Effect of housing types on body weight, biometry and prediction of body weight using body biometry of the dual purpose French guinea fowl in Nigeria.

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Abstract

A total 116 dual purpose French guinea fowls were managed intensively in an unroofed and roofed house types in Katsina metropolitan city and at Bugaji. Data were collected on measurements using a plastic rule, a flexible measuring tape, a venire caliper and a weighing scale. The data were subjected to analysis of variance, regression and correlation. Guinea cocks under unroofed house had significantly (P<0.05) longer beak length, shank length, wattle length, and helmet width than guinea cocks under roofed house who had significantly longer (P<0.05) wing span and tail length. On the other hand, there was no significant difference (P>0.05) difference between guinea cocks managed under both housing types on mean body weight, thigh length, neck length, body length, chest circumference, head length, keel length and helmet length. Guinea hens raised in the roofed house were significantly (P<0.05) higher in mean beak length and shank length than birds under unroofed house who were found superior in mean helmet length and helmet width. There was no significant difference (P<0.05) in mean body weight and body linear measurements evaluated. There were significant (P<0.01) positive correlations between body weight, beak length, shank length, thigh length, chest circumference, body length, head length and helmet length. Chest circumference followed by body length were the best body linear measurements for body weight prediction in both sexes. The dual purpose French guinea fowl can be raised under both housing types without any conflict on body weight of birds.

Keywords: Body linear measurement, Body weight, Dual-purpose, French guinea fowl, House-type, Prediction.

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Introduction

The United Nation/Food and Agricultural Organization estimated minimum protein requirements at 70 g/head/day out of which 34 g should be from animal protein sources [1]. Contrarily, Nigerian consumes 25% less than the recommended 34 g/head/day animal protein [2]. Guinea fowl has promising potentials as world's alternative poultry enterprise [3]. The birds are known for their high prolificacy and wide ubiquitous distribution in Africa, Asia, Europe, North America and Australia [4]. Guinea fowl has the potential to diversify rural poultry production if properly kept and managed [5]. Prevalent cases of animal protein deficiency are common among most rural populaces [6] who don't have sufficient economics for improved standard of living. Hence the need to explore the use of species that has peculiar attributes: able to survive satisfactorily under free range management, good economic return with minimum cost of production and prolificacy [7,8]. Guinea fowl species has the potential for utilization as an alternative for improving the standard of living and the nutritional needs among the rural inhabitant [9]. Hence determining the correlations between body weight and body linear measurements, prediction of body weight from body linear measurements and effects of housing types on guinea fowl performance may go a long way in guiding farmers appropriately.

The costs associated with the production of exotic chicken (poultry breeds) has been a barrier for their introduction into the rural production. Therefore, the needs to identify other poultry species that can supply animal protein to the rural populaces must not be overlooked. Therefore, the potential of the dual purpose. French guinea fowls and the effect of house type on their performance are worthy of investigation. Since the cost of erecting, roofing and concretizing a poultry pen could scare the rural farmer participation. Hence providing information on the effect of house-type on the performance of these birds under the semi-arid climate will be useful to both large scale and smallholder farmers. The objectives of this study were to predict body weight using body biometry, determine the correlation between body linear traits and body weight, as well as the effect of house-types on the performance of the dual purpose French guinea fowl.

Materials and Methods

The study was conducted in some selected local government areas in Katsina state. Katsina is situated within North West Region of Nigeria, within the tropic region of the world between latitude 12º59' N/longitude 7º36' E and latitude 12.983º N and 7.600º E of the Greenwich Meridian (GMT) with altitude of 182.82 to 457 meters above sea level [10]. According to Koppen climate classification system, Katsina has a hot semi-arid climate. The annual rainfall is short and lies between 500-800 mm, the temperature ranges between 21°C and 35°C, the area experiences relative humidity variations of 20% to 40% in January and then rises to 80% in the rainy season [11].

Management of the experimental birds

The dual-purpose French guinea fowls were imported from France at day old and raised under intensive management. Birds were fed commercial layer diet twice daily (morning and evening) and water was provided adlibitum at maturity birds were sampled from two housing types, roofed and unroofed housing.

