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EFFECT OF HOLSTEIN INFLUENCE ON THE INCIDENCE OF ASSISTED BIRTH, BIRTH WEIGHT, 30 DAY WEIGHT AND AVERAGE DAILY GAIN OF HOLSTEIN-ZEBU CROSSBRED CALVES IN A SUB-SAHARAN AFRICAN ENVIRONMENT.

***O. OLUTOGUN, A. MAIDAJI, S.O. AYELOJA AND A.R. ABDULLAH**
Department of Animal Science, University of Ibadan, Nigeria.

Target Audience: Farmers, researchers, students

ABSTRACT

Weights at birth (BWT), 30-day (30DWT) and average daily gain (ADG) of 45 calves of various grades of Holstein and Zebu (Bunaji) genes born between 1993 and 1997 at the Integrated Dairy Farm (IDF), Jos, Nigeria were analyzed using the least-square procedures of Harvey (1987). The genotypes of Holstein (100, 50, 75 and 87.5%) exerted significant effects on these traits (P<. 01) while calf sex, parturition event and genotype*sex interaction had no effect (P > 0.05) on birth weight, 30DWT and ADG.
The least square means and standard errors (LSM±SE) of BWT for male calves were 41.54 ± 2.08, 34.53 ± 3.21, 39.34 ± 2.43 and 32.27 ± 2.93 kg for 100, 50, 75 and 87.5% Holstein genes respectively. For females, the corresponding figures were 35.89 ± 1.95, 33.83 ± 2.93, 40.00 ± 4.15 and 28.30 ± 3.63 kg. The LSM±SE of 30DWT of male calves were 54.99 ± 2.46, 45.81 ± 3.79, 52.00 ± 2.87 and 47.18 ± 3.46 kg respectively. Similar figures for female calves were 48.48 ± 2.31, 49.01 ± 3.46, 52.00 ± 4.89 and 43.52 ± 4.28 kg for 100, 50, 75 and 87.5% Holstein genes in the crossbred calves. The LSM±SE for ADG from birth to 30d of age were .451±. 058, .382±. 090, .426 ± .082 and .492±. 035 kg for males and .417±.055, .512±.083, .394±.116 and .459±.103 for females of 100,50,75 and 87.5% Holstein inheritance respectively. The mean birth weight for non-assisted calves at parturition was 33.69 ± 1.76 kg while assisted calves weighed 37.75 ± 1.53 kg at birth.
The result of the study indicated that care should be exercised in determining the level of Holstein genes in crossbreeding in rural areas of the Sub-Saharan African environment where veterinary services are non-existent or expensive. It is therefore recommended that Bos Taurus inheritance should not exceed 50% in the tropics.

Keywords: Holstein x Zebu, crossbreeding, birth weight, preweaning weight, dairy calves, Sub-Sahara Africa.

**Corresponding Address:*

DESCRIPTION OF THE PROBLEM

Previous studies on crossbreeding Friesian-Holstein and Zebu have shown that besides increased milk production in the crossbred females, there is also rapid weight gain in the surplus males available for fattening as beef cattle (11). Early growth traits were directly related to later performance on the feedlot (4) and to the level of Holstein genes in these crossbreds.

Knowledge of the relative importance of both genetic and environmental factors that cause differences in the weight of calves at different ages are of considerable practical importance. This information is necessary to evaluate properly the levels of various genotypes of animals if dyctocia is to be reduced to the minimum particularly in Sub-Saharan African environment where veterinary services are scanty and/or expensive.

In most Sub-Saharan West African environment there is yet no stratification in cattle production environment. Cattle are kept for both meat, milk and draft. Consequently, both male and female calves are important in the prevailing production environment. The gainability of calves is a factor to be considered in any crossbreeding programme. (13) noted that the birth weight of calves is related to subsequent growth rate. Furthermore, the average daily gain of calves is influenced by calf genotype, sex and the management system (7, 16, 1).

Studies on these various factors affecting the preweaning performances of purebred and crossbred Holstein calves with Zebu breed showed substantial heterosis for growth traits (9, 11).

The objectives of the present study are to determine the effects of Holstein influence, sex of calf, parturition events*Holstein influence interaction on the birth weight and performance traits till 30d of age of purebred and crossbred calves in Sub-Saharan West African environment .

MATERIALS AND METHODS

Preweaning performance records of 45 purebred (HH) and crossbred Holstein (HZ) calves (24 males and 21 females) born between 1993 and 1997 were collected from a peri-urban commercial dairy farm in a sub-Saharan African environment of Vom, Nigeria. The integrated Dairy Farms (IDF) Vom, Plateau State of Nigeria is located at an altitude of 1280m above sea level on longitude 08°45'E and latitude 09°43'N in the Guinea Savanna belt of Nigeria. Daily temperature varies from 13.9°C in December/January to 28.6°C in June/July while the rainfall ranges between 1300 to 1500mm annually. Monthly relative humidity at 12.00 G.M.T. varies between 14 and 74%.

