# **Relationship Between Liveweight and Linear Body Measurements in Sheep and Goats in South-South Nigeria**

## **ABSTRACT**

*This study was conducted to establish the relationship between liveweight and linear body measurements in sheep and goats and to develop prediction models for estimating liveweight using these measurements. A total of 82 animals (47 goats and 35 sheep) aged between 2 and 36 months were randomly selected from different households and the University of Uyo Livestock Unit. The animals were subjected to the traditional grazing system, and linear body measurements such as body length, height at withers, heart girth, and neck circumference were taken. Linear regression models were estimated to predict liveweight using these measurements. The results showed a significant correlation between liveweight and various linear measurements, with heart girth, body length, and forelimb length being the most reliable predictors. Regression models developed for different age groups revealed high prediction accuracies, particularly in goats aged 16-22 months and sheep aged 2-8 months. the prediction model revealed that forelimb length, tail length and ear width were the variables responsible for 99.9% of the variation in body weight of sheep (R2=0.999). Significant positive correlations were found between body weight and neck length (r = 0.798, p < 0.05), neck circumference (r = 0.775, p < 0.05), body length (r = 0.823, p < 0.01), ear width (r = 0.759, p < 0.05), heart girth (r = 0.867, p < 0.01), and height at withers (r = 0.683, p < 0.05). The study concludes that in the absence of weighing scales, body measurements can serve as reliable alternatives for estimating liveweight in sheep and goats, particularly in rural areas where weighing scales are unavailable.*

### **Keywords:** Sheep, Goats, Liveweight, Linear Body Measurements, Regression Model

1. **INTRODUCTION**

According to Lawal-Adebowale (2012), Nigeria has goat population of 34.5 million and sheep population of 21.1 million. A large number of these goats are raised at subsistence level by resource poor farmers. According to Villers *et al*. (2009) income derived from goat/sheep products need to be managed properly because of their financial situation; these farmers are unable to procure weighing scale for determining the weight of their animals. As a result, farmers rely on estimation of live weights for various purposes including feeding, when to breed, determination of dosage of medications and vaccinations. Visual determination of the weight of animals is often faced by errors exacerbated by, among other things, using the same estimate for more than one breed of a particular species. Body structure can be deceptive when estimating weight (Otoikhian *et al*., 2008). The net result of reliance on estimated live weights is inefficiencies in both the management of animals and inconsistencies in prices of goats which all work against the farmer.

However, body weight record is not often available for those working with sheep and goat in small-scale farming sectors and in villages, due to non-availability of weighing balance/scale. Linear body measurements have been used to predict body weight in cattle, horse and goat (Ifut *et al*., 1991). In sheep, similar contributions have been made (Sowande and Sobola, 2008.; Kunene *et al*., 2009.; Oke and Obonnaya, 2011). Live weights and linear body measurements taken on live animals have been extensively used for diverse reasons both in experiments and in breeding and selection procedure (Cam *et al.*, 2000a). The accuracy of function used to predict live weight or growth characteristics from live animal measurement is of immense financial contribution to livestock production enterprise. When the producers and buyers of livestock are able to relate the live animal measurements to growth and optimum production and value-based trading system will be realized from accurate prediction. This will ensure that livestock farmers are adequately rewarded rather than the middle men and/or livestock product processors tend to gain more profit in livestock production business, especially in the rural areas of the developing countries (Afolayan *et al*., 2006.; Safu *et al.*, 2009).

Traditionally, animals are visually assessed, which is a subjective method of judgment (Abamikanna and Leigh, 2002). Hence, the development of objective means (Linear body measurement) for describing and evaluating body size and conformation characteristics would overcome many problems associated with visual evaluation. Therefore, this study was conducted to evaluate the relationship between liveweight and linear body measurements in sheep and goats and to develop prediction models for estimating liveweight using these measurements.

1. **MATERIALS AND METHODS**

**2.1 Study Area**

The study was carried out in two study locations in South- South tropical humid Nigeria. The study locations were University of Uyo Research Farm, Annex Campus, Uyo, and Ibesikpo Asutan Local Government Area of Akwa Ibom State, Nigeria. The state lies between latitude 04° 32' and 05° 33N and longitude 07° 25' and 08° 25'E characterized by a humid climate with a mean annual rainfall of 2115mm, binomial in nature, a mean monthly temperature of 27° and a mean relative humidity of 81.60% (range 62% to 88%).

**2.2 Experimental Animals**

A total of 82 animals, 47 goats and 35 sheep aged between 2 and 36 months were randomly selected for linear body and weight measurements from different households in Ibesikpo Asutan Local Government and from the Livestock Unit of the Department of Animal Science, University of Uyo, and used for the research. Ages of the animals were estimated using the animal's dentition (SASTRY and Thomas, 1980), in the absence of written records kept by the owners. The animals were then stratified into 2-8, 9-15, 16-22, 23-29, and 36-36-month age groups for analysis.

**2.3 Animal Management**

The animals were subjected to the traditional management grazing system which allowed them to move freely, graze at day time and recalled back at night to owner's care where they were provided with water and supplementary feed.