The experimental design was the Completely Randomized Design (RCD).

Body linear measurements were collected on beak length, shank length, thigh length, keel length, body length, wing span, wattle length, head length, helmet length, helmet thickness, claw length, chest circumference and tail length and live body weight. Data were taken using a plastic rule, venire caliper and flexible measuring tape for body linear traits whereas a weighing scale was used to determine live body weight.

Data analysis

Analyses of data collected from the study were done using Statistical package for the social sciences (SPSS). Descriptive statistics and analysis of variance (ANOVA) of parameters measured, using the model below

$Y_{ijk}=\mu+X_i+H_j+e_{ijk}$

Where:

Y_{ijk}=Observation on the kth individual in the jthhouse type and the ith sex

μ=Overall mean in the population

X_i=Effect of the ith sex (1, 2)

Hj=Effect of the jth house (1, 2)

e_{ijk}=Residual random error with mean zero and variance that of the population.

Phenotypic (r_p) correlation between body weight and body linear measurements were determined using the formula described by Quaas et al. [12]:

$$B_1 = \frac{\mathrm{N}\Sigma x_i y_i - (\Sigma x_i)(\Sigma y_i)}{\mathrm{N}\Sigma x^2 - (\Sigma x^2)}$$

Where:

$Cov(x)_{Ij}$=The genetic (a), and environmental (e) covariance's between the first and second trait, respectively.

Var. x_{ii}=The genetic (a), and environmental (e) variances of the first trait, respectively.

Var. x_{jj}=The genetic (a), and environmental (e) variances of the second trait, respectively.

Prediction of body weight using linear regression model

Body weight was predicted using regression equations in order to assess the best predictor of body weight from the following body linear measurements.

$Y_i=B_o+B_1X_1$

Where:

Y_i=is the regression equation

B_o=is the intercept

B_1=is the slope of the equation and is given by:

$$B_1 = \frac{\mathrm{N}\Sigma x_i y_i - (\Sigma x_i)(\Sigma y_i)}{\mathrm{N}\Sigma x^2 - (\Sigma x^2)}.$$

Similarly, B_o is given by:

$$B_o = \frac{\Sigma y_i}{\mathrm{N}} - B_1 \frac{\Sigma x_i}{\mathrm{N}}$$

Where:

x=A given body linear measurement

y=Body weight

N=Total number of observation

$\sum x_i y_i$=Summation of the products of body linear measurement and body weight

$\sum x_i$=The summation of a given body linear measurement

$\sum y_i$=The summation of body weights

$\sum x^2$=The summation of the square of the given body linear measurement.

Standard error of estimate for predicting y (Body weight) from x (Body linear measurements)

$$\mathrm{SE} = \frac{\sqrt{\left[\Sigma y^2 - \frac{(\Sigma y)^2}{\mathrm{N}}\right] - \left[\frac{\Sigma \mathrm{XY} - (\Sigma \mathrm{x})(\Sigma \mathrm{y})}{\left[\Sigma x^2 - \frac{(\Sigma x)^2}{\mathrm{N}}\right]}\right]}}{N-2}$$

Where:

$\sum y^2$=The summation of the square of body weight variables

$\sum x^2$=The summation of the square of body linear measurement observation

$\sum xy$=The summation of the products of body linear measurement and body weight

$\sum x$=The summation of body linear measurements observations (X)

$\sum y$=The summation of body weight variables (Y)

$\frac{(\Sigma x)^2}{\mathrm{N}}$ =The expression for the correction factors

N=Total number of observation

N-2=Total degree of freedom

SE=Standard error of estimate.

Results

Table 1a showed the mean values of body weight and body linear measurements interaction with house-type and sex. Guinea cocks under unroofed house had significantly (P<0.05) longer beak length, shank length, wattle length, and helmet width than guinea cocks under roofed house. Guinea cocks under roofed housing had significantly longer (P<0.05) tail length. There was no significant difference (P>0.05) in mean body weight between guinea cocks managed under roofed and unroofed housing types. Thigh length, neck length, body length, chest circumference, head length, keel length and helmet length were not affected by housing types.

