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Body measurement parameters as a function of assessing body weight in goats under on-farm research environment

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ABSTRACT: Body measurement parameters were stepwisely regressed on the body weight of goats in a controlled environment. The results revealed a positive relationship between parameters such as ear length and weight; tail length; distance between eyes and body weight in goats. From the results body weight of goats can be assessed up to 74.29 percent by regressing distance between eyes, tail length and age of the animal on its body weight without the farmer having to contend with the difficult process of weighing the animal.

Key Words: Body weights; Body measurements; Goats; Regression analysis.

Introduction

There is often a great need for livestock herdsmen to know how much their animals weigh. Possible reasons overtime for this may include, management decision such as how much to feed, when to breed, determination of dosages of various medications and vaccines and most important is when to market either as weaner, growers or for slaughter. Probably, for now the most used or easiest as the local farmers may classify it and most scientifically in-accurate method of weight determination is visual appraisal. This skill is developed through practice by estimating the weight of numerous animals without a board or Weigh band (Singh, *et al*, 1990).

Visual determination of the weight of animals is often faced by errors like using the same estimate for more than one breed of a particular species. Body structure can be deceptive when estimating weight (Slippers *et al*, 2000; Steele, 1996). For instance, Red Sokoto goats appear lighter than they actually are because of their light bones. Apart from bones and body structure problem in estimating weight, a white animal always looks bigger than it is. Reasonable skill in estimating weight is therefore necessary for the stockman as it will frequently be necessary to know weights when a weighbridge is not readily available or its use is not practically feasible (Singh and Mishra, 2004). Studies regarding the linear body measurements of various animals have been carried out in some regions of the World and their possible use for estimating the animal's live weight has not be adopted by farmers in the tropics Janssens and Vandepitte, (2004) (Sheep); Touchberry and Lush, (2007) (Dairy Cattle) and Otoikhian and Imasuen, (2005) (Goats).

This study therefore was developed to establish the relationship between live-weight and some body measurements parameters such as distance between eyes, ear length, ear width and Tail length as well as age of the animals in goats.

The objectives of this study include the following: (i) To develop a database for estimating the body weight of goats from body measurements, (ii) To evaluate the effect of sex on the body weight and body measurement in goats, (iii) To determine the relationship between body weight and body measurement in goats.

Experimental Site: The experiment was carried out in a reputable private goat ranch located at Afuze-Emai, Owan East Local Government area of Edo State, Nigeria. The Vegetation map of the area shows that the area occupies a transitional zone between the Savannah and the low land rain forest zones with optimum temperature of 32°C in peak dry season with an annual rainfall ranging from 2,000 – 4,000mm in mid raining season (Otoikhian, 2005; Otoikhian, et al, 2006).

Experimental Animals: One hundred West African Dwarf goats of both sexes with varied ages were sourced directly from the local farmers in preference to buying from the open market because of the low input nature of traditional production system of small ruminants, which ensures that only sick or problematic animals are taken to the market.

Management of Experimental Animals: All animals were managed under a system that seems exactly like their original habitat under a semi-intensive management system. On arrival the animal were given anti-stress to reduce fatigue and possible losses as a result of stress. Animals were let out to graze freely on the padlock during the day and 5.00pm where their feeding was supplemented with whole maize and dry grass forage consisting of dried-dropped *Panicum maximum*, *Gliricidia sepium* and groundnut leaves and stalk as supplement feed to make up for their nutrient requirement. Fresh water was given *ad-libitum*. These lasted for twelve weeks after which the various measurements were taken.

Parameters Measured: The parameters measured includes, Age of the animal, Tail length (The distance of the tail measured in cm from attachment of the tail to the body up to the tip), Distance between eyes (The length in cm between the two eyes across the nose of the animals), Ear Length (Distance between the tip of the ear and the point of attachment to the head), Ear width (The distance between the two sides of the ear at the middle) and sex of the animals were assessed.

Procedure for Data Collection: A flexible tape rule was used to take measurements of tail length, ear length and width while a pair of divider was used to measure the distance between the two eyes and then determined by a wooden ruler. All parameters were estimated when the animal was restrained by holding. Body weight was obtained by a weighing scale.

Statistical analysis and experimental design: Data collected were subjected to various statistical tools in a one-way analysis of variance and then stepwise regression analysis and correlation using SAS (1999) software to compare the relationship among parameters assessed.

