# Phenotypic characterization of linear body measurements of Guinea pigs (*Cavia porcellus*) in the middle belt of Ghana

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**Abstract**— *The study was carried out to investigate the phenotypic characteristics, relationship between body weight and linear body measurements of Guinea pigs in the middle belt of Ghana. A total number of 367 Guinea pigs of about four weeks old were used for the study. The study was conducted in two phases. In the first phase, 310 Guinea pigs were sampled using snowball sampling method. Fifty four Guinea pigs were reared for four months in the second phase. Simple linear regression equation was used for body weight and linear body measurements. All the data were analyzed by using R statistical software version 4.2.1 and SPSS version 21.0. The effects of location had significant ($p \leq 0.01$) variation effect on Guinea pigs whilst sex did not have significant effect ($p > 0.05$) on Cavies. The highest correlation value (0.91) was between body length and heart girth. The least correlation value (0.21) was found between body weight and fore leg length. The simple linear regression equation: Y= -214.69+5.51BL+10.11HG+15.74HW+18.16HL-7.74HLL-5.34FLL, body length (BL), heart girth (HG), height-at-withers (HW) and head length (HL) were the best predictor of body weight in Guinea pigs with $R^2$ of 0.80. The best time to predict the body weight of Guinea pig was in week 2. However, it was concluded that the linear body measurements of Guinea pigs in the middle belt of Ghana serve as good indicators to predict live body weight which breeders can use for breeding purposes.*

***Keywords***— ***Cavia porcellus, characterization, correlation, phenotypic, regression.***

## I. INTRODUCTION

Characterizing indigenous breeds are very essential because they are well adapted to the local environment and require very little economic inputs for their sustenance (APD, 2003). Characterization is paramount for conservation and sustainable utilization of farm animal genetic resources, especially local breeds that are often less envisaged due to their relatively low production potential (Adjei *et al.*, 2015).

Phenotypic characterization generally refers to the process of identifying distinct breed populations and describing their external and production characteristics within a given production environment (Karnuah *et al.*, 2018). Phenotypic characterization describes how to conduct a study on a specific animal population and its production environment which includes; details of what to measure, how to take these measurements and how to interpret them (FAO, 2012). It provides the prerequisite information and guidelines on genetic and molecular characterization (FAO, 2011).

Guinea pigs are widely reared for meat in Latin America and many African countries but their production has received virtually no attention from government institutions and agricultural sector policy makers (AU-IBAR, 2019). Ghana has various breeds of domestic animal species that contribute to agriculture and food security, but there is little knowledge on the characteristics of some of the breeds (APD, 2003). Micro livestock are likely to become increasingly important as a result of rapid increase in human population and urbanization (Assan, 2014). Guinea pigs appear to be cheaper and achievable solution that can be used to supplement and compensate for the protein insufficiency in rural areas for many reasons (Handlos, 2018). However, characterizing indigenous breeds and their subsequent description would assist in the development of economically low esteemed areas of every region through the evaluation of local breeds and thereby promoting conservation of local breeds and preservation of biodiversity (De Marchi *et al.*, 2003).

Ayagirwe *et al.* (2019) indicated that Guinea pigs can be phenotypically characterized based on their observable quantitative traits such as; body weight, head length, body length, heart girth and height.

In accordance with Animal Production Directorate (2003) stated that Ghana Animal Genetic Diversity must conserve indigenous breeds and improve upon their sustainability. Now, it is imperative to characterize these wonderful animals (Guinea pigs) for food, income, multiplication and research.

## II. MATERIALS AND METHODS

### 2.1 Study area and data collection

The research was carried out in the middle belt of Ghana (Ahafo, Ashanti, Bono and Bono East regions). The data collection was obtained from September, 2019 to February, 2021. Ashanti region lies between longitudes 0.15 – 2.25ºW and latitudes 5.50 – 7.46ºN and Bono Ahafo region is located within longitude 0.15ºE and latitudes 8.45ºN and 7.30ºS of Ghana. These regions have annual rainfall between 1,088 mm – 1,800 mm from the beginning of March to end of September and a mean temperature range of 23.9ºC to 32ºC and humidity between 65% - 85% throughout the year (MoFA, 2021ab).

