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MORPHOMETRIC TRAITS AS INDICATORS FOR BODY WEIGHT IN SUDANESE KENANA CATTLE

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ABSTRACT: *In this study body weight in both sexes was predicted using some morphometric. Traits used were height at withers (HTW), heart girth circumference (HGC), abdominal girth circumference (ABGC) and body length (BL). The overall means of live body weight (WT) and of the studied morphometric traits (HGC, ABGC, BL and HTW), respectively, were 281.814 ± 3.527kg, 150.641 ± 0.447, 190.542 ± 1.177, 87.963 ± 0.512 and 119.023 ± 0.497 cm. The phenotypic correlation coefficients for body weight (BW) with HGC, ABGC, BL and HTW in this experiment were 0.98, 0.78, 0.64 and 0.70 respectively. Prediction equations were obtained for combined sex, males and females. R^2 was high in the three equations (0.97, 0.98 and 0.97 respectively). Obtained prediction equations were tested for their validity by estimating body weights of six males and 25 female Kenana cattle. These animals were weighed by three different methods; the equations, Dalton tape and large ruminant scale, and obtained weights were not significantly different (P≤0.05). It was concluded that prediction equations can be used efficiently to estimate live weight in Kenena cattle when it is difficult to use scales.*

ORIGINAL ARTICLE

Keywords: *Body weight, correlations, Kenana cattle, morphometric traits, Sudan*

INTRODUCTION

A study of linear measurements in Africa is important because most traditional African farmsteads lack a weighing machine and adequate knowledge to understand its manipulation. The use of the calibrated weigh band which is very common in developed countries is not common in the developing world because their calibrations are based on temperate breeds of cattle. But simple linear measuring devices will be easy to handle and will assist in selecting animals to become the parents of the next generations (Essien and Adesope, 2003). Essien and Adesope (2003) also reported that over the years, emphasis has shifted from subjective methods of appraising cattle to more objective methods like the use of linear measurements of different body parts. Information on morphometric traits can be used in assessing growth rate, body weights, and feed utilization and carcass characteristics in farm animals (Brown et al., 1973). They can be taken at a relatively low cost with a reasonable accuracy and consistency and they serve as supplemental information for comprehensive performance testing. Gilbert and Gregory (1952) noted that linear body measurements describe an animal more completely than conventional methods of weighing and grading. Ibe and Ezekwe (1994) reported that morphometric traits have been used to characterize breeds, evaluate breed performance and predict live body weight of animal.

Morphometric traits are less subjected to short-term changes as in body weight and allow comparisons in different parts of the body (Russell, 1975) and their use to predict live body weight of animals is perceived more reliable compared to the use of weighing scales which could introduce biases according to the fullness of the gut (Obike et al., 2010). Alsiddig et al. (2010) and Gunawan and Jakaria (2010) found significantly high correlation coefficient for HG with live weight (>0.80) they also reported that stepwise regression showed that HG was a good estimator of weaning and yearling live weight followed by HTW and BL. Kashoma et al. (2011) reported that the correlation of BW with HG at various ages for Tanzania shorthorn zebu cattle were in the range of 0.65–0.94, whereas R^2 for regression equations were 0.87 and 0.88 for females and males. Caglar and Skerden (1993) declared that the regression equations must be determined for beef breeds for different country and regions. Kenana cattle are considered one of the promising dual purpose cattle, yet information on their morphometric traits and their relation with economical traits such as body weights are limited. Hence, this study was conducted to

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provide essential information on some of these morphometric traits.

MATERIAL AND METHODS

Location of study

Data analyzed in this study was collected by measuring morphometric traits in cattle at Um-Benein Research Station and villages around it. This area, Um-Benein, was located in Sinnar state on the western bank of the Blue Nile about 360 km south of Khartoum and 9 km south of Singa. It lies between latitude 13° 04 N and longitude 33° 56 E and is 435 meters above sea level. There are three distinct seasons in the year based on rain fall and temperature, winter (November - February), hot summer (March - June); and wet summer (July - October), with some showers in May and June. In addition to some herds that were studied in the Gezira State.

Animals and their management

A total of 301 animals (Kenana cattles) were used to estimate morphometric traits, whereas thirty one animals (males and females at different ages) were weighed using weighing machine to compare obtained weights with those calculated from prediction equations and Dalton tape for same animals. All the animals were housed in pens fenced by wood materials, steel pipes and sheds of local materials and corrugated zinc sheets. Water was available all the time in steel troughs.

Statistical analysis

The data were subjected to statistical analysis in the SPSS (1983), using least square fixed model procedure (Harvey, 1977) model one. The model included fixed effects of sex, age, lactation number and herd. The residual mean square was used as the random error term to test the significance of differences among groups.
The general model fits the data was:

$$Y_{ijkl} = \mu + S_i + Aj + H_l + e_{ijkl}$$

Where:

Y_{ijkl} = the trait studied (Live body weight).
μ = the overall mean underlying the trait.
S_i = the effect of ith sex (for i = 1 and 2).
Aj = the effect of j^{th} age (for j = 1...5).
H_l = the effect l^{th} of herd (for l = 1...3).
e_{ijkl}= the random error term (All factors considered fixed except for the random error term).

RESULTS AND DISCUSION

Table1 shows least square means of BW, HG, ABC, BL and HTW. The overall mean for HTW for Kenana cattle were similar to those obtained by Alsiddig et al. (2010) for Sudan Zebu Cattle (Baggara type) and Aamir et al. (2010) for Kenana cattle, but lower than others reported for some Sudanese cattle breeds (FAO, 1995). The increase in estimates of Morphometric traits with age in Kenana cattle in this study was similar to the result reported by Green and Carman (1978) who showed that skeletal development within a population become relatively more uniform with age and with that Aamir (2010) who indicated that these measurements were affected with age and the live weight of the animal.