From Table 1b, guinea hens housed under roofed house were significantly (P<0.05) higher in mean beak length, wing span and shank length than hens under unroofed house who had superior mean head length and helmet length. There was no significant difference (P>0.05) in mean body weight, thigh length, chest circumference, wattle length, neck length, tail length and keel length due to effect of housing interaction, with body linear traits and body weight (Tables 1a and 1b).

Table 1a. *Effect of interaction between housing types and sex on body weight and body linear measurement of dual purpose guinea fowl.*

Parameter, BLM (cm)	Guinea cocks under unroofed house	Guinea cocks under roofed house
N	26	24
Beak length	2.56 ± 0.02^{a}	2.44 ± 0.04^{b}
Shank length	8.95 ± 0.08^{a}	8.81 ± 0.07^{b}
Thigh length	14.09 ± 0.12^{a}	13.41 ± 0.17^{a}
Wing span	53.09 ± 0.34^{a}	53.39 ± 0.36^{a}
Chest circ.	38.49 ± 0.20^{a}	38.98 ± 0.22^{a}
Claw length	1.64 ± 0.03^{a}	1.59 ± 0.04^{a}
Tail length	15.51 ± 0.19^{b}	16.60 ±0.19^{a}
Neck length	17.36 ± 0.13^{a}	17.46 ± 0.14^{a}
Body length	28.07 ± 0.21^{a}	27.73 ± 0.22^{a}
Wattle length	3.40 ± 0.07^{a}	3.03 ± 0.07^{b}
Keel length	13.99 ± 0.09^{a}	13.83 ± 0.10^{a}
Head length	8.33 ± 0.05^{a}	7.98 ± 0.04^{a}
Helmet length	1.9 ± 0.06^{a}	1.87 ± 0.05^{a}
Helmet width	1.20 ± 0.02^{a}	1.05 ± 0.04^{b}
	Weight (Kg)	
Body weight	2.87 ± 0.05^{a}	2.85 ± 0.04^{a}

^{a,b}Means with different letter(s) superscripts differ significantly.
N: Number of observations; BLM: Body linear measurements; BW: Body weight.

Table 1b. *Effect of interaction between housing types and sex on body weight and body linear measurement of dual purpose guinea fowl.*

Parameter, BLM (cm)	Guinea hens under unroofed house	Guinea hens under roofed house
N	40	26
Beak length	2.33 ± 0.08^{b}	2.48 ± 0.03^{a}
Shank length	7.82 ± 0.08^{a}	7.55 ± 0.09^{b}
Thigh length	12.53 ± 0.07^{a}	12.34 ± 0.07^{a}
Wing span	49.18 ± 0.16^{a}	50.16 ± 0.02^{a}
Chest circ.	36.96 ± 0.25^{a}	37.20 ± 0.23^{a}
Claw length	1.59 ± 0.39^{a}	1.50 ± 0.15^{a}
Tail length	13.38 ± 0.49^{a}	13.71 ±0.18^{a}
Neck length	16.65 ± 0.35^{a}	16.25 ± 0.13^{a}
Body length	25.95 ± 0.55^{a}	24.81 ± 0.21^{a}
Wattle length	2.27 ± 0.06^{a}	2.21 ± 0.07^{a}
Keel length	13.26 ± 0.30^{a}	13.48 ± 0.11^{a}
Head length	7.41 ± 0.17^{a}	7.09 ± 0.07^{b}
Helmet length	1.26 ± 0.05^{a}	1.03 ± 0.05^{b}
Helmet width	0.96 ± 0.02^{a}	0.95 ± 0.01^{a}
	Weight (Kg)	
Body weight	3.01 ± 0.05^{a}	3.10 ± 0.06^{a}

^{a,b}Means with different letter(s) superscripts differ significantly.
N: Number of observations; BLM: Body linear measurements; BW: Body weight.