Two studies were conducted. For the phase one, a twelve - month survey was performed. Fifty four (54) Guinea pigs farmers were interviewed using a semi-structured interview and questionnaire and 310 Guinea pigs were sampled in middle belt of Ghana using snowball sampling method. In the phase two (field experiment), fifty four (54) Guinea pigs of about four (4) weeks old were reared for four (4) months in Goaso, Ahafo region. Three hundred and sixty-seven (367) Guinea pigs about a month old from the four regions (Ahafo, Ashanti, Bono and Bono East) were sampled for the study.

The data obtained were on the relationship between body weight and linear body measurements of Guinea pigs breeds in the middle belt of Ghana. The linear body measurements of Guinea pigs were recorded using a digital kitchen precision scale and a tape measure. Measurements were recorded in grams (g) and centimeters (cm).

Primary characterization and longitudinal type of design were used for both survey and field experiment.

**FIGURE 1: Taking linear body measurements of Guinea pigs in the middle belt of Ghana**

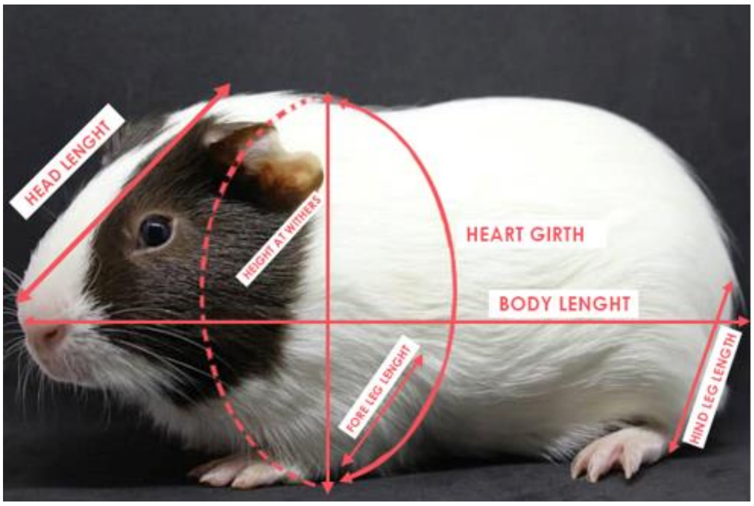


**FIGURE 2: Showing linear body measurements of Guinea pigs in the middle belt of Ghana**

***Body weight (WT):*** The animals were weighed on a scale and their weights read and recorded.

***Body length (BL):*** It was measured from the croup to the tail.

***Height at withers (HW)*:** Measured from ground to the highest point of the withers. This was done by keeping the tape measure tight, straight and perpendicular to the ground.

***Heart girth (HG):*** Measured the circumference around the chest. It was done by placing the tape measure immediately behind the forelegs and pull the tape to fit snugly.

***Head length (HL):*** It was measured from the nose to the neck bone.

***Hind Leg length (HLL):*** It was measured from the socket joint to the highest point of the croup.

***Fore Leg length (FLL):*** It was measured from the shoulder joint to the foot.

### 2.2 Statistical analysis

Evaluation of the effects of location (regions) and sex on body measurements data were analyzed by least squares analysis of variance using the General Linear Model (GLM) of R Statistical Software version 4.2.1 (R Core Team, 2021).

The model used was: $Y_{jk} = \mu + R_j + S_k + RS_{jk} + e_{jk}$, where $Y_{jk}$ = body weight, body length, heart girth, height-at-weight, head length, hind leg length and fore leg length. μ = the overall mean, $R_j$ = the effect of the j[th] regions or location, j = 1…4 (1=Ashanti, 2=Ahafo, 3=Bono and 4=Bono East) $S_k$ = the effect of the k[th] sex of Guinea pigs, k= 1, 2 (1=male, 2=female) $RS_{jk}$ = is the interaction effect between j[th] location and the k[th] sex $e_{jk}$ = the random error term assumed normally and independently distributed, (0, σ2 e). Means were separated using LSD under the Post Hoc Multiple comparison.

Correlation coefficients among the various linear body measurements were estimated using the Pearson's correlation of SPSS 21.0 (SPSS, 2021).

The best prediction equation of the body weight and linear body measurements of Guinea pigs were analyzed using simple linear regression analysis with the aid of R Statistical Software version 4.2.1 (R Core Team, 2021).

