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EGGS HATCHABILITY AND PREDICTION OF BODY WEIGHT IN RHODE ISLAND, NIGERIAN LOCAL CHICKENS AND THEIR RECIPROCAL CROSSES

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Abstract

This study was conducted to determine the hatchability of eggs and to predict bodyweight in Rhode Island, Nigerian local chickens and their reciprocal crosses. A total of 241 eggs were set in the incubator to determine the fertility, hatchability, % Hatch, % dead in shell, % dead in cell and % deformed chicks in the four genotypes (Rhode Island Red (RIR) x Rhode Island White (RIW),Rhode Island Red (RIR) x Rhode Island White (RIW),Nigerian Local Red (NLR) x Rhode Island White (RIW) andNigerian Local Red (NLR) x Nigerian Local White (NLW). Only 94 eggs were hatched. Records of weekly body weight were taken on the 94 chicks. The data collected on body weight of chicks were subjected to correlation analysis to determine the association between body weights of chicks at different ages. Simple linear regression was used to predict chick's weight at different ages. Results indicated that the fertility, hatchability of fertile eggs and hatchability of egg set for the four genotypes were 72-89 percent, 24-65 and 19-57 percent, respectively. Eggs from Rhode Island Red (RIR) x Rhode Island White (RIW) were better in hatchability traits than eggs from Nigerian Local Red (NLR) x Nigerian Local White (NLW) and crossbreds chicken. Significant ($P<0.05$) difference was observed among genotypes in body weight of chicks at hatch and from weeks 1 to 8 weeks of age. RIRxRIW chicks were significantly higher ($P<0.05$) in body weight than other genotypic groups at hatch and at 1-8 weeks of age. Generally, significant ($P<0.05$) positive correlations were obtained between measurements of body weight made at different ages in RIRxRIW, RIRxNLW and NLRxNLW. The prediction equations for chicks' body weight were associated with varying level of R^2 (0.000-0.947). The comparatively higher levels of R^2 were associated with prediction equations for chicks' body weight in RIRxRIW and NLRxNLW. The results suggest that body weight of RIRxRIW and NLRxNLW can be predicted fairly accurately within 0-3 weeks of age using simple linear regression functions. The study concluded that selection for body weight of chicks can be made within 0-3 weeks of life, thereby shortening the generation interval and improving genetic progress in selection for increased chicks' weight. The study recommends further investigation to unravel the basis for decreasing value of R^2 in age specific linear regression function for prediction of body weights in chickens.

Key words: Coefficient of determination, Correlation, Fertility, Hatchability, Regression

INTRODUCTION

Poultry production forms an important component of the livestock subsector in Nigeria. For instance, the contribution of poultry production to total livestock output increased from 26% in 1995 to 27% in 1999, while increase in the production of table eggs accounted for about 13% during the same period (CBN, 1999).

The local Chicken production constitutes a significant portion of the chicken industry and a major contributor to animal protein supply in Nigeria (Ayorinde, 1986). According to Ayorinde *et al.* (2012), the local chicken exhibits higher fertility and hatchability under natural incubation, and better adaptation to the prevailing local managemental conditions than exotic chickens. However, local chickens are generally less productive compared with their exotic counterparts (Mwalusanya *et al*., 2000). Its adaptability merits does not give it a clear-cut superiority over its exotic counterparts in the combination of productivity, adaptability, and resistance to local diseases (Ayorinde *et al*., 2012).

Crossbreeding has been one of the tools for exploitation of genetic variation and hybrid vigour by combination of different important characteristics of each breed (Hanafi and Iraqi, 2001). Cross breeding of local chicken with exotic commercial chicken is expected to produce hybrids that combine the advantage of the productivity in the exotic birds with hardiness in the indigenous birds. In crossbreeding work, there is the need to cross-evaluate performance of hybrids reciprocal crosses derived from each possible direction of crossing (reciprocal crosses), and also to compare hybrids with each of the original parental types. The evaluation of reciprocal cross is imperative because it is often impossible to predict *a priori* how a hybrid between two lineages will perform in comparison with either of its parent types, when assessed on a single trait or combination of traits of interest (Ayorinde *et al.*, 2012).

The evaluation of livestock for body weight is important as it is normally taken to determine the market prices of animals. Correlation between body weight and body size and the use of morphometric measurements to predict body weight is common in literatures as obtained in Akanno *et al*. 2007; Raji *et al*., 2010. However, there is paucity of information on the prediction of body weight of local chickens and their crosses using hatch or 1-3 weeks body weights. The use of predictive equation to determine adult body weight will aid selection process and fasten genetic progress in chicken body weight improvement programmes. This experiment was design to examine the hatchability and body weight performance in Rhode Island Red, Nigerian local chickens and their reciprocal crosses. It also aimed at obtaining estimates of correlation and prediction equations for bodyweight in the four chicken genotypes.

