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Regression equation for selected growth traits prediction in Nigerian Indigenous Cattle (NIC) Genotype

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***Target Audience:** Animal Scientist, Animal breeders/Geneticist, Cattle trader and Farmers*

Abstract

A total of 18 cattle (between 60 – 72 weeks of age) comprising three genotypes (white Fulani, N'dama and white Fulani x N'dama) were used for the experiment. Growth traits measured in centimeters were body length (BDL), hip height (HHT), heart girth (HG), horn length (HL), tail length (TL), ear length (EL) and neck length (NL). The regression analysis was simple linear regression. The values of coefficient of determination (R^2) ranged from 50.00 to 94.20 in White Fulani (WF), with BL and HG having the highest R^2 . This implies that BL and HG could be the best predictors of growth in WF. The values of R^2 ranged from 36.00 to 66.00% in N'dama (ND) cattle with HHT having the highest R^2 (66.00%). R^2 ranged from 80.00 to 90.00% White Fulani x N'dama genotype with TL having the highest R^2 value of 90.00%. This implies that TL could be the best predictors of growth in WF x ND genotype. Amongst all, BL and HG of White Fulani genotype had highest R^2 value (94.20%). Thus BL and HG could be best trait with 94.20% accuracy of prediction, and may be useful criterion in prediction of growth.

***Keywords:** Cattle; Genotypes; Growth traits; Prediction*

Description of Problem

Nigeria is endowed with varied ecological zones with diverse animal genetic resources of the local breeds. These local breeds possess genes relevant for their survival and adaptation to their environment and local breeding goals. According to (1), local cattle are poor milk and meat producers when compared with their exotic counterparts, though they are better adapted to survive and tolerate harsh environment (2).

Indigenous cattle breeds have unique morphological features which distinguishes them from other cattle. These include horn shape and size (3, 4).

Growth traits otherwise called linear body measurements such as chest girth and body length have been proposed as indirect selection criteria for genetic improvement of meat production in cattle (5, 6) and for prediction of live weight, growth traits (7). Linear body measurement have been found to be from moderate to relatively high heritability have a strong positive relationship with growth traits in cattle (8).

The objective of the study was therefore to predict growth traits from age of White Fulani, N'dama and White Fulani x N'dama.

Material and Methods

This experiment was carried out at the Cattle Unit of Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. The farm is located at latitude 05^0 29′ North and longitude 07^0 32′ East and lies at an altitude of 122 m above sea level. This area is situated within the tropical rainforest zone of West Africa which is characterized by long duration of rainfall (April - October) and short period of dry season (November-March). Average rainfall is 2169.8mm in 148 – 155 rain days. Average ambient temperature is 26^0C with a range 22^0C and 30^0C. Its relative humidity ranges from 50 to 90%. These meteorological data were obtained from the meteorological station at the National Root Crops Research Institute, Umudike, Abia State (9).

Experimental animals and their management

A total of 18 cattle aged between 60 - 72 weeks of age comprising White Fulani, N'dama and (N'dama x White Fulani) crosses with six cattle per group which was replicated three times with two animals per replicate were used for the experiment. The cattle were sourced from the university farm. They were managed semi-intensively.

Parameters measured:

Body length (BDL) joint of the scapular to the pin bone.

Hip height (HPH) distance from the platform on which the animals stand to the point of its shoulder.

Heart girth (HG) the body circumference immediately posterior of the front legs or the body circumference on the fore ribs.

Horn length (HL) the length from the base of the horn to the tip of the horn.

Tail length (TL) distance from the base to the end of the tail.

Ear length (EL) distance from the base to the tip of the ear.

Neck length (TL) the length of the neck region from the head to the hump.

The above parameters were measured on individual cattle with the aid of tailor's tape (cm). The animals were restricted by the handlers using cattle crush. Measurements were taken early in the morning prior to grazing.

Statistical analysis

Data obtained were statistically analysed with SPSS (10) version 16.0.

Regression of growth traits on age to determine rate of growth, within each genotypic group.

The regression model was;

$Y_i = a + b\,(Age) + \varepsilon_i \ldots (2)$

Where,

Yi = the linear body parameter (cm)

a = regression constant/intercept

b = the required growth rate/regression coefficient

(Age) = Age/independent variable (week).

ε_i = Random error assumed to be independently, identically distributed with zero mean and constant variance.

Results and discussion

Regression equations of indigenous cattle genotypes

Regression equations of White Fulani, N'dama and White Fulani x N'dama

The regression equations of indigenous cattle at week intervals (60 - 72 weeks of age) are presented in Table 1.

Table 1: Regression of growth traits on age (weeks) in White Fulani

Parameter	Regression equation	R^2 %	a	B	SEM	LOS
BL	BL= 38.930 + 0.070A	94.20	38.930	0.070	0.03	**
HH	HH= 47.900 + 0.080A	88.90	47.900	0.080	0.05	**
HG	HG= 37.930 + 0.070A	94.20	37.930	0.070	0.03	**
HL	HL= 10.040 + 0.040A	50.00	10.040	0.040	0.07	NS
TL	TL= 28.970 + 0.030A	75.00	28.970	0.030	003.	*
EL	EL= 8.930 + 0.050A	89.30	8.930	0.050	0.03	**
NL	NL= 11.900 + 0.080A	80.00	11.900	0.080	0.06	NS

SEM-Standard error of estimate; LOS- Level of significance; BL- Body length; HH - Hip height; HG - Heart girth; HL - Horn length; TL - Tail length; EL - Ear length; NL - Neck length; NS -Not significant; A = Age (weeks), R^2 = Coefficient of determination