The simple linear regression equation was: $Y = \alpha + \beta X$

Where Y is live body weight (BW) or dependent variable; α is the constant value of Y.

Where β is the slope of X defined as the change in Y resulting from a unit change in X.

X is the independent variable represented by BL, HW, HG, HL, HLL, FLL.

## III. RESULTS

### 3.1 Survey results

#### 3.1.1 Body weight and linear body measurement base on location (regions)

The mean body measurements for local Guinea pigs based on regions are indicated in Table 1. The regions were highly significant ($p < 0.01$) on body measurements (*BL, HG, HL, HLL* and *FLL)* of Guinea pigs except for the body weight ($p > 0.05$) and height-at-withers ($p > 0.05$) that did not have influence on the location (regions).

**TABLE 1**
**EFFECTS OF LOCATION (REGIONS) ON BODY WEIGHT AND LINEAR BODY MEASUREMENTS OF GUINEA PIGS IN THE MIDDLE BELT OF GHANA**

| Variable | Region | | | | Mean | *P Value* |
|---|---|---|---|---|---|---|
| | Ashanti | Bono | Ahafo | Bono East | | |
| BW | 378.88±20.58 | 429.84±23.35 | 418.65±12.93 | 357.86±35.57 | 405.19±151.90 | 0.06 |
| BL | 21.68±0.48$^{b}$ | 23.02±0.55$^{ab}$ | 23.67±0.30$^{a}$ | 21.76±0.83$^{ab}$ | 22.83±3.55 | 0.00 |
| HG | 17.01±0.35$^{b}$ | 18.58±0.39$^{a}$ | 17.05±0.22$^{b}$ | 16.81±0.60$^{b}$ | 17.32±2.55 | 0.00 |
| HL | 7.24±0.16 | 7.71±0.18 | 7.47±0.10 | 7.24±0.28 | 7.43±1.19 | 0.09 |
| HW | 6.77±0.15$^{c}$ | 7.73±0.17$^{ab}$ | 8.08±0.09$^{a}$ | 7.33±0.25$^{bc}$ | 7.58±1.09 | 0.00 |
| HLL | 6.19±0.12$^{b}$ | 6.41±0.14$^{b}$ | 6.95±0.08$^{a}$ | 6.42±0.21$^{ab}$ | 6.59±0.91 | 0.00 |
| FLL | 5.31±0.13$^{b}$ | 5.44±0.15$^{b}$ | 6.41±0.08$^{a}$ | 5.41±0.22$^{b}$ | 5.83±0.96 | 0.00 |
| No. | 89 | 60 | 18 | 143 | | |

***P-Value = probability value, BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length***

### 3.1.2 Body weight and linear body measurement base on sex

Mean body measurements for Guinea pigs based on sexes are found in Table 2. Both sexes had no influence ($p > 0.05$) on *BW, BL, HG, HW, HL, HLL* and *FLL*

**TABLE 2**
**EFFECTS OF SEX ON BODY WEIGHT AND LINEAR BODY MEASUREMENTS OF GUINEA PIGS IN THE MIDDLE BELT OF GHANA**

| Variable | Sex | | Mean | *P Value* |
|---|---|---|---|---|
| | Male | Female | | |
| BW | 399.76±17.97 | 408.43±10.99 | 405.19±153.10 | 0.63 |
| BL | 22.85±0.43 | 22.82±0.26 | 22.83±3.64 | 0.95 |
| HG | 17.29±0.31 | 17.34±0.19 | 17.32±2.62 | 0.85 |
| HW | 7.41±0.14 | 7.45±0.09 | 7.43±1.21 | 0.83 |
| HL | 7.64±0.14 | 7.54±0.09 | 7.58±1.22 | 0.51 |
| HLL | 6.56±0.11 | 6.60±0.07 | 6.59±0.96 | 0.68 |
| FLL | 5.77±0.13 | 5.87±0.09 | 5.83±1.09 | 0.46 |
| No. | 113 | 197 | | |

***P-Value = probability value, BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length***

### 3.1.3 Correlation between body measurements of Guinea pigs from survey

The correlations coefficient between body weight and linear body measurements ranged from low (0.33) to high (0.87) are indicated in Table 3. The correlation was highly positive and significant ($p < 0.01$) between body measurements. The highest correlation figure was recorded between body weight and body length (0.87), hind leg length and fore leg length (0.87). The body weight and height-at-weigh had the second highest correlation figure (0.79). The least correlation value was found between heart-at-withers and fore leg length (0.33). There was no negative correlation among body measurements.