**2.4 Data Collection**

Linear body measurement and the body weight of the animals were taken at random. Each of the animals selected for measurement was restrained and calmed before measurements were taken on them to ensure that they were not unnecessarily stressed. Each dimension taken was recorded in centimeter (cm) while body weight was recorded in kilograms. Linear body measurements were determined using a tape rule as described by Scarle *et al*. (1989), while the live weight was measured with a weighing scale.

**2.5 Measurements Obtained (Linear Measurement)**

The Body Length (BL): The body lengths of the animals were taken by using measuring tape from the point of the shoulder to the pin bone.

Height at Withers (HAW): This is the distance from the surface of the platform to the wither of the animal.

Heart Girth (HG): Measured by taking the measurement of the circumference of the chest.

Neck length (NL): Taken as length of cervical region, from neck attachment with head to the neck attachment with body from lateral side.

Neck Width (NW): Measured from dorsal border to ventral border in the center of the neck.

Ear Length (EL): Distance between the tip of the ear and the point of attachment to the body

Ear Width (EW): Measured as the widest part in the center of the ear.

Tail Length (TL): Measured from the base to the tip of the tail and width as the widest part in the center of the tail.

**2.6 STATISTICAL ANALYSIS**

Linear regression models were estimated for different age groups of animals. These regression models were determined using stepwise multiple regression. In each case, an equation following the pattern,

$Yi=β\_{0}+β\_{1}X\_{1}+β\_{2}$×2

Whereas;

$Y\_{i}$=Body weight of animal in kg.

$β\_{0} = $Intercept of the best fit line.

β1, β2 = Partial regression co-efficient of body weight of different prediction variables.

$X\_{1}, $2$X\_{2}…….$ .Xn = the different predictor variables.

S.E = Standard error of estimate.

**3. RESULTS**

**3.1 Regression Coefficient**

Regression coefficient yields an estimate of the growth components of the animal. Using the prediction functions, positive regression coefficients show that an increase in the predictor variable leaves a corresponding increase in the body weight of the animal and vice versa as seen in Table 1 and 2.

**3.2 Regression Coefficient in Goats**

Table 1 shows the results of goats at different age groups (2-8, 9-15, 16-22, 23-29 and 30-36 months) respectively. In goats (2-8months old), the prediction model revealed that HG is the sole predictor variable, accounting for up to about 71% of the variation in body weight of this group of goats (R2=0.716). In goats (9-15/months old), the prediction model revealed that BL was the predictor variable with reasonable contribution to the variation in body weight. This model had a prediction accuracy of 87.06% arising from the R2 value of 0.8706.

**Table 1: Multiple Linear Regression coefficient of Goat Body Linear Measurements (cm)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| DependentVariable | IndependentVariables | Interceptb0 | RegressionCoefficient b1 | R2 | T | S.E.E. |
| Age 2-8 months |  |  |  |  |  |
| Bw | Hg | -18.497 | 0.555 | 0.716 | 4.598 | 0.577 |
|  |  |  |  |  | -3.571 |  |
| Age 9-15 months |  |  |  |  |  |
|  | BL | -23.417 | 0.833 |  | 3.900 |  |
|  |  |  |  |  | -2.775 |  |
| Age 16-22 months |  |  |  |  |  |
| Bw | F1 | -10.2 | 0.25 | 1.00 | - | - |
|  | Fc |  | 0.425 |  |  |  |
|  | Ew |  | 0.300 |  |  |  |
|  | Tc |  | 0.800 |  |  |  |
| Age 23-29 months |  |  |  |  |  |
| Bw | F1 | -45.46 | 4.461 | 82.2 | 5.685 |  |
|  | Hlm |  | 3.05 |  | -2.883 |  |
|  | T1 |  | 3.193 |  | 2.589 |  |
|  |  |  |  |  | -2.244 |  |
| Age 30-36 months |  |  |  |  |  |
| Bw | Fc | 11.804 | 0.695 | 1.00 | - | - |
|  | N1 |  | 0.593 |  |  |  |
|  | Nc |  | -0.295 |  |  |  |
|  | B1 |  | -0.499 |  |  |  |
|  | El |  | -1.878 |  |  |  |
|  | Ew |  | 1.267 |  |  |  |
|  | Flm |  | 1.247 |  |  |  |
|  | Hlm |  | 0.198 |  |  |  |
|  | H$g$ |  | -0.118 |  |  |  |
|  | Haw |  | -0.867 |  |  |  |
|  | Tc |  | 1.852 |  |  |  |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference

In goats (16-22 months old) the prediction model revealed that FL, FC, EW and TC were the predictor variables with reasonable contribution to the variation in body weight. This model had a perfect prediction accuracy of 1.0% avoiding any error arising from the R2 value of 1.00. In goats (23-29 months old), the prediction model revealed that FL, HLM and TL were the predictor variables with reasonable contribution to the variation in body weight. This model had a prediction accuracy of 82.20% arising from the R2 value of 0.822. And in Goats (30-36 months old), the prediction model revealed that FC, NL, NC, BL, EL, EW, FLM, HLM, HG, HAW, and TC were the predictor variables with reasonable contribution to the variation in body weight. This model had a perfect prediction accuracy of 100% with no error arising from the R2 value of 1.00.

