# ESTIMATION OF GENETIC PARAMETERS IN UNN CATTLE POPULATION

**Ohagenyi, I.J., & Udeh, V. C.**
*Department of Animal Science, University of Nigeria, Nsukka, Nigeria.*
***Correspondence email: ifemma.ohagenyi@unn.edu.ng; Tel: +2348160516532***

## ABSTRACT
This study was conducted to estimate the variance components and heritability for birthweight and weaning weight, as well as the genetic and phenotypic correlations between these traits in N'dama and Muturu crosses at the University of Nigeria Nsukka (UNN) cattle herd. The study lasted for 6 months and the heritability and genetic correlation of the traits were estimated using Restricted Maximum Likelihood (REML) method of SAS mixed model. The direct heritability estimates obtained were 0.15±0.05 and 0.45±0.05 for birth weight and weaning weight respectively. The direct genetic correlation between the two traits was positive (0.53) between birth weights and weaning weights.
**Keywords:** Genetics, heritability, N'dama, Muturu and Correlation

## INTRODUCTION
The beef cattle sub-sector plays important roles in the Nigerian economy, not only in terms of its contribution to the gross domestic products (GDP) but also contributes substantially to the supply of animal protein (FDLPCS, 2002 and Tewe, 2010). In the opinion of Grain de Sel (2010), Nigeria is by far the leading beef cattle producer in Central and West Africa with the cattle herds estimated at over 16 million heads, which is far ahead of Niger (8.7 million), Mali (8.2 million) and Chad (7 million).
However, Nigeria's rapidly growing population which is expected to reach 250+ million persons by 2030 (NLTP, 2019-2028), coupled with rising incomes and urbanization, are translating into increased demand for livestock products (FAO, 2018). Recent estimates suggest that, between 2010 and 2050, beef, poultry meat and milk consumption will increase by 117, 253 and 577 per cent, respectively (ASL2050 FAO, 2018). Hence, there is need to genetically upgrade the performance of our indigenous cattle species to raise the potential for higher meat yield.
Long (1980) opined that the genetic improvement of beef production systems is hinged primarily on two procedures which are; selection within breeds to enhance critical characters and selection among, and combination breeds to produce individuals that better fit production conditions and resources. N'dama and muturu which are predominant in the south eastern Nigeria produce minimally and are usually referred to as unimproved. However they have good adaptive traits that makes them hardy and resistance to certain environmental factors and diseases. Hence, they can be used in advanced beef cattle improvement programmes. Moreover, birth weight and weaning weight traits are recognized as important traits in determining economic efficiency of beef cattle (Oni et al 1988), and also an important selection criteria because of the ease with which they can be measured (Gregory 1965).
The effectiveness of breeding programmes depends on the accuracy of genetic and phenotypic parameter estimates, which include heritability and repeatability (Burrow, 2001). However, since the inception of breed improvement programmes in Nigeria, there has been no comprehensive analysis of the data generated either to obtain estimates of genetic parameters or to evaluate the genetic progress achieved in these populations. Such estimates are not only necessary for planning future breeding strategies but are also relevant for predicting response to selection and for evaluating genetic programmes. Although many genetic parameter estimates are now available in the literature from different breeds and production conditions, estimates of genetic and phenotypic parameters in pure breed indigenous cattle populations are scarce (Bosso et. al., 2002). Hence, the primary objective of this study is to estimate genetic parameters for birth weight and weaning weight of N'dama and Muturu crosses which will be used in subsequent genetic evaluation of the breed.
The objective of this study was to estimate the variance components and heritability for birthweight and weaning weight, as well as the genetic and phenotypic correlations between these traits in UNN cattle population.

## MATERIALS AND METHODS

### The study area

Data used in this study were obtained from the breeding and production records of beef cattle at the University of Nigeria Animal Science Farm, Nsukka. Nsukka lies within longitude 6˚45'E and 71E and latitude 7˚12.5'N (Ofomata, 1975) and on the altitude 447m above sea level. The climate of the study area is typically tropical, with relative humidity ranging from 65 – 80% and mean daily temperature of 26.8˚C (Agbagha et al., 2000). The rainy season is between April and October while dry season is between November and March with annual rainfall range of 1680 – 1700mm (Breinholt et al., 1981). The experiment lasted for three months.