**TABLE 3**
**CORRELATION OF BODY WEIGHT AMONG LINEAR BODY MEASUREMENTS OF GUINEA PIGS FROM SURVEY**

| | BW | BL | HG | HW | HL | HLL | FLL |
|---|---|---|---|---|---|---|---|
| BW | - | | | | | | |
| BL | 0.87** | - | | | | | |
| HG | 0.64** | 0.66** | - | | | | |
| HW | 0.79** | 0.78** | 0.51** | - | | | |
| HL | 0.67** | 0.73** | 0.53** | 0.55** | - | | |
| HLL | 0.60** | 0.69** | 0.51** | 0.54** | 0.71** | - | |
| FLL | 0.45** | 0.59** | 0.49** | 0.33** | 0.67** | 0.87** | - |

***** Significant p < 0.01, BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length***

## 3.2 Field experiment results

### 3.2.1 Body weight and linear body measurement base on location (regions)

Mean body measurements for Guinea pigs based on location (region) are presented in Table 4. The location did not have effects on most of the body measurements of Guinea pigs. The Guinea pigs had similar values ($p > 0.05$) for all the body measurements except for hind leg length that had some differences ($p < 0.01$) and fore leg length was highly significant ($p < 0.01$).

**TABLE 4**
**EFFECTS OF LOCATION (REGIONS) ON BODY WEIGHT AND LINEAR BODY MEASUREMENTS OF GUINEA PIGS IN THE MIDDLE BELT OF GHANA**

| | BW | BL | HG | HW | HL | HLL | FLL |
|---|---|---|---|---|---|---|---|
| BW | - | | | | | | |
| BL | 0.87** | - | | | | | |
| HG | 0.64** | 0.66** | - | | | | |
| HW | 0.79** | 0.78** | 0.51** | - | | | |
| HL | 0.67** | 0.73** | 0.53** | 0.55** | - | | |
| HLL | 0.60** | 0.69** | 0.51** | 0.54** | 0.71** | - | |
| FLL | 0.45** | 0.59** | 0.49** | 0.33** | 0.67** | 0.87** | - |

***** Significant p < 0.01, BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length***

### 3.2.2 Body weight and linear body measurement base on sex

Table 5 shows the mean body measurements for Guinea pigs based on sexes. Both sexes had no effect (p > 0.05) on *BW, BL, HG, HW, HL, HLL* and *FLL*.

**TABLE 5**
**EFFECTS OF SEX ON BODY WEIGHT AND LINEAR BODY MEASUREMENTS OF GUINEA PIGS IN THE MIDDLE BELT OF GHANA**

| Variable | Sex | | Mean | *P value* |
|---|---|---|---|---|
| | Male | Female | | |
| BW | 272.18±17.19 | 264.34±10.98 | 267.54±62.10 | 0.65 |
| BL | 21.55±0.76 | 22.31±0.48 | 22.00±2.74 | 0.32 |
| HG | 16.91±0.66 | 17.66±0.42 | 17.35±2.37 | 0.26 |
| HW | 7.16±0.21 | 7.22±0.14 | 7.19±0.77 | 0.78 |
| HL | 7.23±0.19 | 7.08±0.13 | 7.14±0.71 | 0.45 |
| HLL | 6.48±0.24 | 6.36±0.15 | 6.41±0.86 | 0.62 |
| FLL | 6.21±0.28 | 6.29±0.18 | 6.26±1.01 | 0.74 |
| No. | 20 | 34 | | |

***P-Value = probability value, BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length***

### 3.2.3 Correlation between body measurements from field experiment

Table 6 to 9 showed the degree of correlation between body weight and linear body dimensions for the experimental animals in week; 0, 2, 4 and 8 respectively which ranged from low (0.33) to high (0.87). The correlation coefficients were positive and highly significant (p < 0.01: 0.05) between body measurements such as body length, heart girth, height-at-weight and head length. The body length highly correlated with heart girth (0.91) as in Table 7. The second high correlation was found between body length and heart girth (0.88) in Table 8. Body weight and fore leg length (0.21) had the least correlation value as indicated in Table 9. Tables 8 and 9 revealed that as Guinea pigs grow older their body weight became highly correlated with hind leg length The body weight did not correlate with fore leg length in the field experiment. There was no negative correlation among body measurements.