**3.3 Regression Coefficient in Sheep**

**Table 2: Multiple Linear Regression coefficient of Sheep Body Linear Measurements (cm).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| DependentVariable | IndependentVariables  | Interceptb0 | RegressionCoefficient b1 | R2 | T | S.E.E. |
| Age 2-8 months |  |  |  |  |  |
| Bw | F1 | 3.483 | 0.432 | 0.999 | 64.608 |  |
|  | T1 |  | -0.118 |  | -14.797 |  |
|  | Ew |  | 0.335 |  | -3.571 |  |
|  |  |  |  |  | 9.026 |  |
| Age 9-15 months |  |  |  |  |  |
| Bw | F1 | 3.556 | 0.488 | 0.75 | 4.045 |  |
|  |  |  |  |  | -0.961 |  |
| Age 16-22 months |  |  |  |  |  |
| Bw | Haw  | -0.385 | 0.688 | 0.973 | 10.598 |  |
|  | Tc  |  | -1.791 |  | -7.422 |  |
|  |  |  |  |  | -0.107 |  |
| Age 23-29 months |  |  |  |  |  |
| Bw | Nc  | 1.585 | 0.705 | 0.901 | 6.802 |  |
|  |  |  |  |  | 0.514 |  |
| Age 30-36 months |  |  |  |  |  |
| Bw | F1 | -17.063 | 1.446 | 0.943 | 8.297 |  |
|  | Hg  |  | 0.284 |  | 4.712 |  |
|  |  |  |  |  | -3.842 |  |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference

Table 2 shows sheep of different age groups (2-8, 9-15, 16-22, 23-29 and 30-36 months) respectively. In sheep (2-8 months old), the prediction model revealed that FL, TL and EW were the variables responsible for 99.9% of the variation in body weight of this group of sheep (R2=0.999). In sheep aged between 9-15 months old, the prediction model revealed that only FL could predict reasonably the variation in body weight. The model had a prediction accuracy of 75.0% arising from the R2 value of 0.75. In sheep aged between 16-22 months old, the prediction model revealed that HAW and TC were the predictor variables with reasonable contribution to the variation in body weight. This model had a prediction accuracy of 97.3% arising from the R2 value of 0.973. In those between 23-29 months old of age, the prediction model revealed that NC is the sole predictor variable which could account for up to about 90.1% of the variation in body weight of this group of sheep (R2=0.901) while sheep aged between 30-36 months old revealed that FL and HG were the predictor variables with reasonable contribution to the variation in body weight with a prediction accuracy of 94.3% arising from the R2 value of 0.943.

**3.4 Correlation Analysis**

**3.4.1 Correlation Coefficients for Goats**

In young goats (2-8 months), body weight exhibited strong positive correlations with several linear body measurements. Specifically, significant positive correlations were found between body weight and neck length (NL, r = 0.798, p < 0.05), neck circumference (NC, r = 0.775, p < 0.05), body length (BL, r = 0.823, p < 0.01), ear width (EW, r = 0.759, p < 0.05), heart girth (HG, r = 0.867, p < 0.01), and height at withers (HAW, r = 0.683, p < 0.05). These findings suggest that in this age group, these linear measurements could be used to estimate body weight with reasonable accuracy.

As the goats matured (9-15 months), the pattern of correlations shifted. Significant positive correlations were observed between body weight and body length (BL, r = 0.783, p < 0.05), hind limb muscle (HLM, r = 0.732, p < 0.05), and height at withers (HAW, r = 0.731, p < 0.05). This indicates that different linear measurements may become more relevant predictors of body weight as the animals grow and develop.

Interestingly, in the 16-22 month age group, no significant correlations were found between body weight and any of the linear body measurements assessed. This could suggest a period of growth where body weight and linear proportions undergo less predictable changes.

In older goats (23-29 months), a significant positive correlation was observed between body weight and forelimb length (FL, r = 0.701, p < 0.05). This association persisted in the oldest age group (30-36 months), where body weight was also significantly and positively correlated with forelimb length (FL, r = 0.548, p < 0.05). This may indicate that forelimb length becomes a more reliable indicator of body weight in mature goats.

**3.4.2 Correlation Coefficients for Sheep**

Similar to goats, young sheep (2-8 months) exhibited strong positive correlations between body weight and several linear body measurements, including forelimb length (FL, r = 0.976, p < 0.01), neck circumference (NC, r = 0.872, p < 0.01), body length (BL, r = 0.844, p < 0.01), and heart girth (HG, r = 0.853, p < 0.01). These measurements appear to be good predictors of body weight in young sheep.

In the 9-15 month age group, body weight was positively correlated with forecannon circumference (FC, r = 0.896, p < 0.05), ear length (EL, r = 0.865, p < 0.05), hind limb muscle (HLM, r = 0.841, p < 0.05), and heart girth (HG, r = 0.840, p < 0.05). This suggests that as with goats, the key linear measurements associated with body weight can change with age.

For sheep aged 16-22 months, a significant positive correlation was found between body weight and height at withers (HAW, r = 0.828, p < 0.05). In the 23-29 month age group, body weight was strongly and positively correlated with neck circumference (NC, r = 0.959, p < 0.01).

Mature sheep (30-36 months) showed significant positive correlations between body weight and a wider range of linear measurements, including forelimb length (FL, r = 0.904, p < 0.01), forelimb muscle (FLM, r = 0.786, p < 0.05), neck circumference (NC, r = 0.873, p < 0.01), body length (BL, r = 0.862, p < 0.01), hind limb muscle (HLM, r = 0.861, p < 0.01), and heart girth (HG, r = 0.723, p < 0.05).