The farm is owned by the West African Milk Company Plc (WAMCO) and was started in 1986 by the leasing 500 hectares of the abandoned Government-owned dairy project of the National Veterinary Research Institute, Vom (6). The first animals were brought in July 1988 with the purchase of 100 locally sourced purebred Bunaji heifers (Zebu) and 76 pregnant purebred Holstein heifers and one bull from Holland.

Mating was by artificial insemination with semen of Holstein bulls imported from Holland. A vasectomised bull fitted with chin ball was used to detect oestrus. Video camera was also installed in the barn to monitor oestrus behaviour of animals. Human monitors were also used in the mornings and evenings. Animals detected on oestrus were separated into insemination paddock while an experienced inseminator carried out the insemination in the morning following the day of detection. Insemination was carried out throughout the year. Rectal palpation was carried out 90-d post breeding to detect pregnancy. Pregnant heifers were managed on planted pastures and supplemented with concentrates containing 22% crude protein till due dates. Water and mineral supplements were fed *ad libitum*. Health management of the herd was under the scrutiny of the resident Veterinarian who handled both curative and prophylactic treatments.

At birth, calves were weighed within 24 hours, ear tagged and nursed by the dam for the first four days. Thereafter, the calves were separated into individual pens in a well-lighted and well-bedded calf nursery. These calves were fed whole milk at 10% of their body weight twice a day, split into morning and evening feeding. Assisted calves at birth were fed by the use of feeding bottles with colostrum and milk until they could be bucket-fed.

At the age of three weeks, calves were fed concentrate of 23.9% crude protein *ad libitum*. Grass hay and maize silage were also fed *ad libitum* from four weeks of age. Saltlicks were offered from two weeks of age. At all times, calves had access to clean and cool water and were weighed fortnightly.
Records of performance characteristics on 45 calves (24 males and 21 females) were extracted from the herd records at Vom, covering a period of 5 years (1993 – 1997). The age of the calves was standardized to 30-day weight (30DW) and average daily gain (ADG) calculated using the formula by (2).

$$30DW = \frac{(W_t - W_0)}{A_t} \times 30 + W_0$$

$$ADG = \frac{30DW - W_0}{30}$$

Where 30DW = Adjusted weight at 30d
W_t = Weight between 25 and 35d
W_0 = Birth weight (kg)
A_t = Age when W_t was taken
ADG = Average daily gain to 30d (kg)

The verified data were analyzed using the mixed model least squares and maximum likelihood computer program (8). The independent variables were calf sex, calf genotype, calving condition and calf sex by calf genotype interaction. The dependent variables are birth weight (BWT), average daily gain (ADG) and thirty-day weight (30 DW). The descriptive statistics was obtained with (15).

The statistical model adopted was:

$$Y_{ijkl} = \mu + a_i + b_j + (ab)_{ij} + c_k e_{ijkl}$$

Where Y_{ijkl} = the record of the k-th calving condition of the j-th calf genotype of the i-th calf sex

μ = the common mean

a_i = effect of the i-th sex of calf

b_j = effect of the j-th genotype of calf

$(ab)_{ij}$ = effect of the interaction of i-th sex of calf of j-th genotype.

c_k = effect of the k-th calving condition

e_{ijkl} = random error term.

Preliminary analysis of the data showed that birth year and season were confounded with genotypes due perhaps to the small numbers of calves per cell and were not included in the final model for this analysis.

RESULTS AND DISCUSSION

Descriptive statistics shown in Table 1 indicated significant variation within the genotypes as indicated by the coefficient of variation of 18.44% for BWT, 35.1% for ADG and 15.26% for 30DWT.This was due to the fact that Holstein genes varied from 100% to 50% The highest coefficient of variation was observed in

Table 1: Descriptive statistics of BWT, ADG and 30DWT of various Holstein genes of dairy calves in Nigeria.

Trait	Mean (kg)	SD (kg)	CV(%)
BWT	36.82	6.79	18.44
ADG	0.452	0.16	35.12
30DWT	50.33	7.68	15.26

the ADG as this variable reflected the gaining ability of these various genotypes even at that early age. The mean squares from the analysis of variance of BWT, ADG and 30DW of purebred Holstein and the crossbreds is shown in Table 2. In all the three traits analyzed, the level of Holstein breeding significantly influenced birth weight ($p<.01$). Sex effect was not significant contrary to expectation due to the small sample size and the confounding effects of unequal subclass numbers within the genotypes. Several works indicated the superiority of male calves over females in most breeds and breeding (17, 18, 14, 3). Table 3 shows the effect of Holstein influence specifically on birth weight of male and female calves in this Sub-Saharan African environment. Except for 75% Holstein 25% Zebu, due probably to the small sample size, male calves were

Table 2: Mean squares from the analysis of variance of birth weight (BWT), average daily gain (ADG) and 30 day-weight (30DWT) of Holstein x Zebu crossbred calves.