**TABLE 6**
**CORRELATION COEFFICIENTS BETWEEN BODY WEIGHT AND LINEAR BODY MEASUREMENTS IN WEEK 0**

| | BW | BL | HG | HW | HL | HLL | FLL |
|---|---|---|---|---|---|---|---|
| BW | - | | | | | | |
| BL | 0.84** | - | | | | | |
| HG | 0.78** | 0.76** | - | | | | |
| HW | 0.69** | 0.69** | 0.76** | - | | | |
| HL | 0.68** | 0.72** | 0.73** | 0.66** | - | | |
| HLL | 0.26 | 0.35* | 0.54** | 0.46** | 0.51** | - | |
| FLL | 0.23 | 0.32* | 0.51** | 0.39** | 0.51** | 0.83** | - |

***Significant (p < 0.05), ** significant (p < 0.01), BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length.***

**TABLE 7**
**CORRELATION COEFFICIENTS BETWEEN BODY WEIGHT AND LINEAR BODY MEASUREMENTS IN WEEK 2**

| | BW | BL | HG | HW | HL | HLL | FLL |
|---|---|---|---|---|---|---|---|
| **BW** | - | | | | | | |
| **BL** | 0.82** | - | | | | | |
| **HG** | 0.85** | 0.91** | - | | | | |
| **HW** | 0.68** | 0.56** | 0.67** | - | | | |
| **HL** | 0.67** | 0.59** | 0.62** | 0.66** | - | | |
| **HLL** | 0.26 | 0.30* | 0.35** | 0.46** | 0.51** | - | |
| **FLL** | 0.23 | 0.25 | 0.32* | 0.39** | 0.51** | 0.83** | - |

***Significant p < 0.05, **significant p < 0.01, BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length***

**TABLE 8**
**CORRELATION COEFFICIENTS BETWEEN BODY WEIGHT AND LINEAR BODY MEASUREMENTS IN WEEK 4**

| | BW | BL | HG | HW | HL | HLL | FLL |
|---|---|---|---|---|---|---|---|
| **BW** | - | | | | | | |
| **BL** | 0.75** | - | | | | | |
| **HG** | 0.83** | 0.88** | - | | | | |
| **HW** | 0.55** | 0.55** | 0.60** | - | | | |
| **HL** | 0.56** | 0.59** | 0.69** | 0.62** | - | | |
| **HLL** | 0.49** | 0.47** | 0.46** | 0.64** | 0.53** | - | |
| **FLL** | 0.25 | 0.42** | 0.35** | 0.57** | 0.49** | 0.81** | - |

***** Significant p < 0.01, BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length***

**TABLE 9**
**CORRELATION COEFFICIENTS BETWEEN BODY WEIGHT AND LINEAR BODY MEASUREMENTS IN WEEK 8**

| | BW | BL | HG | HW | HL | HLL | FLL |
|---|---|---|---|---|---|---|---|
| **BW** | - | | | | | | |
| **BL** | 0.71** | - | | | | | |
| **HG** | 0.81** | 0.79** | - | | | | |
| **HW** | 0.41** | 0.53** | 0.47** | - | | | |
| **HL** | 0.38** | 0.33* | 0.40** | 0.27* | - | | |
| **HLL** | 0.39** | 0.46** | 0.38** | 0.31* | 0.45** | - | |
| **FLL** | 0.21 | 0.32* | 0.22 | 0.26 | 0.32* | 0.82** | - |

***** Significant p < 0.05, ** significant p < 0.01, BW= body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length***