Table 3: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf goats for aged 2 – 8 months

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.404  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.330  | 0.458  | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | 0.798 \*\* | 0.496  | 0.058  | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | 0.775\* | 0.321 | -0.034  | 0.904\*\* | 1 |  |  |  |  |  |  |  |  |  |
| BL | 0.823\*\* | 0.228 | - 0.068  | 0.787\* | 0.841\*  | 1 |  |  |  |  |  |  |  |  |
| EL | 0.067  | -0.433  | - 0.353  | 0.109  | 0.276  | 0.117 | 1 |  |  |  |  |  |  |  |
| EW | 0.759\* | 0.067  | 0.581  | 0.390  | 0.398  | 0.392  | 0.259  | 1 |  |  |  |  |  |  |
| FLM | 0.662  | 0.143  | - 0.154  | 0.867\*\*  | 0.930\* | 0.792\* | 0.464  | 0.391  | 1 |  |  |  |  |  |
| HLM | 0.380  | -0.209 | - 0.140  | 0.493  | 0.515  | 0.307  | 0.843\*\* | 0.524  | 0.718\*  | 1 |  |  |  |  |
| HG | 0.867 \*\* | 0.296  | 0.277  | 0.624  | 0.742\* | 0.685\*  | - 0.057  | 0.646  | 0.531 | 0.175  | 1 |  |  |  |
| HAW | 0.683\* | 0.268  | 0.087  | 0.783\*  | 0.635  | 0.406  | 0.289  | 0.590  | 0.672\* | 0.700\* | 0.563 | 1 |  |  |
| TL | 0.309  | 0.707\*  | - 0.021  | 0.600  | 0.449  | 0.514  | - 0.099  | - 0.169  | 0.452 | 0.036  | 0.017 | 0.135 | 1 |  |
| TC | 0.550 | 0.000 | 0.046  | 0.286 | 0.295 | 0.422 | 0.546 | 0.679\* | 0.434 | 0.630 | 0.298 | 0.432 | 0.310 | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

**Table 4: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf goats for aged 9-15 months.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.095 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.276 | -0.453 | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | -0.127 | -0.516 | 0.809\* | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | -0.062 | -0.613 | 0.755\* | 0.759 | 1 |  |  |  |  |  |  |  |  |  |
| BL | 0.783 | 0.098 | 0.459 | 0.000 | 0.036 | 1 |  |  |  |  |  |  |  |  |
| EL | 0.485 | -0.592 | 0.703 | 0.417 | 0.732\* | 0.552 | 1 |  |  |  |  |  |  |  |
| EW | 0.659 | -0.488 | 0.357 | 0.000 | 0.108 | 0.714 | 0.709 | 1 |  |  |  |  |  |  |
| FLM | -0.053 | 0.267 | -0.745\* | 0.850\* | -0.824\* | -0.115 | -0.469 | 0.115 | 1 |  |  |  |  |  |
| HLM | -0.732 | 0.275 | -0.222 | 0.000 | -0.083 | -0.329 | -0.544 | -0.621 | -0.041 | 1 |  |  |  |  |
| HG | -0.535 | 0.532 | -0.357 | -0.098 | -0.437 | -0.334 | -0.838\* | -0.704 | 0.089 | 0.844\* | 1 |  |  |  |
| HAW | -0.731 | 0.516 | -0.472 | -0.125 | -0.285 | -0.661 | -0.834\* | -0.945\* | 0.061 | 0.798 | 0.870\* | 1 |  |  |
| TL | -0.647 | 0.067 | 0.035 | 0.258 | 0.515 | -0.488 | -0.054 | -0.683 | -0.455 | 0.574 | 0.253 | 0.581 | 1 |  |
| TC | -0.535 | -0.150 | 0.351 | 0.384 | 0.489 | -0.277 | 0.128 | -0.515 | -0.320 | 0.426 | 0.103 | 0.310 | 0.573 | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

**Table 5: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf goats for aged 16-22 months.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.550 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.418 | 0.608 | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | 0.492 | -0.131 | -0.463 | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | -0.273 | -0.146 | -0.514 | -0.139 | 1 |  |  |  |  |  |  |  |  |  |
| BL | -0.372 | 0.099 | 0.350 | -0.756 | 0.419 | 1 |  |  |  |  |  |  |  |  |
| EL | -0.290 | 0.186 | 0.655 | -0.707 | -0.588 | 0.267 | 1 |  |  |  |  |  |  |  |
| EW | -0.492 | -0.657 | -0.463 | -0.250 | 0.347 | -0.094 | 0.000 | 1 |  |  |  |  |  |  |
| FLM | 0.467 | -0.415 | -0.293 | 0.791 | -0.307 | -0.777 | -0.447 | 0.153 | 1 |  |  |  |  |  |
| HLM | 0.549 | 0.045 | 0.159 | 0.686 | -0.523 | -0.324 | -0.243 | -0.686 | 0.542 | 1 |  |  |  |  |
| HG | -0.246 | -0.722 | -0.694 | 0.250 | 0.693 | 0.094 | -0.707 | 0.500 | 0.316 | -0.086 | 1 |  |  |  |
| HAW | -0.127 | 0.631 | 0.318 | -0.686 | 0.452 | 0.616 | 0.243 | -0.086 | -0.868 | -0.647 | -0.300 | 1 |  |  |
| TL | 0.290 | -0.186 | -0.655 | 0.707 | 0.588 | -0.267 | -1.000 | 0.000 | 0.447 | 0.243 | 0.707 | -0.243 | 1 |  |
| TC | 0.492 | -0.131 | -0.463 | 1.000 | -0.139 | -0.756 | -0.707 | -0.250 | 0.791 | 0.686 | 0.250 | -0.686 | 0.797 | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

