Nig. J. Anim. Prod. 2022, 49(3):1-5. https://doi.org/10.51791/njap.v49i3.3522 *Nigerian Journal of Animal Production*

Short Communication

Zoometric measurement parameters and its relationship with body weight in white Fulani calves under on-farm research environment

Ekpo, J. S., Christoper, G. I., Okon, U. M.
Department of Animal Science, Akwa Ibom State University, Obio Akpa Campus, Akwa Ibom State, Nigeria.
Corresponding author: utibeokon93@gmail.com

Abstract

The inability of farmers in the rural areas to effectively determine the weight of cattle due to the unavailability and unaffordability of measuring scales has been a major constraint in live weight determination of cattle for the market. Hence, the need for zoometric measurement of body parts. A total of seven white Fulani calves aged 14 days were used as the study material to investigate the zoometric measurement parameters and its relationship with bodyweight in White Fulani calves under on-farm study. The calves were allowed to graze with their mothers in the open field from 8:00am and 4:00pm local time. The animals were restrained before measurements were taken on them to avoid unnecessary stress. Body weight measurements were taken using a measuring scale while zoometric body parts were measured using a flexible tailor's tape. The experiment lasted nine months. The overall mean values for body weight, body length, body circumference, girth circumference, height at wither, neck circumference and neck length were 62.62±3.44kg, 28.97±0.34cm, 37.09±0.46cm, 36.53±0.36cm, 36.70±0.40cm, 24.24±0.28cm, and 13.73±0.25cm, respectively. Body weight was positively and significantly (P<0.05) correlated with other body parts measured with the highest correlation recorded between live weight and heart girth (0.915). Linear function provided the best fit for body weight and linear body measurements indicating that zoometric measurements of body parts can be used as a selection criterion for estimating body weight in white Fulani calves, most especially in the rural areas where measuring scales are not usually available and affordable. It is therefore recommended that multiple linear regression model should be used as an index predictor of body weight in white Fulani calves.

Keywords: Live weight, white Fulani calves, zoometric measurements, correlation, regression

Paramètres de mesure zoométriques et sa relation avec le poids corporel dans les veaux de Fulani blanc sous environnement de recherche à la ferme

Résumé

L'incapacité des agriculteurs dans les zones rurales de déterminer efficacement le poids des bovins en raison de l'indisponibilité et de l'infrontation des échelles de mesure a été une contrainte majeure dans la détermination du bétail en direct du bétail pour le marché. Par conséquent, le besoin de mesure zoométrique des parties du corps. Un total de sept veaux blancs des Fulani âgés de 14 jours ont été utilisés comme matériel d'étude pour étudier les paramètres de mesure zoométriques et sa relation avec un poids corporel dans les veaux de Fulani blanc sous une étude à la ferme. Les veaux ont été autorisés à parcourir avec leurs mères dans le champ ouvert de 8h00 et 16h00 heure locale. Les animaux ont été retenus

avant que des mesures ne soient prises pour éviter le stress inutile. Des mesures de poids corporel ont été prises à l'aide d'une balance de mesure tandis que des pièces de corps zoométriques ont été mesurées à l'aide d'une bande de tailleur flexible. L'expérience a duré neuf mois. Les valeurs moyennes globales pour le poids corporel, la longueur du corps, la circonférence du corps, la circonférence du tronc, de la hauteur au garrot, le tour de cou et de la longueur du col était 62,62 ± 3,44 kg, 28,97 ± 0.34cm, 37,09 ± 0.46cm, 36,53 ± 0.36cm, 36,70 ± 0,40 cm, 24,24 ± 0,28cm et 13,73 ± 0,25cm, respectivement. Le poids corporel était de manière positive et significative (p <0,05) corrélé avec d'autres parties du corps mesurées avec la corrélation la plus élevée enregistrée entre le poids en direct et la circonférence du cœur (0,915). Fonction linéaire fournie le meilleur ajustement du poids corporel et des mesures corporelles linéaires indiquant que les mesures zoométriques des pièces du corps peuvent être utilisées comme critère de sélection pour estimer le poids corporel dans les veaux de Fulani blanc, surtout dans les zones rurales où les balances de mesure ne sont généralement pas disponibles et abordable. Il est donc recommandé que plusieurs modèles de régression linéaire soient utilisés comme prédicateur d'index du poids corporel dans les veaux de Fulani blanc.