The traits were significant ($p<0.05$) except for Horn length and Neck length which were not significant ($p>0.05$). Prediction equations relating linear body measurements with age in White Fulani cattle are shown in Table 4.21. The values of coefficient of determination (R^2) ranged from 50.00 to 94.20 in White Fulani, with body length and Heart girth showing the highest R^2 value. This implies that body length and Heart girth could be the best predictors of growth in White Fulani cattle in Nigeria. Moreover, assessment of linear body measurements has been found useful in quantifying body size and shape (11). However, coefficient of determination obtained for regression equations were positive and high for most of the parameters studied, BL and HG with highest coefficient of determinations is similar to report obtained by (12) on White Fulani cattle. Also, regression coefficient for BL and HG indicates that for any unit change in age (weeks), there would be a corresponding 0.070 cm increases in body length and heart girth in white Fulani cattle respectively. High coefficient of determinations for body length and Heart girth were also reported (13). Growth traits such as heart girth and body length have been proposed as indirect selection criteria for genetic improvement of meat production in cattle (6) and for prediction of live weight, growth traits (7).

Prediction equations relating linear body measurements with age in N'dama cattle are shown in Table 2.

Table 2: Regression of growth traits on age (weeks) in N'dama

Parameter	Regression equation	R^2 %	a	B	SEM	LOS
BL	BL= 44.870 - 5.890A	49.40	44.870	-5.890	10.88	NS
HH	HH= 33.300 + 0.420A	66.00	33.300	0.420	0.55	NS
HG	HG= 35.920 - 0.400A	42.90	35.920	-0.400	0.84	NS
HL	HL=59.20 + 1.270A	59.20	1.270	0.410	0.62	NS
TL	TL=23.100 + 0.020A	36.00	23.100	0.020	0.19	NS
EL	EL=4.740 + 0.420A	61.70	4.740	0.420	0.60	NS
NL	NL=4.640 + 3.220A	51.40	4.640	3.220	5.71	NS

SEM-Standard error of estimate; LOS- Level of significance; BL- Body length; HH - Hip height; HG - Heart girth; HL - Horn length; TL - Tail length; EL - Ear length; NL - Neck length; NS -Not significant; A = Age (weeks), R^2 = Coefficient of determination

The values of coefficient of determination (R^2) ranged from 36.00 to 66.00% in N'dama cattle genotype with Hip height showing the highest R^2 value (66.00%). This implies that Hip height (HH) could be the best predictors of growth in N'dama cattle. Moreover, assessment of linear body measurements has been found useful in quantifying body size and shape (11). Regression coefficient for HH indicates that for any unit change in age (weeks), there would be a corresponding 0.42 cm increase in Hip height in N'dama genotype.

The results showed that all the growth traits were not significant ($p>0.05$) but with positive intercepts. Negative slopes were observed in BL and HG which indicates, that for any unit change in age there would be a corresponding 5.89 cm and 0.40 cm unit decreases in BL and HG respectively. Therefore, BL and HG could not be good criterion for selection of N'dama cattle.

The BL and HG were lowest in N'dama genotypes whereas highest in White Fulani, and this might be because White Fulani cattle are known for their genetic predisposition of hardiness, heat tolerance and adaptation to local conditions (14).

Table 3: Regression of growth traits on age (weeks) in White Fulani x N'dama

Parameter	Regression equation	R^2 %	a	B	SEM	LOS
BL	BL = 39.450 + 0.040A	80.00	39.450	0.040	0.03	NS
HH	HH = 47.900 + 0.080A	80.00	47.900	0.080	0.06	NS
HG	HG = 37.850 + 0.110A	89.60	37.850	0.110	0.06	*
HL	HL = 14.900 + 0.080A	80.00	14.900	0.080	0.06	NS
TL	TL = 27.950 + 0.060A	90.00	27.950	0.060	0.03	*
EL	EL = 6.950 + 0.090A	85.30	6.950	0.090	0.06	*
NL	NL = 11.900 + 0.080A	80.00	11.900	0.080	0.06	NS

SEM-Standard error of estimate; LOS- Level of significance; BL- Body length; HH - Hip height; HG - Heart girth; HL - Horn length; TL - Tail length; EL - Ear length; NL - Neck length; NS -Not significant; A = Age (weeks), R^2 = Coefficient of determination

Prediction equations relating linear body measurements with age in White Fulani x N'dama (WF x ND) are shown in Table 3. The values of coefficient of determination (R^2) are high and ranged from 80.00 to 90.00% for WF x ND genotype with Tail length (TL) showing the highest R^2 value of 90.00%. This implies that Tail length could be the best predictors of growth in White Fulani x N'dama genotype. Regression coefficient for TL indicates that for any unit change in age, there would be a corresponding 0.06 cm increase in Tail length in White Fulani x N'dama genotype.

The results showed that there were significant ($p<0.05$) relationship in regression of age on HG, TL and EL (Table 3) in WF x ND genotype unlike lack of significant in N'dama alone. This may be as a result of genetic differences (11, 15). Also, the growth traits may have been influenced by breed, age and animal condition (16, 17). Some selected growth traits such as BL, HH, HL and NL studied were not significant ($p>0.05$) but all with positive slopes and intercepts. Positive slopes and intercept were observed in all the growth traits in WF x ND genotype.

Conclusion and Applications

1. The present findings could be useful in designing scheme and aid selection strategy for improvement of White Fulani, and White Fulani x N'dama in the humid tropics of Nigeria.
2. Strong relationships between most growth

traits and age in White Fulani, and White Fulani x N'dama genotypes are generally positive, strong and significant, and therefore age can be used to predict the respective growth traits in these cattle.

3. Body length and Heart girth could be best predictors of growth in White Fulani cattle.
4. Hip height (HH) could be the best predictor of growth in N'dama cattle.
5. Tail length could be the best predictor of growth in White Fulani x N'dama genotype

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