MATERIALS AND METHODS

Location of the study

The rearing of parent birds and hatching of eggs were carried out using the poultry facilities at the Department of Animal Production, University of Ilorin. Ilorin is located between rainforest of the Southwest and Savannah grassland of Northern Nigeria with co-ordinates of 8° 30' 0'' North, 4° 33' 0'' East. It lies on an altitude of 305m, 1001' above sea level, with annual rainfall, relative humidity and day temperature of600-1200 mm, 65-80% and 33-37^{0} C, respectively.

Experimental animals and Management

A total of 241 eggsproduced from different crosses of Rhode Island and Nigerian chickens (Table 1) were used for the determination of fertility, hatchability and analysis of un-hatched eggs. The parent birds from which eggs were obtained were kept in cages, the female birds were artificially inseminated with fresh semen and the eggs were hatched in electric incubator. A total of 94 chicks produced from the hatchability experiment were put in cages in a completely randomized design to evaluate the effect of genotype on body weight performance over a period of 8 weeks and to obtain estimates of correlation and prediction equations for bodyweight in the four chicken genotypes.The Nigerian local chicken used as parent stock was a mixed population of Yoruba and Fulani chickens. A commercial chick marsh with a calculated Crude Protein content of 21.09% (CP) and Metabolizable Energy (ME) of 2795 kcal/kg was fed to the birds for a period of 8 weeks and water wassupplied *ad-libitum* to all the birds. Other management practices such as routine medication andsanitation were as recommended for chicken by NRC (1994).

Data collection

% fertility, Hachability of fertile eggs and hatchability of total eggs sets were calculated using the methods of Mauldin (2003). The breakout analysis of culled eggs wasdone by visual appraisal as described by Lourens *et al.* (2006).Body weights of birds were recorded on weekly basis for eight weeks.

Statistical analysis

Microsoft excel program was used to record all the data before preliminary statistical analysis were done. All the data collected were subjected to Analysis of Variance (ANOVA) using SPSS package (version 17.0, 2008). The procedure of Steel and Torrei (1980)was used to separate means for significant difference.The same SPSS package (version 17.0, 2008) was used to carry out correlation analysis and logistic regression analysis.

The following statistical model was used to partition the variance components used for the analysis.

$Y_{ijk} = \mu + \alpha_I + \varepsilon_{ijk}$

Where;

Y_{ij}= records of *j*th chick belonging to the*i*th genotype.

μ= Common mean

αi = effect of *i*th genotype

εij = Random error

RESULTS AND DISCUSSION

Fertility, Hatchability and Hatch-out Analysis

The Fertility, Hatchability and Hatch-out Analysis of eggs from Rhode Island, Nigerian local and their reciprocal crossbreds are presented in Table 2. The fertility of eggs ranged from 72-89 percent while the hatchability of fertile eggs and hatchability of egg set were 24-65 and 19-57 percent, respectively. Eggs from Rhode Island Red x Rhode Island White chickens were better in fertility, hatchability of fertile eggs and hatchability of set eggs than those from purebred local and crossbred chicken.

The lowest hatchability was obtained in the crossbred NLRXRIW. The most common cause of un-hatched eggs was dead in cell; this was followed by dead in shell. Both % deformed and % banger accounted for only 6-22 percent of un-hatched eggs in the four genotypes (Table 2).

Weekly Body Weight

The results of weekly body weight (g) of chicks from the four genotypes are presented in Table 3. The results showed significant difference ($P<0.05$) among the four genotypic groups in weekly body weight of chicks. RIRXRIW chicks were significantly higher ($P<0.05$) in body weight than other genotypic groups at hatch and at 1-8 weeks of age. NLRxRIW chicks were significantly higher ($P<0.05$) in body weight than RIRxNLW at hatch and at 8 weeks of age. NLRxNLW chicks had the lowest body weight at hatch and at weeks 1, 2 and 3.

Correlation and Prediction Equation for Weekly Body Weight

The correlation between hatch and subsequent body weight, regression equations and their coefficient of determination for the prediction of chicks' weight from hatch weight in RIRxRIW, RIRxNLW, NLRxNLW and NLRxRIW is presented in Table 4. There were significant correlations ($P<0.05$, 0.47-0.82) between hatch weight and subsequent body weights in RIRxRIW chicks. The correlations between hatch weight and subsequent body weights in RIRxNLW chicks were significant ($P<0.05$) at weeks 1, 3, 4, 7 and 8. The correlations between hatch weight and subsequent body weights in NLRxNLW chicks were significant ($P<0.05$) at weeks 1, 2, 5 and 6. The correlations between hatch weight and subsequent body weights in NLRxRIW chicks were not significant ($P>0.05$). The R^2 value for predicting body weight at hatch (independent variable) decreased with advancing age of chicks (dependent variable) in RIRxRIW, RIRxNLW and NLRxNLW chicks, respectively. The results on the coefficient of determination (R^2) showed that NLRxNLW had the best fitted regression equation for predicting body weight of chicks from their hatch weight (R^2 =51-89%). R^2 values for RIRxRIW, RIRxNLW and NLRxRIW were 22-67 %, 10-27% and 0-28%, respectively (Table 4).