Mots-clés: Poids en direct, veaux blancs Fulani, mesures zoométriques, corrélation, régression

Introduction

Africa in general and Nigeria in particular is blessed with large livestock resources including various breeds of cattle, sheep and goats. This inhabitation of various flora and fauna species in the country is made possible by the existing diversity of agro-ecological zones (Alemayehu and Tikabo, 2010). Farm animals especially large ruminants like cattle has proven to be a satisfactory source of food for mankind all over the world. The Nigerian cattle provides more than 90% of the total annual domestic milk output (Walshe *et al*., 1991) while the white Fulani breed has been recognized as the principal producer (Adeneye, 1989). In the rural areas, especially, where resources are insufficient and the acquisition of expensive weighing scale is unaffordable, zoometric body measurements being an indirect method of estimating body weight has been reported to be practical, faster, easier and cheaper approach (Semakula *et al*., 2011). Zoometric body part measurement relationship with body weight is not only important in the development of predictive equations; it could also be very useful in the genetic improvement strategies which ultimately lead to an achievement of optimum combination of body weight and good conformation (Chineke *et al*., 2002). The aim of this study was to access the zoometric measurement parameters and its relationship with body weights in white Fulani calves under on-farm research environment.

Materials and methods

The research work was undertaken at the cattle unit of the cattle unit of Akwa Ibom State University Teaching and Research Farm. The area is situated between latitude 4°30'N and longitude 7°30'E (SLUK-AK, 1989). A total of seven white Fulani calves aged 14 days were used for the experiment. The animals were raised under a semi-intensive system of management. Each calf was identified by ear tagging. The calves were allowed to graze with their mothers in the open field from 8:00am and 4:00pm local time. The animals were restrained before measurements were taken on them to avoid unnecessary stress. The experiment lasted nine months. Zoometric body parts were measured in centimeters using a

flexible tailor's tape as described by Okon *et al*. (2018). Body weight measurement was taken in kilogram using a weighing scale. The parameters measured include, body length (the body of the cattle was measured from the joint of the scapular to the pin bone), body circumference (circumference around the body), girth circumference (circumferential measurement taken around the chest), height at wither (distance from the platform on which the animal stands to the point of its shoulders), neck circumference (measured as the distance round the neck) and neck length (measured as the distance between the edges of the neck to the lower jaw region).

Data collected were subjected to correlation and regression procedure of SPSS (2001) using the model:

$Y_{ij} = a + b_i x_i + e_{ij}$

Where: Y_{ij} = Body weight (dependent variable)

a = Intercept

b_i = Partial regression coefficient of dependent variable

x_i = i^{th} independent variable e_{ij} = Random error

Results and discussion

The results including the means and standard errors related to the body measurements of white Fulani calves are shown in Table 1. Mean values for body weight and body parts measured (cm) were respectively 62.62±3.44kg, 28.97±0.34cm, 37.09±0.46cm, 36.53±0.36cm, 36.70±0.40cm, 24.24±0.28cm, and 13.73±0.25cm for body weight, body length, body circumference, girth circumference, height at wither, neck circumference and neck length. There was significant difference ($P<0.05$) in body weight of the calves as they grew older. This agrees with the findings of Okon *et al*. (2018) and Orthenuata and Olutogun (1994) who reported an increase in body weight gain and linear body measurements in cattle as the animals grew older.

Table 1: Means±SEM of body weight and zoometric measurements of body parts ofwhite Fulani calves