Regression equations for predicting body weight using body linear measurements

The summary of the regression equations for predicting body weight using beak length, shank length, thigh length, chest circumference, body length, head length and helmet length is presented in Table 2. The best linear predictor was the chest circumference in both guinea hens and guinea cocks because it has the lowest standard error of estimation, 0.19 for guinea hens while 0.17 for the guinea cocks. Body length was the second best linear predictor, the standard error for estimation were 0.27 and 0.22 for guinea cocks and guinea hens respectively. The best linear predictor (chest circumference) showed higher level of coefficient of determination with body weight, 0.767 and 0.647 for guinea hens and guinea cocks respectively. Helmet length was the poorest body linear measurement for body weight prediction with highest standard errors of prediction, 0.30 and 0.23 for guinea cock and guinea hens respectively.

Body weight was positively correlated with beak length, shank length, thigh length, chest circumference, body length, head length and helmet length. All body linear traits used for the prediction were positively correlated with body weight at (P<0.01) level of significance among both sexes. The relative significant of a body linear trait in predicting body weigh depend directly on the coefficient of determination (R) but inversely on the standard error for estimation (SEE). Chest circumference was the best linear predictor of body weight and had 0.767 and 0.647 coefficients of determination for guinea hens and guinea cocks respectively. The estimated standard errors for predicting body weight using chest were (best linear predictors) the lowest 0.19 and 0.17 for guinea hens and guinea cocks (Table 2).

Discussion

Effect of house type on beak length

The average beak length of guinea cocks under the unroofed house type was significantly (P<0.05) longer than those from

Table 2. *Regression equations for determining the best body linear trait for estimating body weight among guinea hens and cocks.*

Predictor,	Equation	SEE	R	SD of pred.
Hens, BkL	Bwt=1.85+0.50 BkL	0.29	0.490	0.12
ShL	Bwt=1.57+0.19 ShL	0.28	0.358	0.54
ThL	Bwt=1.06+0.16 ThL	0.29	0.262	0.48
ChC	Bwt=-2.73+0.16 ChC	0.19	0.767	1.44
BoL	Bwt=0.69+0.95 BoL	0.27	0.408	1.26
HdL	Bwt=1.96+0.15 HdL	0.29	0.204	0.40
HeL	Bwt=3.04+0.04 HeL	0.30	0.486	0.33
Cocks, BkL	Bwt=1.68+0.47 BkL	0.22	0.311	0.15
ShL	Bwt=2.25+0.07 ShL	0.23	0.114	0.57
ThL	Bwt=2.80+0.01 ThL	0.23	0.393	1.86
ChC	Bwt=-2.42+0.14 ChC	0.17	0.647	1.08
BoL	Bwt=0.66+0.79 BoL	0.22	0.313	0.89
HdL	Bwt=-0.29+0.15 HdL	0.21	0.437	0.25
HeL	Bwt=2.91-0.28 HeL	0.23	0.407	0.27

SEE: Standard error for estimation; R: Correlation coefficient of determination; SD pred: Standard deviation of the predictor; BkL: Beak length, ShL: Shank length; ThL: Thigh length; ChC: Chest circumference; BoL: Body length; HdL: Head length; HeL: Helmet length.

roofed house type (2.56 ± 0.02 versus 2.44 ± 0.04 cm) however, the beak length of guinea hens managed under the roofed house type (2.48 ± 0.03 cm) was significantly superior over those reared under the unroofed house type (2.33 ± 0.08 cm).The average beak length of guinea cocks and guinea hens in this study are lower than 3.95 ± 0.03 and 3.66 ± 0.02 cm for guinea cocks and guinea hens respectively Venkatesan et al. [13]. The reason for the lower mean beak lengths in this study could be due to differences in the genetic make-up.