Source	df	BWT	ADG	30DWT
Genotype	3	163.247	10708.091	100.419
Calf Sex	1	51.170	3871.891	26.966
Parturition condition	1	82.519	16005.073	159.635
Genotype x Calf sex	3	22.229	14790.243	53.266
Remainder	36	34.447	27274.278	47.918
**=p<.01				

Table 3: Effect of Holstein gene on birth weight of crossbred calves.

	Male			Female		
Genotype	n	$\overline{X}$	se	n	$\overline{X}$	se
100%Holstein	9	41.54	2.08	11	35.89	1.95
50% Holstein	4	34.53	3.21	5	33.83	2.93
75% Holstein	6	39.34	2.43	2	40.00	4.15
87.5% Holstein	5	32.37	2.93	3	28.30	3.63
Overall	24	36.96	1.25	21	34.51	1.57

statistically significantly heavier than females when Duncan's multiple range test was applied (p<.05). The heaviest males were with 100% Holstein influence. This was followed by 75% Holstein 25% Bunaji and 50% Holstein 50% Bunaji whereas 87.5% H 12.5%B was the smallest at birth contrary to expectation. It should be noted that 50% H 50% B calves were carried by purebred Bunaji and the maternal effects were obvious when compared with 75%H 25%B which was carried by half bred dams. Parturition condition denoted by the level of assistance at parturition was influenced by the calves' birth weight as shown in Table 4. Only 40% of the total calves were not assisted at birth. This is significant in its implication in developing countries where cattle production technique is very low. It was also observed that all assisted calves at birth were 12% heavier than non-assisted calves. Except for calves with 87.5%Holstein genes, only 50% Holstein influence was closer to the mean birth weight of non-assisted calves. This implies that Holstein breeding may not exceed 50% if majority of calves would not be assisted at birth. This observation is similar to that of (5). That there was no significant variation in the ADG (Table 5) and 30DWT (Table 6) was not surprising in this study. After parturition all calves were bucket-fed. For the first five days postpartum calves received colostrum. Subsequently they were fed milk at the rate of 10 percent of body weight. Although male calves generally were 1.77kg heavier at 30d than females this was not statistically significant. When the Holstein influence was however considered, 75% H 25% B was the heaviest at this age while 87.5%H 12.5%B was the lightest. This is in conformity with their respective BWT and agreed with similar report in literature that birth weight of calves is related to subsequent growth rates (13).

Table 4: Effect of calf 's birth weight on parturition events in crossbred dairy herd.

Parturition Event	Birth weight (kg)		
	n	$\overline{x}$	se
Not assisted	18	33.69	1.76
Assisted	27	37.75	1.53
Overall	45	35.73	1.00

(5) reviewing crossbreeding *Bos indicus* and *Bos taurus* for milk production in the Tropics after observing nonlinear relationship between level of *Bos taurus* breeding and milk production concluded that 50% *Bos taurus* gene would be recommended in crossbreeding for milk production in the Tropics. (10) at Agege in Nigeria made similar observation. This study supports the conclusion that the optimum proportion of Bos taurus genes showed an improvement in almost all traits up to the 50% level without fear of dystocia and that further grading towards the *Bos taurus* breed had given variable and often conflicting results (5). Therefore in adopting peri-urban

Table 5: Effect of Holstein gene on average daily gain from birth to 30 days of crossbred calves.

Genotype	Male			Female		
	n	$\overline{x}$	se	n	$\overline{x}$	se
100% Holstein	9	0.451	0.058	11	0.417	0.055
50% Holstein	4	0.382	0.090	5	0.512	0.083
75% Holstein	6	0.426	0.068	2	0.394	0.116
87.5% Holstein	5	0.492	0.082	3	0.513	0.102
Overall	24	0.437	0.035	21	0.459	0.102

Table 6: Effect of Holstein gene on 30DWT of crossbred calves.

Genotype	Male			Female		
	n	$\overline{X}$	se	n	$\overline{X}$	se
100% Holstein	9	54.99	2.46	11	48.48	2.31
50% Holstein	4	45.81	3.79	5	49.01	3.46
75% Holstein	6	52.00	2.87	2	52.00	4.89
87.5% Holstein	5	47.18	3.46	3	43.52	4.28
Overall	24	50.02	1.48	21	48.25	1.85

dairy production system, the level of Holstein genes in the future dairy/beef cows must be taken into consideration in the rural and peri-urban Sub-Saharan African environment where access to veterinary services is presently expensive.

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