Months	BW (kg)	BL(cm)	BC(cm)	GC(cm)	HW(cm)	NC(cm)	NL(cm)
1	23.39±1.41^{h}	25.60±0.87^{d}	33.07±1.19^{c}	33.30±0.71^{d}	33.31±0.98^{c}	21.11±0.48^{e}	10.56±0.43^{g}
2	32.10±1.62^{g}	27.09±0.92^{cd}	34.89±1.06^{bc}	34.30±.0.87^{cd}	34.57±1.09^{bc}	22.63±0.58^{de}	11.73±0.36^{f}
3	39.99±1.68^{f}	28.19±0.87^{bc}	36.44±1.13^{abc}	35.84±0.86^{bcd}	35.77±1.19^{abc}	23.31±0.61^{cd}	12.79±0.46^{ef}
4	48.97±1.59^{e}	28.90±0.98^{abc}	37.81±1.06^{ab}	37.11±0.66^{ab}	36.63±1.14^{abc}	23.94±0.68^{bcd}	13.57±0.40^{de}
5	60.49±1.73^{d}	29.37±0.86^{abc}	37.20±1.64^{ab}	36.47±1.18^{abc}	37.09±1.12^{ab}	24.57±0.59^{abc}	13.99±0.44^{cd}
6	74.92±1.66^{c}	29.67±0.85^{abc}	38.34±1.06^{ab}	37.84±0.66^{ab}	37.54±1.16^{ab}	25.07±0.63^{abc}	14.36±0.48^{bcd}
7	88.06±1.48^{b}	30.00±0.82^{ab}	37.86±1.58^{ab}	37.33±1.16^{ab}	38.13±1.03^{a}	25.41±0.64^{ab}	14.99±0.30^{bc}
8	96.41±1.49^{a}	30.60±0.69^{ab}	38.27±1.56^{ab}	37.67±1.19^{ab}	38.50±1.02^{ab}	25.99±0.72^{a}	15.41±0.32^{ab}
9	99.23±1.66^{a}	31.34±0.70^{a}	39.90±0.86^{a}	38.00±0.67^{a}	38.91±1.00^{a}	26.16±0.54^{a}	16.19±0.28^{a}
Overall mean	62.62±3.44	28.97±0.34	37.09±0.46	36.53±0.36	36.70±0.40	24.24±0.28	13.73±0.25

^{abcdh}Means with a different superscript within column are significantly different ($P<0.05$)BW=body weight, BL=body length, BC=body circumference, GC=girth circumference, HW=height at wither, NC=neck circumference, NL=neck length

Table 2: Pearson correlation coefficient of body weight and body dimensions in white Fulani calves

	BW	BL	BC	GC	HW	NC	NL
BW	1	0.578*	0.411	0.523*	0.509*	0.690**	0.810**
BL		1	0.849**	0.873**	0.912**	0.827**	0.802**
BC			1	0.915**	0.813**	0.677**	0.699**
GC				1	0.826**	0.779**	0.694**
HW					1	0.751**	0.786**
NC						1	0.779**
NL							1

** Correlation is significant at the 0.01 level (2-tailed)*Correlation is significant at the 0.05 level (2-tailed)BW=body weight, BL=body length, BC=body circumference, GC=girth circumference, HW=height at wither, NC=neck circumference, NL=neck length

Table 3: Regression equation and coefficient of determination for body weight prediction using zoometric body measurements

Variables	Regression equation	R^2	Sig
BL (X_1)	$Y = -107.34+5.87X_1$	0.33	**
BC (X_2)	$Y = -50.37+3.05X_2$	0.17	**
GC (X_3)	$Y = -122.31+5.06X_3$	0.27	**
HW (X_4)	$Y = -96.24+4.33X_4$	0.26	**
NC (X_5)	$Y = -146.10+8.61X_5$	0.169	**
NL (X_6)	$Y = -91.63+11.23X_6$	0.65	**
BC, NC & NL	$Y = -81.32-2.76X_2+3.43X_5+11.87X_6$	0.73	**
BC, GC, HW & NL	$Y = -87.69-5.11X_2+6.67X_3-3.07X_4+15.22X_6$	0.78	**

Y= Predicted body weight (kg), X_1 = body length (cm), X_2 = body circumference, X_3 = girth circumference, X_4 = height at wither, X_5 = neck circumference, X_6 = neck length

Table 2 shows Pearson's coefficient of correlation between body weight and the zoometric body measurements. Body weight was positively and significantly ($P<0.05$) correlated with all zoometric body parts measured. This indicates that as body weight increased, there was a corresponding increase in body parts assessed. This agrees with the findings of Adewumi and Kazeem (2010) and Dim *et al*. (2012) on Yankasa lambs and Bunaji cows respectively. The high correlation was recorded between body weight and body parts, with the highest correlation recorded between live weight and heart girth (0.915). This implies that the total body size of the animal is a function of length, height and circumference measurement. This result agrees with the findings of Cam *et al*. (2010) and Alade *et al*. (2008).