Effect of house type on shank length

The shank length of guinea cocks raised in the unroofed house type was significantly ($P<0.05$) longer than guinea cocks raised in roofed house (8.95 ± 0.08 versus 8.81 ± 0.07 cm). Similar trend was also noticed in the guinea hens 7.82 ± 0.08 and 7.55 ± 0.09 cm for birds raised in the unroofed and roofed housing system respectively. The longer shank length of guinea cocks and hens housed in the unroofed house may be as a result of hyper activeness stimulated by the open roof type. The average shank lengths in guinea cocks were significantly ($P<0.05$) higher than those of guinea hens under both housing type. The finding in this study was in agreement with Kozaczyński [14] who reported that Purple neck, Royal purple, Lavender and Royal blue guinea cocks were slightly higher in mean shank length than guinea hens (9.75 ± 0.13 versus 9.30 ± 0.11, 9.8 ± 0.14 versus 9.48 ± 0.13, 9.81 ± 0.14 versus 9.43 ± 0.11 and, 10.07 ± 0.23 versus 9.23 ± 0.26 cm.). However, the average shank lengths obtained in this study were lower than those. These differences could be due to differences in strain genetic make-up of the birds.

Effect of house type on thigh length

Thigh lengths of guinea cocks were significantly ($P<0.05$) higher than thigh lengths of guinea hens. The values were 14.09 ± 0.12 versus 13.41 ± 0.17 cm for guinea cocks under unroofed and roofed house types respectively. On the other hand, 12.53 ± 0.07 versus 12.34 ± 0.07 cm respectively were obtained for guinea hens raised in the unroofed and roofed house type. This finding does not agree with Daria et al. [15] cocks (12.0). The average thigh lengths of guinea cocks in the present study were higher than those of pearl, ash and black guinea fowls 13.89 ± 0.06, 13.68 ± 0.09 and 13.66 ± 0.08 cm, however, guinea hens in the present study had lower mean thigh length. This may be due to management and strain diversity.

Effect of house type on wing span

The average wing span in this was significantly ($P>0.05$) affected by house-type. The guinea cocks in the unroofed house (53.09 ± 0.36 cm) and the roofed house (53.39 ± 0.36 cm). There was significant ($P<0.05$) effect of house type on the average wing span of the guinea hens (49.18 ± 0.16 cm) for the unroofed and(50.16 ± 0.02 cm) for the roofed house-type. The longer wing span of the guinea cocks over guinea hens was consistent with Similarly, the finding in this study agrees with Abdul-Rahman et al. [16] who reported higher average wing span of guinea cocks (60.10 ± 1.70 cm) over guinea hens (56.70 ± 1.70 cm). However, the average wing spans obtained in this study is lower than those. The significant effect of wingspan of guinea hens in the roofed house over those in the unroofed house may be a statistical coincidence since the guinea cocks do not show this trend.

Effect of house type on chest circumference

There was no significant effect ($P>0.05$) of house type on the average chest circumferences of the birds. The average chest circumferences obtained from the present study are higher than 34.23 ± 0.19 cm for the Nigeria indigenous guinea fowls [17]. The higher values obtained in this study could be as a result of improvement due to selection of the dual purpose French guinea fowl strain. The superiority of the guinea cocks over guinea hens is consistent with the finding. The non-significant effect of hues-type on body linear parameters of the dual purpose guinea fowl indicate that it can be reared locally even on substandard housing.

Effect of house type on claw length

The average claw lengths of birds were not affected by the house type in both sexes. The claw length of guinea cocks raised under the unroofed and the roofed house type were 1.64 ± 0.03 and 1.59 ± 0.04 cm, respectively whereas 1.59 ± 0.39 and 1.50 ± 0.15 for the guinea hens. The mean claw length in birds may be an indicator for survival potential for feeding and defense. The housing type does not affect the expression of claw length of the birds. Hence all birds managed under the different house-types have equal potential for defense and feeding habits. This implied that none of the housing types presented a detrimental effect on the feeding methods of birds.

Effect of house type on tail length

The average tail lengths of guinea cocks managed in the unroofed house type was significantly ($P<0.05$) lower than those of guinea cocks in the roofed house type (15.51 ± 0.19 versus 16.60 ± 0.19 cm) whereas the guinea hens were not statistically different ($P>0.05$) under the two house type 13.38 ± 0.49 versus 13.71 ± 0.18 cm. The significant differences in tail length of guinea cocks due to house-types may be due to variance in age since house-type may have little or no effect on tail length. The average tail length in the present study is higher than the values.