**Table 6: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf goats for aged 23-29 months.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.701 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.185 | 0.410 | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | -0.470 | -0.150 | -0.369 | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | -0.068 | -0.200 | 0.795\* | 0.555 | 1 |  |  |  |  |  |  |  |  |  |
| BL | 0.539 | 0.796\* | 0.411 | -0.319 | -0.487 | 1 |  |  |  |  |  |  |  |  |
| EL | -0.408 | 0.079 | 0.400 | 0.272 | -0.150 | -0.024 | 1 |  |  |  |  |  |  |  |
| EW | -0.291 | -0.017 | 0.187 | 0.297 | 0.226 | -0.151 | 0.405 | 1 |  |  |  |  |  |  |
| FLM | 0.105 | 0.393 | 0.285 | -0.226 | -0.309 | 0.701 | 0.386 | 0.272 | 1 |  |  |  |  |  |
| HLM | -0.341 | 0.218 | 0.475 | 0.036 | -0.329 | 0.281 | 0.886\* | 0.383 | 0.629 | 1 |  |  |  |  |
| HG | -0.485 | -0.268 | -0.028 | 0.308 | 0.425 | -0.577 | 0.532 | 0.742 | 0.087 | 0.375 | 1 |  |  |  |
| HAW | -0.253 | -0.347 | 0.087 | -0.286 | -0.158 | -0.090 | -0.117 | -0.047 | 0.198 | -0.103 | 0.375 | 1 |  |  |
| TL | -0.228 | -0.762 | -0.087 | -0.138 | 0.014 | -0.499 | -0.218 | 0.048 | 0.181 | -0.317 | -0.103 | 0.280 | 1 |  |
| TC | -0.372 | 0.060 | 0.523 | 0.000 | -0.385 | 0.073 | 0.764 | 0.071 | 0.238 | 0.821 | -0.317 | -0.089 | -0.167 | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 7: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf goats for aged 30-36 months

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.548\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.474 | 0.864\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | 0.074 | 0.104 | 0.123 | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | 0.304 | 0.237 | 0.094 | 0.482 | 1 |  |  |  |  |  |  |  |  |  |
| BL | 0.450 | 0.685\*\* | 0.697\*\* | 0.313 | 0.210 | 1 |  |  |  |  |  |  |  |  |
| EL | -0.234 | 0.152 | -0.085 | -0.254 | -0.244 | -0.218 | 1 |  |  |  |  |  |  |  |
| EW | -0.068 | 0.093 | -0.130 | -0.070 | -0.053 | -0.346 | 0.872\*\* | 1 |  |  |  |  |  |  |
| FLM | 0.507 | 0.383 | 0.268 | 0.060 | 0.559\* | 0.427 | 0.053 | 0.043 | 1 |  |  |  |  |  |
| HLM | -0.012 | 0.175 | 0.110 | 0.198 | 0.268 | -0.117 | 0.411 | 0.471 | 0.375 | 1 |  |  |  |  |
| HG | 0.038 | 0.433 | 0.256 | 0.180 | 0.235 | 0.252 | 0.174 | 0.077 | 0.465 | 0.351 | 1 |  |  |  |
| HAW | 0.168 | 0.506 | 0.575\* | 0.032 | 0.151 | 0.183 | 0.093 | 0.043 | 0.477 | 0.630\* | 0.693\*\* | 1 |  |  |
| TL | 0.073 | 0.406 | 0.369 | 0.128 | 0.097 | 0.368 | 0.019 | -0.228 | 0.471 | 0.344 | 0.845\*\* | 0.795\*\* | 1 |  |
| TC | 0.417 | 0.556\* | 0.415 | 0.257 | 0.071 | 0.472 | 0.274 | 0.125 | 0.495 | 0.334 | 0.643\* | 0.540\* | 0.730\*\* | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 8: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf sheep for aged 2-8 months