Table 3 presents estimates of parameters in linear functions fitted for live weight and zoometric body measurements relationship. In using a single index predictor, a low coefficient of determination with the lowest (0.17) recorded between body weight and body circumference. However, with multiple regressions, a higher coefficient of determination (0.78) was recorded between body weight, body circumference, girth circumference, height at withers and neck length. This suggests that skeletal measurements are better predictors of body weight than tissue measurement. The result agrees with the findings of Pesmen and Yarsinci (2008) and Otoikhian *et al*. (2008) but negates the findings of Ladan *et al.* (2009) in a research on Yankasa ewes and Dim *et al*. (2012) in a research on Bunaji cows.

Conclusion

From this study, it can be concluded that there was a positive relationship between body weight and all body parts assessed. This indicates that zoometric measurements of body parts can be used as a selection criterion for estimating body weight, especially in the rural areas where measuring scales are not usually available and affordable. It is therefore recommended that multiple linear regression model should be used as an index predictor of body weight in white Fulani calves.

References

Adeneye, J. A. 1989. Variation in yield and composition of milk from different quarters of lactating White Fulani cattle in a Tropical environment. *Nigerian Journal of Anim. Prod.,* 16:8-15.

Adewumi, O. O. and Kazeem, G. 2010. The relationship between milk intake, body weight and linear body measurement of Yanaksa lambs. Proceedings of the 15th Anuual Conference of Animal Science Association of Nigeria, 15:163-166.

Alade, N. K., Rajiand A. O. and Atiku, M. A. 2008. Determination of appropriate model for the estimation of body weights in goats. *ARPN J. of Agric. Bio. Sci*. 3(4): 52-57.

Alemayehu, T. and Tikabo, G. 2010. Application of linear body measurements for live body weight estimation in highland sheep in Tigray region, North Ethiopia. *Journal of the Drylands* 3(2):203-207

Chineke, C. A., Agaviezor, B., Ikeobi, C. O. N. and Ologun, A, G. 2002. Proceedings in the 27th Annual Conference of Nigerian Society of Animal Production, FUT Akure, Nigeria, pp 1-3.

Dim, N. I., Egahi, J. O. and Tanko, M. U. 2012. Zoometrical measurements of body parts and their Relationship with live weight in bunaji cows in Zaria Nigeria. *I.J.A.B.R., VOL. 2(2):339-341*

Ladan, S. A., J. O, Egahi and N. I. Dim, 2009. Body biometry as a predictive index for body weights in Yankasa ewes under traditional husbandry system in North Central Nigeria. Proceedings of the 34th Annual Conference of the Nigerian Society for Annual Production, March 15-18, 2009, university of Uyo, Uyo, Nigeria.

Okon, U. M., Umoh, B. I. and Ekpo, J. S. 2018. The Relationship between body weight and linear body measurements in Bunaji calves at different phases of growth. *Aksu Journal of Agric. and food sciences*. 2(1) 189-196

Ortheruata, A. M. and Olutogun, O. 1994. Pre-and post-weaning phenotypic relationship between some N'dama cattle linear measurement in the tropics. *Niger. J. of Anim. Prod.,* 21: 76-82.

Otoikhian, C. S. O., Otoikhian, A. M., Akporhuarho, V. E., Oyefia, V. E. and Isidahomen, C. E. 2008. Body measurement parameters as a function of assessing body weight in goats under on-farm research environment. *African Journal of General Agric.*4(3): 135-140.

Pesmen, G. and Yardimci, M. 2008. Estimating the live weight using some body measurements in Saanen goats. *Archiva Zootechnica* 11(4): 30-40

Semakula, J. P., Lusembo, D. R., kugonza, D., Mutetikka, J., Sennyonjo, J. S. and Mwesigwa, M. 2011.*Liv. Res. For Rural Devt*. 23, 170. http://www.lrrd.org/lrrd23/8/sema23170.htm

SLUK-AK1989. Soil and land use studies. Government print office, Uyo, Akwa Ibom State. Soil survey staff, 1994. Keys to soil taxonomy. Soil management support services (SMSS), technical monogr. No. 19:306p.

Received: 7th November, 2021
Accepted: 26th February, 2022