The correlation coefficient, regression equations and coefficient of determination for the linear model for predictingchicks' weight from week 1 body weight (independent variable) in RIRxRIW, RIRxNLW, NLRxNLW and NLRxRIWis presented in Table 5.

There were significant correlations ($P<0.05$, 0.47-0.93) between week 1 body weight and subsequent body weights in RIRxRIW and RIRxNLW chicks. The correlations between week 1 body weight and subsequent body weights in NLRxNLW chicks were significant ($P<0.05$) at weeks 1, 3, 5 and 6. There were no significant correlations ($P>0.05$) between week 1 body weight and subsequent body weights in NLRxRIW chicks. The R^2value for predicting body weight at week 1 (independent variable) decreased with advancing age of chicks (dependent variable) in the four genotypes.

The NLRxNLW chicks had the best fitted regression equation for predicting body weight of chicks from their hatch weight (R^2

=51-89%). R^2values for RIRxRIW, RIRxNLW and NLRxRIWwere 30-80%, 20-60% and 0-79%, respectively (Table 5).

The correlation coefficients, regression equations and coefficient of determination for predictingchicks' weight from week 2 body weight (independent variable) in the four genotypes are presented in Table 6. There were significant correlations (P<0.05, 0.48-0.86) between week 2 body weight and subsequent body weights in RIRxRIW and RIRxNLW chicks. The correlations between week 1 body weight and subsequent body weights in NLRxNLW chicks were also significant (P<0.05), except at weeks 5 and 8. Generally, the correlations between week 2 body weight and subsequent body weights in NLRxRIW chicks were not significant (P>0.05). The R^2value for predicting body weight at week 2 (independent variable) decreased with advancing age of chicks (dependent variable) in the four genotypes. The NLRxNLW chicks had the best fitted regression equation for predicting body weight of chicks at week 2 (R^2 =61-97%). R^2values for RIRxRIW, RIRxNLW and NLRxRIWwere 46-75%, 23-66% and 1-93%, respectively (Table 6).

Table 7 contains the correlation coefficients; regression equations and coefficient of determination for predictingchicks' weight from week 3 body weight in the four genotypes. There were significant correlations (P<0.05, 0.22-0.92) between week 3 body weight and subsequent body weights in RIRxRIW and RIRxNLW chicks. Generally, the correlations between week 3 body weight and subsequent body weights in NLRxNLW and NLRxRIW chicks were not significant (P>0.05). The R^2value for predicting body weight at week 3 (independent variable) decreased with advancing age of chicks (dependent variable) in the four genotypes. The simple linear regression equation for predicting body weight from chick's weight at week 3 was well fitted for all the genotypes, except NLRxRIW chicks (Table 7).

The correlation coefficients for pooled data (R = 0.78-0.94, Table 8) were generally higher compared to estimates obtained for different weeks (Tables 4-7). The R^2value obtained for the prediction equations for body weight from chicks' weights at hatch, and at weeks 1, 2 and 3 were also higher compared to estimates obtained for different weeks (Tables 4-7).

The fertility of eggs of the four genotypes were higher than 21.49-66.68 percent obtained by Bobbo *et al.* (2013) in their work on comparative assessment of fertility and hatchability traits of nine genotypes of pure and cross bred local chickens in Adamawa State. Fayeye *et al.*(2005) had obtained a fertility of 76 percent in an earlier work on Fulani-ecotype chicken. The hatchability of fertile eggs in this study was however higher than 48 percent obtained by Fayeye *et al* (2005) for Fulani-ecotype chicken.According to Brillard (2003), the fertility of an egg depends directly on the ability of the hen to mate successfully, store sperm, ovulate and support the formation and development of embryo. It also depends on the ability of cock to mate successfully and deposite adequate quantity of high quality semen (Wilson *et al.*, 1979). Such variation in results of fertility and hatchability is common in literatures because fertility and hatchability are influenced by a large number of genetic and non-genetic factors such as feed variation

(Mussaddeq *et al.*, 2002; Lariviere *et al*., 2009), genotype of embryo (King and ori, 2011), egg size, age and shell quality (King and ori, 2011).

The hatch weight of RIRXNLW and NLRXNLW chicks in the present study were close to 27-28grammes obtained by Fayeye *et al.* (2005) in their work on Fulani ecotype chicken. However, Bobo *et al.* (2013) reported lower hatch weight of 7.00-25.62grammes for straight and crossbred local chicks obtained from Adamawa state. Such a wide range in hatch weight is common with studies involving animals of different genetic groups. For instance, Khawaja *et al.* (2012) reported hatch weights of 20.9g to 31.3g in their work on Rhode Island, Fayoumi and their reciprocal crosses. Weekly body weights of chicks were lower than the values reported by Fayeye *et al.* (2005) at weeks 6, 7 and 8for Fulani chicken. They were also lower than the mean bodyweight reported by (Sola-Ojo *et al.*, 2012) for Dominant Black, Fulani Ecotype and their crossbred chicks.