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW |  1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL |  0.976\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.751 | 0.786\* | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | 0.906\*\* |  0.961\*\* | 0.961\*\* | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | 0.872\* | 0.874\* | 0.817\* | 0.776\* | 1 |  |  |  |  |  |  |  |  |  |
| BL | 0.844\* | 0.738 | 0.335 | 0.683 | 0.556 | 1 |  |  |  |  |  |  |  |  |
| EL | 0.741 | 0.764\* | 0.396 | 0.851\* | 0.514 | 0.678 | 1 |  |  |  |  |  |  |  |
| EW | -0.438 | -0.325 | -0.582 | -0.200 | -0.375 | -0.371 | -0.286 | 1 |  |  |  |  |  |  |
| FLM | 0.459 | 0.282 | 0.120 | 0.151 | 0.351 | 0.689 | 0.369 | -0.576 | 1 |  |  |  |  |  |
| HLM | 0.694 | 0.538 | 0.276 | 0.453 | 0.381 | 0.925\*\* | 0.517 | -0.600 | 0.773\* | 1 |  |  |  |  |
| HG | 0.853\* | 0.841\* | 0.953\*\* | 0.725 | 0.891\* | 0.523 | 0.504 | -0.686 | 0.329 | 0.482 | 1 |  |  |  |
| HAW | I 0.199 | -0.010 | -0217 | -0.075 | 0.052 | 0.589 | 0.097 | -0.443 | 0.803\* | 0.759\* | 0.055 | 1 |  |  |
| TL | -0.611 | -0.427 | -0.197 | -0.287 | -0.478 | -0.839\* | -0.296 | 0.493 | -0.886\*\* | -0.887\*\* | -0.428 | -0.854\* | 1 |  |
| TC | -0.079 | 0.049 | 0.198 | -0.004 | 0.302 | -0.430 | -0.277 | 0.495 | -0.384 | -0.665 | 0.030 | -0.646 | 0.3861 | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 9: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf sheep for aged 9-15 months

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.594 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.896\* | 0.714 | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | 0.811 | 0.861\* | 0.952\*\* | -1 |  |  |  |  |  |  |  |  |  |  |
| NC | 0.646 | 0.179 | 0.570 | 0.363 | 1 |  |  |  |  |  |  |  |  |  |
| BL | 0.515 | 0.690 | 0.342 | 0.475 | 0.255 | 1 |  |  |  |  |  |  |  |  |
| EL | -0.865\* | -0.657 | -0.978\*\* | 0.888\* | -0.680 | -0.263 | 1 |  |  |  |  |  |  |  |
| EW | -0.566 | -0.369 | -0.686 | -0.682 | -0.443 | -0.299 | 0.614 | 1 |  |  |  |  |  |  |
| FLM | 0.800 | 0.591 | 0.927\*\* | 0.809 | 0.674 | 0.132 | 0.980\*\* | -0.469 | 1 |  |  |  |  |  |
| HLM | 0.841\* | 0.332 | 0.850\* | 0.664 | 0.877\* | 0.166 | -0.903\* | -0.649 | 0.880\* | 1 |  |  |  |  |
| HG | 0.840\* | 0.903\* | 0.937\*\* | 0.969\*\* | 0.498 | 0.583 | -0.906\* | -0.597 | 0.841\* | 0.700 | 1 |  |  |  |
| HAW | 0.539 | 0.282 | 0.646 | 0.449 | 0.823\* | -0.066 | -0.791 | -0.244 | 0.868\* | 0.822\* | 0.553 | 1 |  |  |
| TL | 0.470 | 0.600 | 0.609 | 0.536 | 0.662 | 0.226 | -0.733 | -0.121 | 0.797 | 0.607 | 0.684 | 0.878\* | 1 |  |
| TC | -0.245 | 0.172 | 0.143 | 0.137 | 0.179 | -0.345 | -0.263 | -0.092 | 0.341 | 0.142 | 0.164 | 0.531 | 0.6001 | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 10: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf sheep for aged 16-22 months

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.111 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.193 | 0.112 | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | 0.608 | 0.176 | 0.804 | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | -0.241 | -0.677 | -0.059 | 0.051 | 1 |  |  |  |  |  |  |  |  |  |
| BL | 0.787 | 0.662 | 0.058 | 0.485 | -0.525 | 1 |  |  |  |  |  |  |  |  |
| EL | 0.352 | 0.772 | -0.071 | 0.026 | 0.928\*\* | 0.730 | 1 |  |  |  |  |  |  |  |
| EW | -0.140 | 0.174 | -0.359 | -0.561 | -0.736 | 0.022 | 0.645 | 1 |  |  |  |  |  |  |
| FLM | 0.617 | 0.008 | 0.781 | 0.748 | -0.332 | 0.341 | 0.235 | 0.004 | 1 |  |  |  |  |  |
| HLM | 0.797 | -0.119 | 0.676 | 0.841\* | -0.076 | 0.432 | 0.064 | -0.269 | 0.921\*\* | 1 |  |  |  |  |
| HG | 0.564 | -0.105 | -0.413 | 0.088 | 0.334 | 0.420 | -0.149 | -0.465 | -0.233 | 0.131 | 1 |  |  |  |
| HAW | 0.828\* | 0.054 | 0.108 | 0.392 | -0.125 | 0.567 | 0.116 | -0.289 | 0.374 | 0.580 | 0.708 | 1 |  |  |
| TL | -0.057 | 0.446 | 0.393 | -0.027 | -0.753 | 0.056 | 0.476 | 0.466 | 0.374 | 0.067 | -0.535 | 0.1061 |  |  |
| TC | -0.612 | -0.073 | -0.057 | -0.368 | 0.352 | -0.574 | -0.530 | -0.342 | -0.540 | -0.545 | 0.000 | -0.082 | 0.186 | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 11: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf sheep for aged 23-29 months