Results

In the present study, age is seen to have effect on body measurement parameters in goat as shown in Table 1. The body parameters measured: Distance between eyes (DBE), Ear length (EL), Ear-width (EW), increased progressively as goat increases in age. This growth rate however reduces with a slight decrease between 1½-2 years, when there seems to be a slow increase in body size, though not statistically different from growth rate in the preceding age groups. The rate of goat growth increases rapidly again between 2-2½ years measuring up to full maturity. Growth rate of the DBE, EL and EW, though increase with increasing age of goat, with a drop between 1½ -2 years, shows no significant difference amongst measurement across the age groups.

TL of goats showed that the highest rate of growth (weight gain) occurred between 2-2½ years, which was shown to be significantly highest. There was also a significant difference in TL as goat grew from 0.5-

1yr and 1-1 $\frac{1}{2}$ Yrs. Body weight measurement was significantly highest between the ages of 0.5-1yr, 1-1 $\frac{1}{2}$ yrs and 1 $\frac{1}{2}$ – 2 yrs do not show any significant difference. It could be analyzed that goat grows fastest between 0.5 - 1 yr with a drop in rate of growth between 1 $\frac{1}{2}$ – 2yrs. Growth rate however increases again between 1 $\frac{1}{2}$ - 2yrs. The body weight of goat is shown to increase greatly between 2 - 2 $\frac{1}{2}$ years touting its weight at 1 $\frac{1}{2}$ yrs. The effect of sex on weight gain in goats is shown in Table 2. sex is shown to have no influence in weight gain of goat. The body parameters measured: DBE, EL, and EW, do not show any significant difference between sexes in goat. Though the TL and BW of female goats are higher than those of males, these do not differ statistically. Thus sex does not have any influence in goat growth as it affects weight gain.

The correlation coefficients of body measurement parameter in goat (Table 3) shows a positive correlation between parameters and body weight that is body measurement parameters increased as weight of goat also increases. However Age of goats had a negative correlation with ear length with value of -0.086.

Table 1. shows the step wise regression equations generated, from the stepwise regression analyses of values of the various parameter as they associate with one another considering body weight of the goat as the dependent variable. From the equations as shown in Table 4 it was revealed that body weight of goats can be assessed up to 72.22% using Tail-length of the animal (goat) while a higher percentage of 74.2% can be obtained considering age of animal and tail length on body weight. Also up to 74.4% of body weight can be assessed from age of animal, distance between eyes, ear length, ear width, and tail length as revealed in equation (x).

Discussion

Weight has been the pivot on which animal production thrives. The knowledge of livestock weight assessment remains the backbone on which all animal production management practices are hinged. Apart from avoiding the errors of visual determination of animal weights, the non-skilled/ non-iterates stockman, which makes up the higher percentage of animal farmers, need a reasonable and simple skill in estimating weight when weighbridge cannot be assessed.

In this study, it is shown that there is a positive correlation between increase in body parameters measured and weight gain. This means animals at different age groups will have differences in measurement of body parts like the DBE, EL, EW, BW AND TL (Osinowo, et al, 1989; Otoikhian, et al, 2006). The slow growth that may occur in goat between 1 $\frac{1}{2}$ – 2yrs is not an indication that goat has attained maturity. It can be explained that in this period (1 $\frac{1}{2}$ – 2yrs) in goat, energy is centered towards weight gain than elongation of body parts. This is seen in this study as the weight of goat doubled from 15.75 in 1 $\frac{1}{2}$ - 2yrs to 32.00 in 2- 2 $\frac{1}{2}$ yrs. Thus, by measurement of some body parameters, the age of goat can be assessed and the timing for different management practices can be pegged accurately to bring goat to a good and desired weight at maturity (Imasuen and Otoikhian 2004).

This study also shown that sex does not have any influence in weight gain of goat (Otoikhian, et al, 2006; NSAP, 1991 and Imasuen and Otoikhian 2004). All body parameters measured against sex did not show any significant difference in weight gain of the animal. The regression equations for assessing body weight from body measurement in goat implies that much percentage of fitness regression of varied body measurement parameters on body weight. From the results up to 74.4% Percentage of body weight can be assessed without having to weight the goat. These results are in line with findings of, but however values of 74.4% and 74.38% assessment are far higher than values reported by Janssens and vandepitte (2004); Touchberry and lush (2007); which therefore implies that the result from this study can be utilized by farmers, which can be used to make varied records as well as support standard marketing process in goat production. However there is the need to develop similar database information for other livestock species since different species have different parameter relationship to avoid mistakes of the past.

Table 1: Effect of age on body measurement parameters in goats.