Fayeye (2014) stated that it is possible to design a selection programme in which a desirable genetic improvement in a certain traits is indirectly realized by basing selection on a known trait to which they are positively correlated. Therefore, the positive correlation between measurements of body weight made at different ages in RIRxRIW, RIRxNLW and NLRxNLW suggest that selection for body weight can be made early in the life of the animal, thereby shortening the generation interval and an improvement in the genetic progress. However, the use of correlated response will only enhance genetic progress if the observed phenotypic correlation has a large genetic component. R^2 values obtained in this study were similar to those reported by Momoh and Kershima (2008) for Nigerian local chickens. The variation in the values of R^2 for prediction equations for different genotypes and age is consistent with existing literatures. For instance, R^2values of between 0.005 and 0.921 were obtained from stepwise regressions by Raji*et al*. (2010) and Okon *et al*.(1997). The high values of R^2 obtained in this study for pure RIRxRIW and NLRxNLW suggests the reliability of linear regression functions for predicting the body weight of chicks in the investigated population. The results therefore indicate that body weight of chicks can be predicted fairly accurately within 0-3 weeks of age. According to Mason *et al.* (1993), a higher coefficient of determination indicated that large percentage of variation in the value of dependent variable can be explained by variation in the values of the independent variable. However, the decreasing value of R^2 for predictions of body weights made at a given age (0, 1, 2 or 3 weeks) as the dependent variable increases need further investigation to establish the role of environmental factors on age specific predictions.

CONCLUSION

The results of this study suggest that there is a positive correlation between measurements of body weight made at different ages in RIRxRIW, RIRxNLW and NLRxNLW. The high values of R^2 for linear regression or prediction equationsobtained from 0-3 weeks old chicks in RIRxRIW and NLRxNLW suggest the reliability of the linear regression function employed. It can therefore be concluded that selection for chicks body weight can be made early in the life of chicks, thereby shortening the generation interval and an improvement in the genetic progress. The study recommends further investigation to unravel the basis for decreasing value of R^2 in age specific linear regression function for predicting of body weights in the investigated flock in Nigeria.

REFERENCE

Akanno, E.C., P.K. Ole, I.C. Okoli and U.E. Ogundu, (2007). Performance characteristics and prediction of body weight of broiler strains using linear body measurements. Proceeding 22nd Annual Conference Nig. Soc. for Animal Prod. Calabar, pp: 162-164.

Ayorinde, K. L., (1986). *Poultry for Protein*, African Farming and Food Processing, Sept/ Oct. 1986: pp. 17-18.

Ayorinde, K. L., Sola-Ojo, F. E. and Toye, A. A. (2012). A Comparative Study of Growth Performance and Feed Efficiency in Dominant Black Strain, Fulani EcotypeChicken and Progeny from their Reciprocal Crosses, *Asian J. of Agric. and Rural Dev., 2 (2): 120-125*

Bobbo A. G., Yahaya M. S. and Baba S. S. (2013).Comparative assessment of fertility and hatchability traits of three phenotypes of local chickens in Adamawa State.*J. of Agric.and Vet. Sci., 4 (2):22-28*

Brillard J.P. (2003). Practical aspects of fertility in Poultry.*World Poultry Sci. J.*59: *441-446.*

Central Bank of Nigeria (1999).Yearly Annual report 2002. Abuja. Nigeria.

Fayeye, T. R. (2014). *Genetic Principles and Animal Breeding*. ISBN: 978-978-941-769-8. 266 pages.

Fayeye T. R., Adeshiyan A. B and Olugbami A. A. (2005) Egg traits, hatchability and early growth performance of the Fulani-ecotype *Livestock Res. for Rural Dev.,17(8)*

Hanafi, M. S. and M. M. Iraqi.(2001). Evaluation of pure breds, heterosis, combining abilities, maternal and Sex-linked effects for some productive and reproductive traits in chickens.Second International Conference on Anim. Prod. Health in Semi- Arid Areas, 4-6 September, Organized by Faculty of Environmental Agricultural Sciences, Suez Canal Univ. El Arish-North Sinai, Egypt, Pp:545-555.

King, ori, A. M. (2011).Review of the factors influence egg fertility and hatchability in Poultry.*Int. J. of Poultry Sci.*10: 483-492.

Khawaja, T., Sohail H. Khan, N Mukhtar, A. Parveen (2012).Comparative study of growth performance, meat quality and haematological parameters of Fayoumi, Rhode Island Red and their reciprocal crossbred chickens, Italian *J. of Anim. Sci., 11:e39*

Lariviere, J. M., Michaux F., Farnir J, .Detilleux V. and Leroy P. (2009). Reproductive performance of the ardennaise chicken breed under traditional and modern breeding management systems.*Int. J. of Poultry Sci. 8: 446-451*.