The results in table 2 shows that there was increase in mean values of morphometric traits and body weight with age, this is similar to the finding reported by Green and Carman (1978).

Information on correlation coefficients between morphometric traits and productive traits were scare. The results in Table 3 showed that a significantly ($P \leq 0.01$) high positive correlation coefficient exist between body weight and heart girth (r = 0.98). This estimate was higher than the results obtained by Alsiddig et al. (2010) in Baggara cattle. However, in early report, Francis et al. (2002) observed a similar trend that body weight was highly correlated ($r \geq 0.90$) with body length, heart girth, height at withers and abdominal girth but particularly so with heart girth (r = 0.96). The results suggested that any of these variables or their combinations would provide a good estimate of predicting live body weight in Kenana cattle. Orheruata (1988) found a similar trend in beef cattle, that high heart girth circumference measurement meant more muscle in the meat.

Different regression equations were also derived to predict live body weights in Kenana cattle. Francis et al. (2002) developed some prediction equation for these traits in Zimbabwe for indigenous, Friesian, Brahman, Red Dane and crossbred cattle.

$Y= -388.438-0.153ABGC-0.419HTW-0.083BL+5.022HGC$ ($R^2=0.97$) (1)
$Y= -377.487+5.483HGC-0.427ABGC-0.883BL-.012HTW$ ($R^2=0.98$) (2)
$Y= -407.830+5.105HGC-0.123ABGC+0.012BL-0.487HTW$ ($R^2=0.97$) (3)

Differences in estimates of morphometric traits reflect useful measures that depict the size and shape of animal.

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Table 1 - Least square means (means±SE) ofmorphometric traits of Kenana cattle according to sex and age groups.

Age	Trait		BW (kg)	HGC(cm)	AGC(cm)	BL(cm)	HTW(cm)
	Sex	No.					
1-2yrs	Male	05	188.00±10.56	129.12 ±1.33	156.43±1.23	77.56±1.33	106.00±2.50
	Female	35	184.24 ± 8.62	128.11±1.38	155.32±1.89	75.66±1.06	104.85±1.19
3-4yrs	Male	07	292.32±12.00	149.00±2.20	161.21±0.34	85.33±1.44	111.03±2.33
	Female	12	284.22 ± 16.29	150.00±2.12	180.47±2.87	86.63±1.62	122.74±2.25
5-7yrs	Male	08	380.33±12.23	153.21±1.22	195.44±1.33	90.00±0.55	125.00±2.33
	Female	45	338.83 ± 11.95	152.83±1.26	193.42±1.72	89.60±0.97	123.35±1.65
8-10yrs	Male	-	-	-	-	-	-
	Female	82	307.28 ± 4.92	155.83±`.01	198.48±1.38	93.06±0.78	122.85±0.68
>10yrs	Male	-	-	-	-	-	-
	Female	103	297.96 ± 19.12	152.83±1.26	198.30±3.18	87.29±192	122.47±2.82
Overall	Male	301	281.81 ± 3.53	150.64 ±0.50	190.54±1.39	87.96±0.51	119.02±0.50
	Female	20	293.90 ± 16.34	130.83±2.24	160.17±3.48	83.33±1.18	112.67±1.07
	Overall	281	282.03 ± 4.98	151.69±1.42	183.63±2.05	95.56±0.70	126.05±0.63

BW= body weight; HGC = Heart girth circumference; AGC = Abdominal girth circumference; BL = Body length and HTW = Height at withers.

Table 3 - Phenotypic correlation coefficients between morphometric traits and some productive traits of Kenana cattle

Trait	HGC (cm)	ABGC (cm)	BL (cm)	HTW (cm)	ACB (kg)	ES (kg)	Age (yrs)
HGC (cm)	1.00	0.82**	0.66**	0.74**	0.92**	0.98**	0.57**
ABGC (cm)		1.00	0.55**	0.66**	0.91**	0.78**	0.66**
BL (cm)			1.00	0.59**	0.48**	0.64**	0.40**
HTW (cm)				1.00	0.58**	0.70**	0.47**
ACB (kg)					1.00	0.92**	0.55**
ES (kg)						1.00	0.53**
Age (yrs)							1.00

** Correlation is significant at (0.01) level (2- tailed); HGC = Heart girth circumference; AGC = Abdominal girth circumference; BL = Body length; HTWs = Height at withers; AC = Actual body weight; ES = Estimated body weights.

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The relatively high accuracy of live body weight prediction obtained in this study suggested that regression equations were sufficient to be use in prediction of body weight from linear body measurements in Kenana cattle. However, more studies are needed to emphasis this statement. This is advantageous, especially in the Sudan, with difficulties in weighing machines

Table 4 - Least square means of estimated body weights (kg) for males and females Kenana cattle obtained using the scale, Dalton weighing band and the derived equation

Method of BW Estimation	Males		Females	
	No.	Weight (M±SE)	No.	Weight (M±SE)
Dalton equation	6	194.00^{a}±5.05	25	274.80^{b}±7.70
Derived equation	6	213.30^{a}±8.08	25	283.80^{b}±10.40
The scale	6	190.33^{a}±6.33	25	283.90^{b}±8.90
Total	18	199.20±4.33	75	280.20±5.10

Means with the same letter were not significantly different ($P > 0.05$). ^{a,b} Different letters denote significant differences at ($P < 0.05$).

CONCLUSION

Information on morphometric is vital and valuable in management and breeding programs and should be well utilized to improve the performance of Sudanese cattle breeds, especially Kenana cattle.

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