Variables	Age Group*			
	0.5 – 1 year	1 – 1.5 years	1.5 – 2 years	2 – 2.5 years
Distance b/w eyes	5.82 ± 0.12 ^a	6.77 ± 0.05 ^a	5.88 ± 0.13 ^a	6.80 ± 0.21 ^a
Ear Length	7.57 ± 0.11 ^a	8.10 ± 0.32 ^a	7.00 ± 0.11 ^a	8.20 ± 0.13 ^a
Ear Width	3.97 ± 0.21 ^a	4.43 ± 0.14 ^a	4.25 ± 0.21 ^a	4.70 ± 0.22 ^a
Tail Length	7.80 ± 0.23 ^b	9.50 ± 0.23 ^{ab}	9.30 ± 0.51 ^{ab}	11.20 ± 0.14 ^a
Body Weight	10.33 ± 0.22 ^b	15.83 ± 0.11 ^b	15.75 ± 0.16 ^b	32.00 ± 0.12 ^a

*Figures represent the means ± SE.

Table 2: Effect of sex on body measurement parameters in sheep.

Variables	Female	Male
Distance b/w eyes	5.99 ± 0.36 ^a	6.23 ± 0.55 ^a
Ear Length	7.46 ± 0.31 ^a	7.67 ± 0.37 ^a
Ear Width	4.26 ± 0.15 ^a	4.14 ± 0.24 ^a
Tail Length	9.24 ± 0.62 ^a	8.47 ± 0.70 ^a
Body Weight	17.64 ± 3.77 ^b	11.57 ± 1.74 ^a

*Figures represent the means ± SE. N = 50

Table 3: Pearson correlation coefficients of body measurement parameters in goats.

	AGEGRP	EYES	EARLTH	EARWDT	TAILLTH	BODYWT
AGEGRP	1.000	0.136	-0.0086	0.380	0.562	0.595
		0.641	0.771	0.180	0.036	0.025
EYES		1.000	0.397	0.788	0.7764	0.619
			0.160	0.001	0.001	0.018
EARLTH			1.000	0.305	0.065	0.071
				0.289	0.825	0.808
EARWDT				1.000	0.799	0.671
					0.001	0.009
TAILLTH					1.000	0.850
						0.000
BODYWT						1.000

Table 4: Stepwise regression equations for assessing body weight from body measurement parameters in goats.

	$Y = a + bx$		
	Y = any value of the dependent variable		
	a = Intercept, the value of Y at Zero X.		
	b = Slope, the regression coefficient the change in Y per Unit change in x.		
Variables:	Dependent	Variable	= Body Weight = Y
(i)	Independent	Variable = Tail-length	
	$Y = -20.670 + 72.2 \times \text{Tail length}$		
(ii)	Independent	Variables = Age; Distance between eyes	
	$Y = -16.21 + 64.8 \times \text{Age} + 64.8 \times \text{Db eyes}$		
(iii)	Independent	Variables = Age; Ear Width	
	$Y = -26.475 + 58.5 \times \text{Age} + 58.5 \times \text{Ear width}$		
(iv)	Independent	Variables = Age; Tail Length	
	$Y = -19.343 + 74.2 \times \text{Age} + 74.2 \times \text{Tail length}$		
(v)	Independent	Variables = Age; Distance b/w eyes; Ear length	
	$Y = -9.347 + 66.06 \times \text{Age} + 66.06 \times \text{Dbeyes} + 66.06 \times \text{Ear length}$		
(vi)	Independent	Variables = Age; Distance b/w eyes; Ear width	
	$Y = -20.586 + 65.39 \times \text{Age} + 65.394 \times \text{Dbeyes} + 65.39 \times \text{Ear width}$		
(vii)	Independent	Variables = Age; Distance b/w eyes; Tail Length	
	$Y = -19.602 + 74.29 \times \text{Age} + 74.29 \times \text{Dbeyes} + 74.29 \times \text{Tail length}$		
(viii)	Independent	Variables = Age; Distance b/w eyes; Ear length; Ear width	
	$Y = -13.818 + 66.75 \times \text{Age} + 66.75 \times \text{Dbeyes} + 66.75 \times \text{Ear lgt} + 66.75 \times \text{Ear width}$		
(ix)	Independent	Variables = Age; Distance b/w eyes; Ear Length; Tail Length	
	$Y = -21.825 + 74.38 \times \text{Age} + 74.38 \times \text{Dbeyes} + .74.38 \times \text{Ear lgt} + 74.38 \times \text{tail length}$		
(x)	Independent	Variables = Age; Distance b/w eyes; Ear Length; Ear Width; Tail Length	
	$Y = -21.409 + 74.40 \times \text{Age} + 74.40 \times \text{Dbeyes} + 74.40 \times \text{Ear lgt} + 74.40 \times \text{Ear width} + 74.40 \times \text{tail lgt.}$		

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