Lourens, A. R.; Molenaar, H.; Van Den Brand, M.J.; Heetkamp, R.; Meijerhof and Kemp, B. (2006).

Effectof egg size on heat production and the transition of energy from egg to hatchling.*Poult. Sci., 85: 770-776.*

Mason, R. O., Lind, D. A. and Marchal, W. G. 1983. Statistics: An Introduction. New York: Harcourt Brace Jovanovich, Inc. Pp 368-383.

Mauldin,J. M. (2003). Breakout Analyses Guide for Hatcheries. The PoultrySite.*http://www.thepoultrysite.com/articles/160/breakout-analyses-guide-for-hatcheries*

Momoh, O.M. and Kershima D.E. (2008). Linear body measurements as predictors of body weight in Nigerian local chickens. *Asset series A 8(2): 206 – 212*

Mussadideq, Y., Daud S. and Akhtar S. (2002). Astudy on the laying performance of cross (FAY+ RIR) chickens under different plans of feeding. *Int. J.of Poultry Sci.1: 188-192.*

Mwalusanya, N. A., Katule, A. M., Mutayoba, S. K., Mtambo, M. M., Olsen, J. E., Minga, U. M. (2002). Productivity of local chickens under village management conditions.*Trop. Anim. Health Prod. 34(5):405-16.*

NRC, (1994).*Nutrient Requirement of Poultry*. 9th Edition., National Research Council, Washington, DC., USA Pp: 155.

Okon, B, Ogar I.B, Mgbere O.O. (1997). Interrelationship of live body measurements of broiler chickens in a humid tropical environment.*Nig. J. Anim. Prod. 24(1):7-12.*

Raji, A. O., Joseph U.I, Ibrahim D.K (2010). Regression models for estimating breast, thigh and fat weight and yield of broilers from non-invasive body measurements. *Agric. and Biol. J. of North Amer,.1(4): 469-475.*

Sola-Ojo F. E., Ayorinde K. L., Fayeye T. R and Toye A. A. (2012).Effects of Heterosis and Direction of Crossing on Production Performance of F1 Offspring of Dominant Black Strain and Fulani Ecotype Chickens. *Agrosearch (2012) 12 No. 1: 95 - 105*

SPSS (2008).SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc.

Steel, R.G.D. and Torrei, J.H. (1980).Linear additive model, principles and procedures of statistics.A biometrical approach.Second Edition. McGraw-Hill Book Company. pp. 100-109.

Wilson, H.R., Piesco, N.P, Miller, E.R. and Nebseth, W.R. (1979).Prediction of the fertility potential of broiler breeder males.*World poultry Sci. J.* 35: 95-118.

Table 1: Mating plan and number of chicks produced from different crosses of Rhode Island and Nigerian local chickens

Sire	Dam	Number of eggs	Chicks
RIR (4)	RIW (8)	72	32
RIR (4)	NLW (8)	51	28
NLR (4)	NLW (8)	65	23
NLR (4)	RIW (8)	53	11
	Total	241	94

Number of birds in parenthesis, RIR = Rhode Island Red, RIW = Rhode Island White, NLR = Nigeria Local Red, NLW = Nigeria local White

Table 2: Fertility, Hatchability and Hatch-out Analysis of eggs from Rhode Island, Nigerian local and their crossbreds

	Genetic groups			
Parameters	RIRXRIW	RIRXNLW	NLRXNLW	NLRXRIW
Number of eggs set	72.00	51.00	65.00	53.00
% Fertility	88.89	86.27	72.31	77.36
% Hatchability	51.56	65.19	51.06	24.39
% Hatch/egg set	45.83	56.86	36.92	18.87
% Dead in Shell	17.19	11.36	17.02	29.27
% Dead in Cell	28.13	15.91	31.92	43.33
% Deformed	6.06	10.34	20.85	0.00
% Banger	0.00	1.96	1.54	9.08

RIRXRIW = Rhode Island Red Male x Rhode Island White Female, RIRXNLW = Rhode Island Red Male x Nigeria local White Female, NLRXNLW= Nigeria Local Red Male x Nigeria local White Female, NLRXRIW = Nigeria Local Red Male x Rhode Island White Female

Table 3: Mean body weight of Rhode Island, Nigerian local and their crossbreds chicken

