductive efficiency of a diary cow can be evaluated based on the weight of her calf at birth. Calf birth weight is useful in selection criterion for increased production and for reproductive efficiency. Plasse and Koger [1] 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 [2]. According to Jain *et al*. [3] 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, on the environmental conditions on which she lives, on the genetic constitution of the foetus [4]. Calf birth weight is one of the most important factors influencing calf performance [5], weaning weight [6] and provides first information on the growth potential of the animal [3]. Robertson *et al*. [7] and Kemp *et al*. [8] 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*. [9] reported no significant effect of age of dam or parity on calf birth weight, but Magana and Segura [10] observed the reverse trend.On the `effect of sex of calf, Suttan *et al*. [9] and Carew *et al*. [11] reported that male calves were heavier at birth than female mates. In sheep, Balogun *et al*. [12] and Bemji *et al*. [13] observed that the weight of lambs at birth affected their survival and subsequent growth. In addition, several authors have reported significant effect of sex [14], parity [13], breed [15], season and year [16] on lamb's birth weight. In cattle, Reynolds *et al*. [17] reported significant differences in birth weight of Angus and Brahma calves, while Magana and Segura [10] 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*. [18] reported no significant effect of season on birth weight of N'Dama cattle and in sheep, Togun [19] observed non-significant effect of sex and season on birth weight of West African dwarf sheep.

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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.[*20] reported repeatability estimate (R=0.12±0.09) of birth weight in White Fulani. The present study was undertaken to determine the effects of non-genetic factors on birth weight in White Fulani cattle. The breed is a dual-purpose type and trypano-tolerant [21]. 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

Data on birth weight of 148 calves (males: 66; females: 82) of White Fulani cattle were obtained from records routinely kept at the Teaching and Research Farm, University of Ibadan. Ibadan is situated in the Southwest, Nigeria and lies about 7°26^{1}N and 3°54^{1}E. The urban city is grouped under the rainforest vegetation zone and enjoys a two-peaked rainfall pattern for about 6-7months in a year while the dry season lasts for about 5-6months. The annual rainfall in the zone during the observation period was 1540.5mm and the average minimum and maximum temperatures over the same period were 20.45°C and 29.25°C, respectively, while the mean relatively humidity at 9.00am 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 are Elephant grass (*Panicum purpureum*), Guinea grass (Pan*icum maximum*) and Centrosema (*Centrosema pubescens*). Rotational grazing was carried during raining season while dry season was supplemented with hay and/or brewers dried grains.

Management of Cows and Calves: 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 5days to obtain colostrums and thereafter, they were switched over to bucket feeding. Calves were weight within 24hours 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 are sex of the calf, season of calving and the age of dam. Age of dam was subdivided into young (3-5years) mature (6-8years) and adult (>8years). In addition, 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:

$Y_{ijkl} = \mu + A_k + S_j + B_i + \epsilon_{ijkl}$

Y_{ijkl} = Observation of l^{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)

ϵ_{ijkl} = random error

Repeatability estimate computed from variance components using the method of Becker [22].

$$R = \frac{\sigma^2_B}{\sigma^2_B + \sigma^2_w}$$

The standard error of R estimate computed as:

$$S.E.\ (R) = \frac{2(m-1)\ (1-R)^2\ [1+ (k_1-1)\ R]^2}{K^2_1\ (m-N)\ (N-1)}$$ As per [23]

Whereas

R = Repeatability estimate

m = Number of observations on each cow

N = Number of individuals

σ^2_B = Variance components between cows

σ^2_w = Variance components within cows

S.E (R) = Standard error estimate for unequal numbers

$$K_1 = \frac{1}{N-1}\left[\frac{m - \sum m^2_K}{m}\right]$$

Σm^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 perSAS [24].

RESULTS AND DISCUSSION

Table 1 shows the effect of age of dam on birth weight. There was no significant effect of age of the dam on birth weight. The respective 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 and were similar. The obtained result agreed with the findings of Suttan *et al*. [9] but contradicted the observation of Magana and Segura [10]. 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.

Table 2 shows the effect of sex of calf on birth weight. 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. The result confirmed previous findings [3, 9] in cattle and [14] in sheep. In contrast, however, Orunmuyi *et al*. [18] 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 calving normally encountered with such exercise.

Table 2 also shows the effect of season on calf birth weight. There was no significant effect of season on birth weight. The respective 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 and were similar. Magana and Segura [10] and Orunmuyi *et al*. [18] reported similar findings. In contrast, however, Jain *et al*. [3] reported a significant effect of season on birth weight. According to Jain *et al*. [3], 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.

Table 3 shows the repeatability estimate for birth weight computed for cows with more than one record. The value was 0.28±0.10 and higher than 0.12±0.09 reported by Oni *et al*. [20] in this same breed. The computation was meant to assess the real producing ability of individual cows in the population.

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

Factor (Age)	N.	LSQ±SE
Young	47	23.73±0.63[a]
Mature	44	24.57±0.63[a]
Adult	57	23.3±0.55[a]

N- Number of observations

a: means in columns with common superscripts are not significantly different

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

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

N.: number of observations

a,b: means in columns with different superscripts are significantly different

Table 3: Repeatability estimate: variance components

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

Df- degree of freedom

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.