Effect of house type on neck length

There was no significant effect due to house type on mean neck length (17.36 ± 0.13 and 17.46 ± 0.14 cm) for the guinea cocks and (16.65 ± 0.35 and 16.25 ± 0.13 cm) for the guinea hens. The average neck length of guinea cocks in the present study is significantly higher than the reported 17.03 ± 0.10 cm for the Northern guinea indigenous guinea fowls. The average neck length of birds in this study were lower than the reported values for the mature guinea hens and guinea cocks. The difference could be due to age and strain.

Effect of house type on body length

There was no significant effect of house type on mean body length of birds. The values obtained were 28.07 ± 0.21 and 27.73 ± 0.22 cm for guinea cocks raised under unroofed and roofed house respectively. Similarly, guinea hens did not show difference significant variation due to house type 25.95 ± 0.55 and 24.81 ± 0.21 cm respectively for the unroofed and the roofed house type. The body lengths obtained in the present study are higher than (22.17 ± 0.13 cm) reported for indigenous guinea fowl in north central Nigeria. The body lengths of the guinea cocks and guinea hens obtained in this study were lower than mean body length of guinea cocks and guinea hens (33.80 ± 0.90 and 32.10 ± 0.90 cm) respectively. The higher body length obtained in this study could be due to genetic improvement on the dual purpose French guinea fowl.

Effect of house type on wattle length

There was a significant influence due to house types, 3.40 ± 0.07 versus 3.03 ± 0.07 for guinea cocks raised under unroofed and roofed house respectively. On the other hand, guinea hens did not show significant effect due house type on mean wattle length 2.27 ± 0.06 and 2.21 ± 0.07 cm. The non-consistent house-type effect on wattle length expression could be due to age. The average wattle lengths obtained for guinea cocks and guinea hens in this study were higher than 2.4 ± 0.12 and 2.1 ± 0.13 cm for guinea cocks and guinea hens. Similar trend was observed by Prinsloo et al. [18] where wattle length of guinea cocks were longer than that of guinea hens 2.49 ± 0.34 versus 2.16 ± 0.35 cm. There was no establishing trend on effect of house type on wattle length. Since these are avenue for body temperature regulation, the dual purpose guinea fowl can be reared under village conditions.

Effect of house type on keel length

Keel length was not affected by house-type. The average keel lengths obtained in this study are higher than 12.96 ± 0.03 cm for indigenous guinea fowls in Lafiya Nassarawa state [19]. This indicated the superiority of the dual purpose French guinea fowl over the indigenous breeds in the north central Nigeria. The trend obtained in the present study where guinea cocks were higher than guinea hens in mean keel length agrees with who informed that the guinea cocks of the Royal purple, Lavender and Royal blue are higher than keel length of the counterpart guinea hens. The non-significant effect of house-type on keel length further justifies the potential of the dual purpose guinea fowl for growth under substandard environment.

Effect of house type on head length

Guinea cocks raised under the unroofed house type do not differ in average head length with those raise in roofed house 8.33 ± 0.05 versus 7.98 ± 0.04 cm. However, guinea hens housed in the unroofed house were significantly higher than those raised under the roofed house 7.41 ± 0.17 versus 7.09 ± 0.07 cm. This trend may be due to variation in age body size as the trend was not consistent.

Effect of house type on helmet length

House type did not affect helmet length of the guinea cocks (1.90 ± 0.06 versus 1.87 ± 0.05 cm) for the unroofed house versus roofed house. Helmet length for guinea hens in the unroofed house 1.26 ± 0.05 was higher than guinea hens under roofed house 1.03 ± 0.05. The helmet lengths in the present study are lower than the reported range 2.85 ± 0.74 to 3.47 ± 0.55 cm [20]. Similar trend to the findings in this present study showed guinea cocks have higher mean helmet length (2.57 ± 0.40 cm) than guinea hens (2.25 ± 0.37 cm). The superiority of the helmet length of the guinea cocks over guinea hens in the present study is also consistent with the finding of who observed 2.6 ± 0.04 and 2.22 ± 0.35 cm for guinea cocks and guinea hens respectively. Again the inconsistencies and lack of a clear trend on the effect of house-type on helmet length may be due to age or other parameters than house-types.