### Management of the herd

A total of 15 cows and 5 sires were used for the experiment. They were bred and managed properly through calving till weaning. Calving occurs all year round as no strict breeding season is enforced. Calves were weighed within 24 h of birth and thereafter weighed at bi-monthly intervals using a 100Kg capacity weighing scale. Calves were identified at birth and branded later, close to weaning. Calves were weaned at about 6 months of age. All animals were treated against ecto- and endoparasites and routine prophylaxis for trypanosomiasis and babesiosis was administered. The vegetation of the research station is described as guinea savannah type. The predominant grass species on UNN pasture are *Panicum maximum, Pennisetum purpureum* and *Cynodon dactylon* interspersed with legume species like *Centrosema pubesence, Mucuna sp., Mimosa sp.* and others.

### Statistical analysis

Data were edited such that only animals with complete records on sire, dam and all fixed effects were used. The number of animals in the final data set were analysed by the MIXED model procedure of SAS (SAS University Edition 2019). The model used include the fixed effect of sex (male and female) and random effect of sire. Restricted maximum likelihood (REML) method of SAS mixed model was used to estimate the observable variance components due to sire ($\sigma_s^2$) and error ($\sigma_w^2$ ). Estimates of genetic correlations were obtained using varcomp procedure of Harveys computer program (Harvey, 1990). The programme also computed the genetic correlations and the appropriate standard errors of the estimated heritabilities.

$$h^2 = \frac{4\delta_s^2}{\delta_s^2 + \delta_w^2}$$

Where, $h^2$ is the sire heritability; $\delta_s^2$ is the sire variance component and $\delta_w^2$ is the error variance component.

$$rG = \frac{Cov\ (x\ y)}{\sqrt{\delta_s^2(x)\delta_s^2\ (y)}}$$

Where, *rG* is the genetic correlation; Cov (x y) is the genetic covariance of x and y components; $\delta_s^2$ (x) is the sire variance of x component and $\delta_s^2$ (y) is the sire variance of y component.

The detailed description of animals at UNN population is presented in Table 1 below.

Table 1: Descriptive statistics of the data

| | Birth Weight | Weaning weight |
|---|---|---|
| No of records | 15 | 15 |
| No of sires | 5 | 5 |
| No of dams | 23 | 23 |
| Progeny per sire | 3 | 3 |
| Progeny per dam | 1 | 1 |
| Mean (kg) | 10.77 | 58.29 |
| Standard deviation | 2.37 | 7.03 |
| Coefficient of variation (%) | 22 | 12.07 |

## RESULTS AND DISCUSSION

Sex effect was not significant (P>0.05) for birthweight. However, there is significant difference (P<0.05) between male and female calf weight at weaning. Male calves weighed 6.87kg (11.8%) heavier. The result is in line with the work of Hopkins (1977), who observed an increased sex

differences with increasing growth rate, signifying that male animalse are more responsive to improvement in the environment. The levels of weight advantage of male calves recorded in this study are comparable to what can be estimated from the values of Tawah et al. (1993) in Gudali but lower compared with values estimated by Tuah and Danso (1985) for WASH and Ndama in the humid forest zone of Ghana where favourable rainfall regime allowed greater quantities of high quality forage to be produced throughout the year, thus improving the nutritional environment for greater expression of male calves' responsiveness to improved environment.

## Variance components and heritability in UNN cattle population

The variance and heritability estimates for birth and weaning weights are presented in Table 3 below.

**Table 2: Variance covariance components and estimates for heritability (± SD) for birth and weaning weights**

| | Birth Weight | | Weaning weight |
|---|---|---|---|
| Variance-covariance estimates | | | |
| Additive direct variance | 0.8 | | 16.37 |
| Error variance | 4.7 | | 19.89 |
| Phenotypic variance | 5.5 | | 36.26 |
| Phenotypic correlation | | 0.05 | |
| Genetic correlation *rG* | | 0.53 | |
| | | | |
| Heritability estimates | | | |
| Direct heritability | 0.15 ± 0.05 | | 0.45 ± 0.05 |
| Total heritability | 0.15 | | 0.45 |

### Heritability

The variance, covariance and heritability estimates for birth and weaning weights are presented in Table 2. The estimates were low to medium but are in agreement with values reported by other researchers. The heritability value of 0.15 ± 0.05 for Birthweight in this study was close to 0.149 reported by Peters *et al.* (1998) for the same breed in a similar environment but lower than 0.37 reported by Johnson *et al.*(1992). Estimates of direct additive heritability (hi) for weaning weight (0.38 + 0.18) are in agreement with results of Mackinnon et al. (1991). The increase in heritability estimate with increase in age obtained in this study follows the same trend noted by Fogarty (1995).