In conclusion, in order to improve the reproductive efficiency of this breed in this country, supplemental feeds should continue to be given to pregnant cows especially during the dry season when scarcity of green pastures is normally experienced.

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REFERENCES

1. Plasse, D. and K. Koger, 1967. A study of birth weight. Mems Assoc. Lat. Ameri. Prod. Ani., 2: 7-22.

2. Roy, J.H.B., 1980. The calf studies in the Agricultural and Food Sciences. Butterworths, 4th ed. pp: 2-52.
3. Jain, R.D., Qureshi, M.I. and F.H. Khan, 1996. Factors affecting birth weight of purebred Rambouilet sheep under Indian conditions. Indian Veterinary Journal, 73: 592-594
4. Mahadevan, P., 1966. Breeding for milk production in the Tropical cattle. Technical Communication Number 17 of the Commonwealth Bureau of Animal Breeding and Genetics, Edinburgh. pp: 153-157.
5. Phillipson, J., 1976. Studies on calving difficulty, still birth and associated factors in Swedish cattle breeds. 11. Effects of non-genetic factors. Acta Agricultural Scandinavian, 26: 165-168.
6. Balahanov, I., G. Konstantonor and G. Sinnirsk, 1970. Biological relationship between body weight of cows and birth weight of their offspring in Tolbukhm region. Animal Breeding Abstract, 10(15): 28.
7. Robertson, R.L., J.O. Sanders and T.E. Cartwright, 1980. Direct and maternal effects on Preweaning characters of Brahman, Hereford and Brahma-Hereford crossbred cattle. J. Animal Sci., 63: 435-440.
8. Kemp, R.A., L.A. Schaffer and J. Wilson, 1984. Breed of dam, age of dam and sex of calf effects in the Canadian Simmental sire proving program. Canadian J. Animal Sci., 64: 1-8.
9. Suttan, Z.A., M.H. Khali, H.E. El-Sobby and M. Abdul-Rahman, 1987. Factors influencing performance and milk production of diary cattle. J. Animal Sci., 10: 961-968.
10. Magana, J.G. and J.C. Segura, 1997. Heritability and factors affecting growth traits and age at first calving of Zebu beef heifers in Southeastern Mexico. Tropical Animal Health Production, 29: 185-192.
11. Carew, S.F., J. Sanford, Y.J. Wissocq, J. Darkin and J.C.M. Trail, 1986. N'Dama cattle productivity at Teko Livestock Station, Sierra Leone and initial results from crossbreeding with Sahiwal. ILCA Bulletin, 23: 2-10.
12. Balogun, R.O., Olayemi, M.E. and O.A. Osinowo, 1993. Environmental factors affecting birth weight and litter size in Yankasa sheep. Nigerian J. Animal Production, 20: 14-19.
13. Bemji, M.N., O.A. Osinowo, O.W. Ehoche and A.O. Aduku, 1996. Birth weight and litter weight in Yankasa sheep: environmental factors and heritability estimates. Nigerian J. Animal Production, 2(1): 5-11.
14. Osinowo, O.A., B.Y. Abubakar and A.R. Trimneli, 1993. Genetic and phenotypic relationships between gestation length, litter size and litter birth weight in Yankasa sheep. Animal Production J., 43: 111-118.
15. Das, S.M., J.E.O. Rege and M. Shibre, 2002. Productivity of black head Persia sheep in Tanzania. Proceedings of 2th Biennial Conference of ASRRN AICC, Arusha, Tanzania. pp: 235-240.
16. Khombe, C.T., 1985. Environmental factors affecting the growth and viability of crossbred sheep and goats on range grazing in Zimbabwe. In: Wilson, R. T. and Bourzat, D. (eds) small ruminants in African agriculture. ILCA, Addis Abba, Ethiopia, pp: 46-57.
17. Reynolds, W.L., T.M. De Reuee, S. Maoin and K.L. Koonce, 1980. Factors influencing gestation length, birth weight and calf survival of Angus-Zebu and Zebu cross beef cattle. J. Animal Sci., 5(4): 860-867.
18. Orunmuyi, M., O. Olutogun and OT.F. Abanikanda, 2001. Preweaning growth characteristics of N'Dama cattle in the humid tropic of Nigeria. Proceeding of Nigeria Society of Animal Production, 26: 15-17.
19. Togun, V.A., 2005. Effect of season of lambing on reproductive performance traits of West African Dwarf sheep. Proceedings of 10th Annual Conference, Animal Science Association of Nigeria, September 12-15, 2005, University of Ado-Ekiti. pp: 73-76.
20. Oni, O.O., V. Buvanendran and N.I. Dim, 1989. Estimates of genetic and phenotypic parameters for body weight in Bunaji (White Fulani) cattle. Tropical Agriculture (Trinidad), 66(4): 369-371.
21. MacLenna, M., 1999. Aspects of the ecology of Trypanosomiasis affecting livestock production. Animal Production in the Tropics, 2: 318-329.
22. Becker, W.A., 1984. Manual of quantitative genetics 4th edition.
23. Swiger, L.A., W.R. Harrey, D.O. Everson and K.E. Gregory, 1964. The variance of interclass correlation involving groups with one observation. Biometrics, 28: 818-826.
24. Statistical Analysis System, SAS, 2001. SAS Users Guide: Statistics, 8th edition, SAS Institute, Cary, NC, USA.