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.710 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.663 | 0.332 | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | 0.000 | 0.101 | 0.120 | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | 0.959\*\* | 0.696 | 0.690 | 0.064 | 1 |  |  |  |  |  |  |  |  |  |
| BL | -0.627 | -0.616 | -0.438 | -0.765 | -0.645 | 1 |  |  |  |  |  |  |  |  |
| EL | -0.367 | -0.616 | -0.146 | -0.789 | -0.330 | 0.899\* | 1 |  |  |  |  |  |  |  |
| EW | 0.068 | -0.070 | 0.083 | -0.916\* | 0.110 | 0.679 | 0.828\* | 1 |  |  |  |  |  |  |
| FLM |  0.420 | 0.759 | 0.334 | -0.164 | 0.549 | -0.206 | -0.129 | 0.379 | 1 |  |  |  |  |  |
| HLM |  0.210 | 0.759 | -0.129 | -0.273 | 0.137 | -0.051 | -0.283 | 0.152 | 0.647 | 1 |  |  |  |  |
| HG | -0.530 | -0.822\* | -0.130 | -0.460 | -0.433 | 0.779 | 0.909\* | 0.574 | -0.297 | -0.594 | 1 |  |  |  |
| HAW |  0.578 | 0.752 | 0.170 | -0.578 | 0.510 | 0.000 | 0.000 | 0.525 | 0.699 | 0.816\* | -0.392 | 1 |  |  |
| TL | 0.736 | 0.439 | 0.333 | -0.663 | 0.638 | 0.042 | 0.229 | 0.613 | 0.333 | 0.333 | -0.120 | 0.801 | 1 |  |
| TC | 0.733 | 0.366 | 0.252 | -0.610 | 0.637 | 0.009 | 0.217 | 0.550 | 0.219 | 0.219 | -0.100 | 0.708 | 0.980\*\* | 1 |

**BW:** Body Weight, **FL:** Forelimb Length, **FC:** Forecannon Circumference, **NL:** Neck Length, **NC:** Neck Circumference, **BL:** Body Length, **EL:** Ear Length, **EW:** Ear Width, **FLM:** Forelimb Muscle, **HLM:** Hind Limb Muscle, **HG:** Heart Girth, **HAW:** Height at Withers, **TL:** Tail Length, **TC:** Tail Circumference, \*. Correlation is significant at the 0.05 level (2-tailed), \*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 12: Correlation coefficient between body weight (kg) and linear body measurements (cm) in West African Dwarf sheep for aged 30-36 months

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BW | FL | FC | NL | NC | BL | EL | EW | FLM | HLM | HG | HAW | TL | TC |
| BW | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FL | 0.904\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| FC | 0.586 | 0.451 | 1 |  |  |  |  |  |  |  |  |  |  |  |
| NL | 0.559 | 0.590 | 0.501 | 1 |  |  |  |  |  |  |  |  |  |  |
| NC | 0.873 | 0.953\*\* | 0.402 | 0.328 | 1 |  |  |  |  |  |  |  |  |  |
| BL | 0.862\*\* | 0.685\* | 0.360 | 0.255 | 0.720\* | 1 |  |  |  |  |  |  |  |  |
| EL | -0.023 | -0.144 | -0.083 | 0.540 | -0.367 | -0.164 | 1 |  |  |  |  |  |  |  |
| EW | 0.440 | 0.438 | 0.520 | 0.360 | 0.378 | 0.208 | -0.175 | 1 |  |  |  |  |  |  |
| FLM |  0.786\*\* | 0.538 | 0.876\*\* | 0.406 | 0.542 | 0.683\* | -0.058 | 0.388 | 1 |  |  |  |  |  |
| HLM |  0.861\*\* | 0.644\* | 0.677\* | 0.483 | 0.626 | 0.855\*\* | 0.028 | 0.182 | 0.891\*\* | 1 |  |  |  |  |
| HG | 0.723\* | 0.427 | 0.519 | 0.319 | 0.417 | 0.892\*\* | 0.033 | 0.138 | 0.789\*\* | 0.910\*\* | 1 |  |  |  |
| HAW | W 0.000 | -0.050 | 0.661\* | 0.275 | -0.140 | -0.169 | 0.054 | 0.231 | 0.379 | 0.076 | 0.057 | 1 |  |  |
| TL | 0.353 | 0.361 | 0.801\*\* | 0.642\* | 0.203 | 0.083 | 0.035 | 0.723\* | 0.493 | 0.315 | 0.218 | 0.685\* | 1 |  |
| TC | -0.369 | -0.348 | -0.003 | 0.469 | -0.605 | -0.483 | 0.650\* | 0.071 | -0.264 | -0.334 | -0.231 | 0.476 | 0.411 | 1 |

**4. DISCUSSION**

According to Mayaka *et al.*, (1995), animal live body weight is an important feature, but can seldom be measured in rural areas due to lack of reasonable accurate scales. Hence, farmers have to rely on questionable estimates of the body weights of their sheep and/or goats, leading to inaccuracies in decision making. The primary method of weighing animals without scale is to regress body weight to body characteristics, which can be measured readily. Body measurements have been used to predict body weight by several authors in many breeds of sheep and goats (Aziz and Sharaby, 1993; Enevoldsen and Kristensen,1997; Atta and El Khidir, 2004; Riva *et al.*, 2004; Afolayan *et al.*, 2006; Sowande and Sobola, 2007; Iqbal ,2010). They reported that different models might be needed to predict body weight in different environmental conditions and breeds. This is evident in this research. Also, this result showed that the body weight and height at withers of the farm animals were found to increase significantly with age. Younas *et al.* (2013) showed that animals ranging from day 2nd to 15th months of age have more potential to grow physically making it possible for a few major body measurements like body length, height at withers, fore limbs and heart girth to have profound role in early stages of anima's life cycle and so comfortably predict their live weight. This corroborates the findings of this research. There is an increasing complexity in predicting the weight of goats aged 16-36months.