### Correlation

Phenotypic and additive direct genetic correlation coefficients between birth weight and weaning weight were 0.05 and 0.53 respectively. While the phenotypic correlation coefficient was slightly lower than those from other studies, the genetic correlation coefficient was similar to literature values. The unweighted and weighted means obtained from a review by Koots et al. (1994), of all published studies on correlations between birth and weaning weights were 0.36 and 0.46 for phenotypic correlations and 0.47 and 0.55 for genetic correlations, respectively. The lower phenotypic correlation relative to genetic correlation is in agreement with the trend reported in the reviews by Woldehawariat et al. (1977) Mohiud- din (1993) and Koots et al. (1994). The moderate genetic correlation between birth and weaning weights indicates that selection for one trait will result in a moderate positive correlated response in the other trait.

## CONCLUSION

Estimates of heritability indicate that additive genetic variance exists for these traits. Selection for these traits, therefore, is likely to result in genetic gain for growth in UNN cattle population under tsetse infection pressure in south-eastern Nigeria and in the humid zone of Africa in general. The high genetic correlations between birth weight and weaning weight indicates that birth weight could be used as a cost effective means for selecting for cattle with high post weaning weight. The differences between male and female calves for weaning was highly significant hence, it is important

for sex of calf to be correlated for in analysing preweaning calf data. Genetic improvement of indigenous West African cattle has been attempted in the past by crossbreeding with exotic breeds of cattle with little or no emphasis placed on selection. The estimates of genetic parameters obtained in this study indicate that if genetic improvement through selection for birth and/or weaning weight of indigenous cattle and their crosses is desired, there is high posibility for high genetic progress to be achieved.

**REFERENCES**

Agbagha, F.M., Ezema F.U. and Omeke, B.C.O. (2000) Studies of Mangaement Effects on Fertility of Purbred and Crossbred Exotic Gilts in Two Breeding Farms at Nsukka. *Nigeria Journal of Animal Production*. 28(1)Pg 20.

Breinholt, K.A., Gowen, F.A. and Nwosu, C.C. (1981). Influence of Environmental and AnimalFactors on Day and Night Grazing Activity of Imported Holstein Freisian Cows in the Humid Lowland Tropics of Nigeria. *Trop. Animal Produc*.6:4.

Ofomata, G.E.K. (1975). Nigeria in Maps. Eastern States, Ethiope Publishing Co. Ltd. Benin.

Johnson, Z.B., Wright, D.W., Brown, C.J., Bertrand, J.K. and Brow, A.H. Jr. (1992) J. Anim. Sci 70 : 78-88.

Burrow, H. M. (2001). Variances and covariances between productive and adaptive traits and temperament in a composite breed of tropical beef cattle. *Livestock Production Science*, v. 70, n. 3, p. 213-233.

FAO. (2018). ASL2050: Livestock Production System Spotlight Ethiopia Cattle Sector. Rome, Italy: Food and Agriculture Organization of United Nation.

Grain de sel (2010). Demand for Farm Animal Products in Nigeria: An Opportunity for Sahel Countries? www.inter-reseaux.org/IMG/pdf/p14-15_Animal.pdf.

NLTP (2019). National Livestock Transformation Plan (NLTP) 2019-2028. Strategy Document, National Economic Council.

Tewe, O.O. (2010). Sustainability and Development: Paradigms from Nigeria's Livestock Industry. Inaugural lecture series; University of Ibadan Press, Ibadan.

Peters, S.O., Nwosu, I.C., Ozoje, M.O. and Ikeobi, C.O..N (1998). Genetic parameter estimates for growth traits in cattle genotypes. Proc 6th WCGALP 26: 101 – 104