	Weekly Weight in grammes								
Genetic groups	0	1	2	3	4	5	6	7	8
RIRXRIW	36.36±0.47[a]	64.23±1.12[b]	82.07±1.56[b]	104.58±3.23[a]	132.88±2.61[a]	152.66±3.27[a]	176.85±3.38[b]	198.41±3.73[b]	216.93±3.40[b]
RIRXNLW	27.62±0.32[a]	42.51±1.15[ab]	56.32±1.36[b]	71.63±2.12[a]	91.41±2.07[a]	113.11±2.30[a]	132.39±2.41[a]	154.04±2.30[a]	179.75±2.63[a]
NLRXNLW	28.62±0.82[a]	38.33±1.92[a]	49.32±1.52[b]	69.83±2.37[a]	95.83±3.39[a]	122.33±2.42[a]	144.83±2.73[b]	167.67±3.52[b]	193.17±2.94[b]
NLRXRIW	36.06±0.35[b]	44.50±1.04[b]	56.50±3.79[b]	75.00±3.34[a]	97.50±2.39[a]	123.75±3.77[a]	153.75±3.30[b]	180.25±3.35[b]	202.75±2.32[b]

abcMeans in the same column bearing same superscript are not significantly (P>0.05) different. RIRXRIW = Rhode Island Red Male x Rhode Island White Female, RIRXNLW= Rhode Island Red Male x Nigeria local White Female, NLRXNLW= Nigeria Local Red Male x Nigeria local White Female, NLRXRIW= Nigeria Local Red Male x Rhode Island White Female

Table 4: Correlations and Prediction equations for chicks' weight from hatch weight in RIRxRIW, RIRxNLW, NLRxNLW and NLRxRIW chicks.

	Independent var; week 0 (hatch weight)				
Dep(weeks)	Regression equation	R	R^2	Std Error	Sig
RIRXRIW					
1	Y = 2.241x - 18.341	0.81967.1		0.082	0.000
2	Y = 2.574x - 12.709	0.75256.6		0.441	0.000
3	Y = 4.258x - 54.614	0.62539.0		0.971	0.000
4	Y = 4.256x - 25.557	0.71849.9		0.754	0.000
5	Y = 5.425x - 50.845	0.66745.8		1.708	0.000
6	Y = 5.163x - 10.876	0.66846.6		1.396	0.002
7	Y = 4.762x + 25.246	0.55831.1		1.719	0.013
8	Y = 3.638x + 84.598	0.46721.8		1.672	0.044
RIRXNLW					
1	Y = 1.296x + 6.924	0.50925.9		0.439	0.007
2	Y = 0.955x + 30.386	0.32110.3		0.563	0.102
3	Y = 2.071x + 15.927	0.40716.6		0.904	0.035
4	Y = 2.355x + 26.091	0.47522.6		0.872	0.012
5	Y = 2.449x + 44.154	0.38715.0		1.190	0.051
6	Y = 2.331x + 69.041	0.31209.7		1.588	0.158
7	Y = 4.151x + 39.392	0.51526.6		1.543	0.014
8	Y = 4.112x + 66.187	0.50425.4		1.576	0.017
NLRXNLW					
1	Y = 1.501x - 4.425	0.86074.0		0.397	0.013
2	Y = 1.612x + 3.356	0.94389.0		0.254	0.001
3	Y = 2.237x + 5.804	0.77560.1		0.912	0.070
4	Y = 3.331x + 0.482	0.80762.5		0.217	0.052
5	Y = 2.460x + 51.925	0.83669.9		0.807	0.038
6	Y = 3.063x + 57.154	0.92084.6		0.665	0.009
7	Y = 2.001x + 110.402	0.71350.9		0.983	0.111
8	Y = 2.695x + 116. 045	0.75156.4		1.185	0.085
NLRXRIW					
1	Y = 0.288x + 34.124	0.09901.0		2.052	0.901
2	Y = 5.663x -147.726	0.53228.3		6.366	0.468
3	Y = 3.119x - 37.489	0.33311.1		6.241	0.667
4	Y = 1.962x + 26.752	0.29208.5		4.543	0.708
5	Y = -5.391x + 318.186	0.51026.0		6.426	0.490
6	Y = -0.49x + 155.519	0.00500.0		6.583	0.995
7	Y = 0.978x + 144.944	0.09901.0		6.939	0.901
8	Y = -1.396x + 253.099	0.21504.6		4.494	0.785

Y= dependent variable, X independent variable, RIRXRIW = Rhode Island Red Male x Rhode Island White Female, RIRXNLW= Rhode Island Red Male x Nigeria local White Female, NLRXNLW= Nigeria Local Red Male x Nigeria local White Female, NLRXRIW= Nigeria Local Red Male x Rhode Island White Female

Table 5: Correlations and Prediction equations for chicks' weight from week 1 body weight in RIRxRIW, RIRxNLW, NLRxNLW and NLRxRIW chicks.