This was also observed by earlier researchers (Sowande and Sobola, 2008). The complexity arises in that, more parameters have been fitted into the models in order to predict live weight of animals in this group. For instance, in goats of 30-36 months, 12 parameters have been retained in the equation. This is not so with the sheep. In sheep, the prediction equation has retained only five parameters in the older animals (16-36/months). These parameters include: Forelimbs, Height at Withers, Tail circumference, Neck circumference and Heart girth. These confirm the reports of Atta and El Khidir, 2004; Riva *et al.*, 2004. Correlation analyses between body weights of animals with other linear measurements have yielded significantly high and, in most cases, positive coefficients. This is not unprecedented as it was also observed by other researchers (Riva *et al.*, 2004, Tadessel and Gebremariam 2010). This pattern of association might be interpreted to mean that both parameters vary together (i.e an increase in one lead to a corresponding increase in the other). This is in tandem with the views of Tadessel and Gebremariam (2010).Tadessel and Gebremariam (2010) in a related study opined that the higher the correlation coefficient of body weight with a given linear body measurement demonstrates that on the basis of the dimension of that body measurements, the body weight could be predicted most accurately. The current result agrees with this observation in that live weight of sheep and goats in most groups are predicted by a singular body linear measurement which correlated highly and significantly with the predicted variable.

## **5. CONCLUSION**

Linear body measurements can be effectively used to estimate liveweight in sheep and goats, providing a practical alternative to weighing scales in rural areas. Heart girth, body length, and forelimb length were the most reliable predictors, with high accuracy across various age groups.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Authors hereby declare that NO generative AI technologies such as Large Lnaguage Models (ChatGPT, COPILOT, etc) and text – to – image generators have been used during the writing or editing of this manuscript.

**COMPETING INTEREST**

Authors have declared that there is no competing interest among the authors.

**References**

Abanikannda, O. T. F. and Leigh, A. O. (2002). Comparative (visual and condition) scoring of zebu catle in Lagos state. Proceedings of 7th SAnnual -354.

Afolayan, R. A., Adeyinka, I. A. and Lakpini, C. A. (2006). The estimation of liveweight from body measurements in Yankasa sheep. Czech *Journal* of *Animal Science* 51*:*343-348.

Atta, M. and O. A. El Khidir (2004). Use of heart girth, withers height and scapula-ischial length for prediction of liveweight of Nilotic sheep. *Small Ruminant Research*,55:233-237.

Cam, M., Olfaz A. and Soydan E. (2010). Body Measurements reflect body weights and carcass yields in Karayaka sheep. *Asian Journal of Animal and Veterinary Advances*,5:120-127.

Ifut O. J., Essien A. L. and Udo D. E. (1991). The conformation characteristics of indigenous goats reared in southeastern tropical humid Nigeria. *Beitr.Tropical Land wirtsch veterinary medicine,* 20:215-222.

Iqbal, Z. M. (2010). Evaluation of three Pakistani sheep bricks for their national resistance to artificial infection of *Haemonchus* *controtus*. *Veterinary* *Parasitology*, 168 (1-2): 1415-

Kunene, N. W, Nesanvuni, A. E. and Nsahlai, I. V., (2009). Determination of prediction equation for estimating body weight of zulu (Nguni) sheep. *Small Ruminant Research*, 84,41-46.

Lawal-Adebowale, O. A. (2012). Factors Influencing Small Ruminant Production in Selected Urban Communities of Abeokuta, Ogun State. *Nigerian* *Journal of Animal Production,* 39(1): 218-228.

Oke, U. K. and Ogbonnaya E. O. (2011). Application of physical body traits in tropical environment. *Livestock Research for Rural Development*, 23.

Otoikhian C. S. (2008). Goat management systems in Nigeria sub-tropical environment. Book of Abstract 2nd International post graduate course in Ruminant Meat production and management. *Heb University of Jerusalem. Faculty of Agriculture Rehovot, Israel.*

Riva, J., Rizzi, R.,Marelli, S. and Cavalchini, L. G. (2004). Body measurements in Bergamasco sheep. *Small Ruminant Research*, 55:221-227.

Safu, K., S. O. Apori, A. Elijah-Mensah and K. Oppong-Asane, (2009). Livestock entrepreneurs from Northern Ghana: Their motivations and challenges.of African Business and Development, May 19-23,2009, Kampala, Uganda, 171-179.

SAS Institute Inc. (2001) Statistical Analysis Software. SAS Institute Inc., Cary, NC, USA.

Sastry S. R. and Thomas C. K., (1980). Dentition in farm animal management in:39-45.

Scarle,T. W., Mccgraham, N., Donnelly J. B. and Makgan, D. E. (1989). Breed and of Agricultural science 113:349-354.

Sowande and Sobola O. (2008). Body measurements of West African Dwarf sheep as parameters for estimation of live weight. *Tropical Animal Health and Production*, 40,433-439.