### 3.2.4 Prediction of body weight from linear body measurements using simple regression

Simple linear regression equation among body weight and linear body measurements (BW, BL, HG, HW, HL, HLL and FLL) of Guinea pigs were presented in week; 0, 2, 4 and 8 respectively were significant ($p < 0.05$) as found in Table 10. The study revealed that the best time to predict Cavies body weight was in week 2. The best predictor of body weight in Guinea pigs were body length (BL), heart girth (HG), height-at-withers (HW) and head length (HL) with $R^2$ of 0.80 which shows that there was 80% of variations in live body weight and linear body measurements of the experimental Guinea pigs. The highest coefficient of determination figure ($R^2 = 0.80$) was found in week 2 which recorded low value of Standard error of means (SEM = 28.93). There was 80% variations in body weight (BW) of Guinea pigs between BL, HG, HW, HL, HLL and FLL in week 2 of the experiment. Week 0, reveals second highest coefficient of determination value ($R^2 = 0.78$ or 78%, SEM = 31.02) which begun with high in magnitude and direction. But the strength in coefficient of determination started declining in week 4 ($R^2 = 0.76$ or 76%, SEM = 29.65) and week 8 ($R^2 = 0.68$ or 68%, SEM = 37.60) in direction of the predictive equation. The best predictive equation to determine live body weight in Guinea pigs was:

Y= -214.69+5.51BL+10.11HG+15.74HW+18.16HL-7.74HLL-5.34FLL

Where Y= live body weight (BW), BL= body length, HG= heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length and FLL= fore leg length respectively.

**TABLE 10**
**PREDICTION OF BODY WEIGHT FROM LINEAR BODY MEASUREMENTS USING SIMPLE REGRESSION**

| Week | Equation | SEM | $R^2$ | Sig |
|---|---|---|---|---|
| 0 | Y= -281.99+15.99BL+11.68HG+7.60HW+8.96HL-7.99HLL-9.01FLL | 31.02 | 0.78 | * |
| 2 | Y= -214.69+5.51BL+10.11HG+15.74HW+18.16HL-7.74HLL-5.34FLL | 28.93 | 0.8 | * |
| 4 | Y= -104.52+3.01BL+15.06HG+5.21HW-2.27HL+27.98HLL-25.99FLL | 29.65 | 0.76 | * |
| 8 | Y= -151.87+4.21BL+15.85HG+0.01HW+3.47HL+12.69HLL-8.74FLL | 37.6 | 0.68 | * |

****Significant p < 0.05, Y= live body weight, BL=body length, HG=heart girth, HW=height-at-weight, HL=head length, HLL=hind leg length, FLL=fore leg length, $R^2$ = Coefficient of determination, SEM=Standard error of mean***

## IV. DISCUSSION

### 4.1 Body measurements of Guinea pigs

The mean body weight of the adult Ghanaian local Guinea pigs established in the middle belt of Ghana was 405.19 g. The average body weights for males and females were 399.76 ± 17.97g and 408.43 ± 10.99 g respectively from the farmers. The finding agrees with Ayagirwe *et al.* (2019) who reported that adult average body weight of Guinea pig was 562.77 g and obviously females were heavier (600.50 g) than males (525.04 g). Also, Mwalukasa (2009) stated that the mean live weight of mature Guinea pig was 530.40 g, whereas adult body weight of male and female Cavies above 6 months of age from farmers were 571.3 g and 548.9 g in the Njombe district, Tanzania differs from the current result. According to Egena *et al.* (2010) who revealed that mean weight of adult male and female Guinea pigs were 454.00 ± 14.69 g and 436.67 ± 6.52 g in Nigeria. In the present results, the average body weight of the local Cavy that was three months old found in the field experiment was 267.54 g where the mean body weights for males and females were 272.18 ± 17.19 g and 264.34 ± 10.98 g respectively.

Abossede *et al.* (2019) observed that live weight of male and female Cavies were 310.19 ± 132.75 g and 285.54 ± 106.29 g respectively in the southern part of Benin. This partly agrees with the present findings from the field experiment.