	Independent var; week 1				
Dep (weeks)	Regression equation	R	R^2	Std Error	Sig
RIRXRIW					
2	Y = 1.152x +7.919	0.89580.1		0.105	0.000
3	Y = 1.935x - 22.302	0.75557.0		0.307	0.000
4	Y = 1.962x + 5.013	0.87977.3		0.194	0.000
5	Y = 2.476x - 10.307	0.82167.3		0.315	0.000
6	Y = 1.892x + 55.346	0.68046.2		0.495	0.001
7	Y = 1.836x + 80.494	0.59735.7		0.598	0.007
8	Y = 1.548x + 117.449	0.55230.4		0.568	0.014
RIRXNLW					
2	Y = 0.908x + 18.112	0.77760.4		0.147	0.000
3	Y = 1.343x + 14.132	0.61947.8		0.281	0.000
4	Y = 1.311x + 34.769	0.67445.4		0.287	0.000
5	Y = 1.048x + 66.736	0.47422.5		0.397	0.014
6	Y = 1.062x + 87.234	0.50625.7		0.404	0.016
7	Y = 1.105x + 107.060	0.48923.9		0.441	0.021
8	Y = 1.032x + 135.865	0.45120.3		0.457	0.035
NLRXNLW					
2	Y = 0.907x + 14.304	0.92685.7		0.167	0.003
3	Y = 1.07x + 28.746	0.87075.8		0.303	0.024
4	Y = 1.404x + 42.006	0.79863.7		0.530	0.051
5	Y = 1.036x + 82.623	0.82568.1		0.354	0.043
6	Y = 1.305x + 94.793	0.91984.4		0.281	0.010
7	Y = 0.913x + 132.662	0.76358.3		0.386	0.077
8	Y = 1.048x + 152.997	0.68546.9		0.558	0.134
NLRXRIW					
2	Y = 3.154x -83.846	0.86574.7		1.296	0.135
3	Y = 2.846x -51.654	0.88678.6		1.051	0.114
4	Y = 1.692x + 22.192	0.73554.0		1.105	0.265
5	Y = 0.423x + 104.923	0.11701.4		2.545	0.883
6	Y = -0.577x + 197.423	0.18203.3		2.205	0.818
7	Y = 0.269x + 168.269	0.08000.6		2.384	0.920
8	Y = 0.038x + 201.038	0.01700.0		1.587	0.983

Y= dependent variable, X independent variable, RIRXRIW = Rhode Island Red Male x Rhode Island White Female, RIRXNLW= Rhode Island Red Male x Nigeria local White Female, NLRXNLW= Nigeria Local Red Male x Nigeria local White Female, NLRXRIW= Nigeria Local Red Male x Rhode Island White Female

Table 6: Correlations and Prediction equations for chicks' weight from week 2 body weight in RIRxRIW, RIRxNLW, NLRxNLW and NLRxRIW chicks.

	Independent var; week 2				
Dep (weeks)	Regression equation	R	R^2	Std Error	Sig
RIRXRIW					
3	Y = 1.694x - 36.772	0.85172.4		0.191	0.000
4	Y = 1.498x + 7.718	0.86474.7		0.159	0.000
5	Y = 1.938x - 10.625	0.82768.4		0.241	0.000
6	Y = 1.611x + 44.676	0.74555.6		0.349	0.000
7	Y = 1.709x + 58.128	0.71651.3		0.404	0.001
8	Y = 1.470x + 96.212	0.67545.6		0.390	0.002
RIRXNLW					
3	Y = 1.349x - 5.313	0.81165.7		0.192	0.000
4	Y = 1.301x + 16.697	0.78161.0		0.208	0.000
5	Y = 1.155x + 45.809	0.62038.4		0.299	0.001
6	Y = 1.148x + 67.711	0.64842.1		0.301	0.001
7	Y = 1.039x + 95.540	0.54429.6		0.358	0.009
8	Y = 0.919x + 127.985	0.47522.6		0.380	0.025
NLRXNLW					
3	Y = 1.532x - 6.019	0.98396.7		0.142	0.000
4	Y = 1.987x - 2.098	0.88878.9		0.512	0.018
5	Y = 1.237x + 61.082	0.77960.7		0.498	0.068
6	Y = 1.475x + 71.830	0.82067.2		0.515	0.046
7	Y = 1.281x + 104.278	0.84671.5		0.404	0.034
8	Y = 1.532x + 117.314	0.79162.6		0.593	0.061
NLRXRIW					
3	Y = 0.850x + 26.991	0.96593.2		0.162	0.035
4	Y = 0.555x + 66.147	0.87977.2		0.213	0.121
5	Y = 0.055x + 120.647	0.05500.3		0.701	0.945
6	Y = 0.061x + 150.321	0.07000.5		0.613	0.930
7	Y = 0.309x + 162.777	0.33411.1		0.618	0.666
8	Y = 0.084x + 198.014	0.13701.9		0.429	0.863

Y= dependent variable, X independent variable, RIRXRIW = Rhode Island Red Male x Rhode Island White Female, RIRXNLW= Rhode Island Red Male x Nigeria local White Female, NLRXNLW= Nigeria Local Red Male x Nigeria local White Female, NLRXRIW= Nigeria Local Red Male x Rhode Island White Female

Table 7: Correlations and Prediction equations for chicks' weight from week 3 body weight in RIRxRIW, RIRxNLW, NLRxNLW and NLRxRIW chicks.