Effect of house type on helmet thickness

Helmet thickness was significantly affected by house type among the guinea cocks, 1.20 ± 0.02 versus 1.05 ± 0.04 cm for birds raised under the unroofed and the roofed house type respectively. Contrarily, helmet thickness was not affected by the house type among guinea hens 0.96 ± 0.02 versus 0.95 0.01 cm. The average helmet thickness in this study is lower than the reported range of 1.11 ± 0.16 to 1.74 ± 0.63 cm. Again a clear trend on effect of housing type on helmet thickness was not established. The observed effect on guinea cocks may be due to age.

Effect of house type on body weight

Guinea hens weigh higher than guinea cocks, the higher body weight of the guinea hens over the guinea cocks could be due to larger reproductive organs. Furthermore, the presence of relatively larger egg clusters in the dual purpose guinea hens may be a possible factor that contributed to the higher body weight of the guinea hens. House type has no effect on mean body weight (2.87 ± 0.05 versus 2.85 ± 0.04 kg) for guinea cocks and (3.01 ± 0.05 versus 3.10 ± 0.06 kg) for guinea hens housed in the unroofed and the roofed houses. The higher mean body weight in guinea hens is consistent with Sales and Du Preez [21] who observed 1.927 and 2.043 kg for guinea cocks and guinea hens respectively. Similar discovery showed that guinea hens tend to have relatively higher body weight than guinea cocks. Body weight of dual purpose guinea cocks and guinea hens were not significantly ($P>0.05$) affected by housing types. This implied that varied housing types can be use for rearing the dual purpose guinea fowls without significant effect on body weight gain.

Body weight prediction from body linear measurements

Beak length, shank length, thigh length, chest circumference, body length, head length and helmet length were found to be positively correlated with body weight. The relative importance in of beak length, shank length, thigh length, chest circumference, body length, head length and helmet length for predicting body weight varies directly with the correlation coefficient between body weight and the predictor variable. The coefficients of regression and correlation of body weight versus beak length, shank length, thigh length, chest circumference, body length, head length and helmet length in this study will be useful references for manipulating biometric traits in order to arrive at desired goal during improvement.

The positive associations of body weight with shank length, thigh length, body length, thigh length and chest circumference were in agreement with Oke et al. [22]. The existence of positive correlations between body weight and body linear measurements implies that the expressions of body weight and body linear measurements were governed by the same physiological mechanism.

Body weight was predicted from body linear measurements (beak length, shank length, thigh length, body length, chest circumference, head length and helmet length) in this study, this agrees with Ojedapo et al. [23] who informed that body weight of commercial layer chickens could be predicted from body linear measurements.

Conclusion and Recommendation

Conclusion

Guinea cocks housed under both housing types showed no significant difference in mean body weight and other body linear measurements taken (thigh length, neck length, body length, chest circumference, head length, keel length, helmet length and body weight). There was also no significant difference due to effect of housing on mean body weight, thigh length, chest circumference, wattle length, neck length, tail length, keel length, and body weight of guinea hens [24].

Body weight and body linear measurements of the dual purpose guinea cocks and guinea hens were not affected by housing types. Few parameters (beak, shank length, wattle length and helmet thickness) did not show a define trend and may have been influenced by age difference rather than housing types. Guinea cocks and guinea hens of the dual purpose French guinea fowl are rugged and can be reared under substandard housing system.

Recommendation

Farmers in the southern guinea savannah should incorporate the dual purpose French guinea fowl as part of rural poultry production since the dual purpose French guinea fowls were not affected by substandard housing under the semi-arid conditions.

Furthermore, the presence of abundant vegetation in the southern guinea savannah as opposed to the semi-arid zone is the may be an avenue for the birds to thrive under free range management in the southern guinea savannah.

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