The adult males and females have live body weight ranging from 900 - 1200 g and 700 - 900 g for the exotic breeds of Cavies (Quesenberry *et al.,* 2012). The variations in the current findings and previous reports on the average body weight of male Guinea pigs from farmers could be attributed to the fact that most of the females Cavies were matured. Husein (2015) stated that most of the males rabbit used in his study were growing ones. Average body length, heart girth, height-at-weight, head length, hind leg length and fore leg length from the survey result were 22.83 cm, 17.32 cm, 7.43 cm, 7.54 cm, 6.59 cm and 5.83 cm respectively. Similar survey on adult Guinea pigs conducted by Egena (2010) was 25.20 cm, 16.87 cm, 5.36 cm, 4.56 cm and 2.53 cm respectively except for the body length that scored high value, the rest of the results were lower than the current study. The present research confirms that, an average body length, heart girth, height-at-weight, head length, hind leg length and fore leg length on experimental animals have the following values; 22.00 cm, 17.35 cm, 7.19 cm, 7.14 cm, 6.41 cm and 6.26 cm respectively. Abossede *et al.* (2019) obtained 24.94 cm, 14.14 cm and 3.89 cm for head-body length, chest circumference and Left hind foot length (FL) respectively which is lower than present study except for head-body length. The variations may be due to genetic and environmental effects carried out by selective breeding on the animals (Ayagiwe *et al.,* 2015; Najat, 2019). Sex did not have any tremendous influence ($p > 0.05$) on both sexes for the body measurements from survey result. Body measurements of female Guinea pigs were 408.43 ± 10.99 g, 22.82± 0.26 cm, 17.34 ± 0.19 cm, 7.45 ± 0.09 cm, 7.54 ± 0.09 cm, 6.60 ± 0.07 cm and 5.87 ± 0.09cm for body weight, body length, heart girth, height-at-weight, head length, hind leg length and fore leg length respectively.

The finding disagrees with Egena *et al.* (2010) and Abossede *et al.* (2019) who sited that Cavies males were heavier in body weight and body measurements ($p < 0.05$) than females. Therefore the heavy males could be used to mate with females in the flock because of their size. In terms of experimental animals, the sexes had no significant effect ($p > 0.05$) on body measurements (*BW, BL, HG, HW, HL, HLL* and *FLL*). The present report indicated that female Guinea pigs were heavier in most of the morphometric traits; *BL, HG, HW* and *FLL* (22.31± 0.48 cm, 17.66 ± 0.42 cm, 7.22 ± 0.14 cm and 6.29 ± 0.18 cm) respectively than their male counterpart except *BW, HL* and *HLL* (272.18 ± 17.19 g, 7.23 ± 0.19 cm and 6.48 ± 0.24 cm). Moreover, Hagan *et al.* (2016) also indicated that male grasscutters were heavier in body weight and body measurements than females. The higher body weight observed in females than males can be ascribed to the fact that many of the females were mature (Husein, 2015). This implies that the body measurements could be used for sexual dimorphism in Guinea pigs. Effect of location (regions) had significant influence ($p < 0.01$) on body measurements such as body length, heart girth, head length, hind leg length and fore leg length of Guinea pigs except for body weight and height-at-withers ($p > 0.05$) that did not have influence on the location (regions) in the survey result. Bono region scored highest; 429.84 ± 23.35 g, 18.58 ± 0.39 cm and 7.71 ± 0.18 cm for BW, HG and HW. Among all the regions that the study took place, Ahafo region recorded highest morphometric readings; BL (23.67 ± 0.30), HL (8.08 ± 0.09 cm), HLL (6.95 ± 0.08 cm) and FLL (6.41 ± 0.08 cm). Bono East region of Ghana had the least morphometric measurements in terms of body weight (357.86± 35.57 g).

The location did not have effect ($p > 0.05$) on most of the body measurements of Guinea pigs except hind leg length and fore leg length that had significant effect ($p < 0.01$) on the experimental animals. Ashanti region obtained the highest recordings for BW (281.58 ± 22.17 g), BL (22.83 ± 0.99 cm) and HG (18.33 ± 0.83 cm). Phenotypic measurement in the Ahafo region scored the highest figure in HL (7.30 ± 0.15 cm). Height-at-weight had 7.28 ± 0.24 cm, hind leg length (6.80 ± 0.25 cm) and fore leg length (6.93 ± 0.24 cm) respectively were the greatest in the Bono region. Notwithstanding, the region that had the least body weight (253.80 ± 19.09 g) was seen in Bono region. Variations in body measurements in all the regions may be ascribed to genetic make-up and change in environmental factors such as management, nutrition, climatic condition of the animals (Ayagiwe *et al.*, 2015; Baffour-Awuah *et al.,* 2005; Beffa *et al.,* 2009).

Various colours categories did not have influence ($p > 0.05$) on body measurements (BW, BL, HG, HW, HL and FLL) of Guinea pigs except HLL and FLL which were significant ($p < 0.01$ and 0.05).