	Independent var; week 3				
Dep (weeks)	Regression equation	R	R^2	Std Error	Sig
RIRXRIW					
4	Y = 0.746x + 53.709	0.85773.5		0.082	0.000
5	Y = 1.025x + 43.058	0.87175.8		0.106	0.000
6	Y = 0.784x + 94.863	0.75053.6		0.168	0.000
7	Y = 0.807x + 113.984	0.69948.8		0.200	0.001
8	Y = 0.616x + 152.51	0.58434.1		0.208	0.009
RIRXNLW					
4	Y = 0.924x + 24.626	0.92485.3		0.077	0.000
5	Y = 0.853x + 50.194	0.70850.1		0.174	0.000
6	Y = 0.837x + 72.443	0.73654.2		0.172	0.000
7	Y = 0.711x + 103.10	0.22333.7		0.223	0.005
8	Y = 0.697x + 129.819	0.56131.5		0.230	0.007
NLRXNLW					
4	Y = 1.195x + 12.350	0.83670.0		0.142	0.038
5	Y = 0.677x + 75.042	0.665	44.2	0.381	0.150
6	Y = 0.846x + 85.754	0.73353.7		0.392	0.097
7	Y = 0.786x + 112.793	0.80965.4		0.286	0.051
8	Y = 0.919x + 128.986	0.73954.7		0.418	0.093
NLRXRIW					
4	Y = 0.687x + 46.007	0.95791.5		0.148	0.043
5	Y = 0.343x + 98.004	0.304 09.2		0.760	0.696
6	Y = 0.224x + 136.959	0.22705.1		0.224	0.773
7	Y = 0.507x + 142.190	0.48223.2		0.653	0.518
8	Y = 0.239x + 184.840	0.34411.8		0.462	0.656

Y= dependent variable, X independent variable, RIRXRIW = Rhode Island Red Male x Rhode Island White Female, RIRXNLW= Rhode Island Red Male x Nigeria local White Female, NLRXNLW= Nigeria Local Red Male x Nigeria local White Female, NLRXRIW= Nigeria Local Red Male x Rhode Island White Female

Table 8: Correlation andPrediction equations for weight using the hatch and weeks 1-3 body weight of chicks. (pooled data).

	Independent var; week 3				
Dep (weeks)	Regression equation	R	R^2	Std Error	Sig
Hatch					
1	Y = 2.098x -15.603	0.862	74.4	0.148	0.000
2	Y = 2.418x -10.332	0.820	66.7	0.205	0.000
3	Y = 2.929x - 9.767	0.860	55.9	0.293	0.000
4	Y = 3.755x - 11.475	0.774	72.4	0.284	0.000
5	Y = 3.507x + 15.899	0.851	63.3	0.328	0.000
6	Y = 4.427x + 11.959	0.796	74.2	0.368	0.000
7	Y = 4.520x + 31.152	0.864	74.6	0.377	0.000
8	Y = 3.790x + 76.789	0.831	69.1	0.362	0.000
Week 1					
2	Y = 2.418x - 10.532	0.820	67.2	0.205	0.000
3	Y = 1.372x + 13.188	0.888	78.8	0.087	0.000
4	Y = 1.688x + 21.562	0.936	87.7	0.007	0.000
5	Y = 1.476x + 52.059	0.836	69.9	0.119	0.000
6	Y = 1.675x + 67.896	0.861	74.1	0.141	0.000
7	Y = 1.640x + 91.804	0.825	68.1	0.160	0.000
8	Y = 1.363x + 128.447	0.787	61.9	0.153	0.000
Week 2					
3	Y = 1.173x + 5.436	0.916	84.0	0.063	0.000
4	Y = 1.393x + 15.347	0.933	87.1	0.065	0.000
5	Y = 1.217x + 46.781	0.836	69.9	0.098	0.000
5	Y = 1.368x + 62.997	0.860	74.0	0.116	0.00
7	Y = 1.341x + 86.875	0.825	68.1	0.131	0.000
8	Y = 1.109x + 124.737	0.783	61.3	0.126	0.000
Week 3					
4	Y = 1.096x + 16.541	0.940	88. 3	0.049	0.000
5	Y = 1.043x + 40.468	0.902	81.3	0.062	0.000
6	Y = 1.075x + 61.818	0.892	79.5	0.078	0.000
7	Y = 1.051x + 86.004	0.853	72.7	0.092	0.000
8	Y = 1.869x + 123.975	0.810	65.6	0.090	0.000

Y= dependent variable, X independent variable, RIRXRIW = Rhode Island Red Male x Rhode Island White Female, RIRXNLW= Rhode Island Red Male x Nigeria local White Female, NLRXNLW= Nigeria Local Red Male x Nigeria local White Female, NLRXRIW= Nigeria Local Red Male x Rhode Island White Female