### 4.2 Phenotypic correlations among body measurements of Guinea pigs

Pearson correlation coefficient between phenotypic measurements are profound to know in the present study of the body traits which are good determinant to show the magnitude and direction that change in one trait could influence the other. Generally, in this study the phenotypic correlation figures were superior ($p < 0.01$: 0.05) between weight and linear body measurements and ranged from low (0.21) to high (0.91).

The highest correlation figure (0.87) was found among body weight and body length and also hind leg length and fore leg length. Similar results have been reported by Ayagirwe *et al.* (2018) who reported strong and significant correlations between weight and body measurements except between body length (BL) and head length (HL) for the two sexes. The least correlation value was found between heart-at-withers and fore leg length (0.33) in the survey result. The high positive correlation was observed between body length and heart girth (0.91) in the field experiment is in line with the result of Egena *et al.* (2010) and Egena (2010) who indicated that strong and positive correlation among body weight and body length, heart girth and trunk length shows that the breeders could use any of these morphometric traits to predict live body weight of Guinea pigs. There was no negative correlation among the body measurements. However, Hagan *et al.* (2016) stated in their report that there was positive and significant correlation between live weight and all the linear body measurements of grasscutter for all the sexes. This means breeders could easily use low and high correlation values of the morphological measurements to predict body traits. It was revealed that as Guinea pigs grow older, their body weight becomes highly correlated with hind leg length.

### 4.3 Prediction of body weight using Linear body measurements of Guinea pigs

Generally, in this study, simple linear regression equations were significant ($p < 0.05$) on body weight and morphometric traits (body length, heart girth, height-at-weight and head length) of Guinea pigs. The best time to predict cavies' body weight was in week 2. The best predictor of body weight in Guinea pigs were body length (BL), heart girth (HG), height-at-withers (HW) and head length (HL) with $R^2$ of 0.80 which shows that there was 80% of variations in live body weight and linear body measurements of the experimental Guinea pigs. Abossede *et al.* (2019) reported similar finding that the body weight was significantly influenced by head body length, chest circumference, neck circumference and head circumference which were used to predict live body weight on Guinea pigs. The implication is that, increment of 1 kg of live weight of the animal will appreciate 5.51 cm in body length, heart girth (10.11 cm), height-at-weight (15.74 cm) and head length (18.16 cm) respectively in Guinea pigs. Moreover, Egena (2010) made similar observation that the $R^2 = 0.84$ (84%) variations of post weaned Guinea pigs for 10 weeks old were the best fit for body weight between body length, trunk length and heart girth. Linear body measurements have been used to predict live weight of many livestock species including grasscutters (Annor *et al.*, 2011), rabbits (Husein, 2015), cattle (Maylinda *et al.*, 2017), pigeons (Najat, 2019) and goats (Ofori *et al.*, 2021). According to Birteeb (2012) and Maylinda *et al.* (2017) who pointed out that despite the use of conventional weighing scales, predictive equation have been very useful determinant of live body weight of livestock. This shows that, the use of regression equation in the linear body measurements have become more powerful solution to estimate live body weight on Guinea pigs. Hence the live body weight of Guinea pigs is profound to predict the growth rate and economic value in livestock that most producers and animal meat processors look up for (Husein, 2015; Najat, 2019).

## V. CONCLUSION

Basically indigenous Guinea pigs in the middle belt of Ghana were small in size with Ahafo region being superior in body weight and linear body measurements. Matured Guinea pigs had an average body weight of 405.19 g when they are about 90 days old and even more. The sexes did not have influence on Guinea pigs production. The body length highly correlated with heart girth (0.91), followed by body weight and body length; hind leg length and fore leg length (0.87). The least correlation value (0.21) was between body weight and fore leg length. The association between these body dimensions would be a good asset to estimate the carcass weight of the Guinea pigs in the middle belt of Ghana. Body length (BL), heart girth (HG), height-at-withers (HW) and head length (HL) were the best predictor of body weight in Guinea pigs. Predictive equation could be useful by farmers, researchers and animal processors to determine the body weight of Guinea pigs. Linear body measurements of Cavies could be used by breeders for breeding purposes to determine various body measurements in the areas where there is scarcity of weighing scale and tape measures.

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