



Live weight estimation of fat-tailed indigenous ewes from Southern Zambia

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Body measurements can be used to predict live weight fairly well in a situation where weighbridges are not available (Goonerwardene and Sahaayuraban 1983). The accuracy of functions used to predict live weight or growth characteristics from live animal measurements is of immense financial contribution to livestock production enterprises. The objective of the present study was to estimate live weight based on linear body measurements of fat-tailed sheep from Zambia.

The data for this study were obtained from 15 adult female sheep age at least 2 years from different flocks. These animals were managed extensively, without supplementary feeding, in different farms of the Lusitu area of the Gwembe Valley in Southern Zambia, where no routine health management system exists, and breeding is through uncontrolled natural mating. Only those animals considered pure breed and of apparent good health were considered for this study. Field data collection was performed during the dry season in August 2011.

Live animal measurement

Animals were weighed by suspending them on a hanging dynamometer. The body dimensional measurements included following 6 traits: withers height (WH, measured as the distance from the top of midline between the hips to the ground), body length (BL, measured as the distance between the point of the shoulder corresponding to the outer and central tuberosity of the left humerus to the left tuber ischii), thoracic girth (TG, measured as the body circumference immediately posterior to the front leg), thoracic depth (TD, measured as the distance from the top of midline between the hips to the sternum), hip width (HW, measured as the distance between tuber coxae), and hip length (HL, measured as the distance from the coxal bone to the ischium of the same side). TG was measured with a flexible tape, while the

other measurements were taken using a rigid ovinometer. Measurements were performed by different individuals.

The PAST software (available at <http://www.nhm.uio.no/norlex/past/download.html>) was used to obtain the statistics of each variable and to test a linear regression for the purpose of obtaining the prediction equation of live weight from body measurements variables.

The results showed that mean weight ranged between 17.4 and 38.8 kg (Table 1). Varying range observed in the weight distribution can be attributed to the fact that the animals were raised under different management conditions. Clearly, this weight was below other studied African breeds, such as the Africander (Gatenby 1991), Sabi from Zimbabwe (Wilson 1991), and Yankasa from Nigeria (Salako, 2006), but similar to the Nigerian Wad (Salako 2006). Of the the studied measurements, the thoracic depth (TD) was most variable, while withers height (WH) and thoracic girth (TG) showed least variability (Table 1). The body length (BL) presented a non normal distribution ($P<0.05$), hence it was excluded from the final analysis.

With Pearson correlation modules of the normally distributed body dimensional characters, thoracic girth was the most related trait to withers weight ($r=0.741$) and thoracic

Table 1. Summary of live-measurement traits for fat-tailed ewes (N=15)

	LW	TG	HW	HL	WH	BL	TD
Min	17.4	57.5	7.5	12.0	52.6	35.0	16.0
Max	38.8	76.0	14.5	19.6	62.0	61.5	34.0
Mean	26.4	67.5	12.1	16.2	56.9	53.4	25.1
Median	26.9	68.0	12.2	16.2	56.0	54.0	25.2
Stand. Dev	5.352	5.399	1.913	2.074	3.302	6.172	4.629
CV (%)	20.30	8.00	17.14	13.85	5.80	11.99	19.16
Shapiro-Wilk W	0.965	0.960	0.903	0.968	0.916	0.813	0.938
p (normal)	0.785	0.691	0.104	0.834	0.168	0.005	0.358

LW, live weight; WH, withers height; BL, body length; TG, thoracic girth; TD, thoracic depth; HW, hip width; HL, hip length. All measurements are in cm, except for LW (kg).

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Table 2. Phenotypic correlations between body measurements (N,15)

	LW	TG	HW	HL	WH	TD
LW		0.002	0.019	0.138	0.003	0.664
TG	0.721		0.002	0.006	0.052	0.262
HW	0.596	0.741		0.026	0.164	0.323
HW	0.402	0.674	0.572		0.215	0.140
WH	0.717	0.511	0.379	0.340		0.217
TD	-0.122	-0.309	-0.274	-0.400	-0.338	

LW, live weight; WH, withers height; BL, body length; TG, thoracic girth; TD, thoracic depth; HW, hip width; HL, hip length.

Table 3. Multiple regression analysis of live weight on thoracic girth plus other variables

	Coeff.	Std.err.	t	P	R ²
Constant	-59.753	20.434	-2.924	0.017	0.000
TG	0.452	0.299	1.512	0.165	0.519
HW	0.486	0.714	0.681	0.513	0.355
HL	-0.261	0.623	-0.419	0.685	0.161
WH	0.845	0.329	2.569	0.030	0.515
TD	0.234	0.220	1.061	0.316	0.015

LW, live weight; WH, withers height; BL, body length; TG, thoracic girth; TD, thoracic depth; HW, hip width; HL, hip length.

depth was negatively correlated to all the body dimensional traits (-0.122/-0.400). Live weight was highly correlated ($r > 0.7$, $P < 0.01$) to thoracic girth and withers height (Table 2).

The predictive equation for live weight is presented in Table 3. Coefficient of determination (R^2) values computed for the body measurements oscillated from 0.01 (thoracic depth) to 0.52 (thoracic girth). The second best relationship was found with withers height and thoracic depth ($R^2 = 0.51$) and the least was for the hip length (16%). In Fig. 1, there is linear regression between the thoracic girth (cm) and the live weight (kg). From the obtained field data, the formula, $LV \text{ (kg)} = 0.991 \text{ TG (cm)} - 40.43$ could be considered as a good predictor.

This study demonstrated that a prediction equation for live weight using the thoracic girth is possible and that this measurement can predict live weight with good precision. This observation is in agreement with many previous studies donkeys (de Aluja *et al.* 2005), goat (Olatunji-Akioye and Adeyemo 2009) and sheep (Afolayan *et al.* 2006). The thoracic girth measurement is easily performed, being the perimeter around the body of the animal immediately behind the front legs.

Probably a multiple regression with the addition of other measurements to chest girth would result in significant improvements in accuracy of prediction. However, under field conditions, live weight estimation using chest girth alone

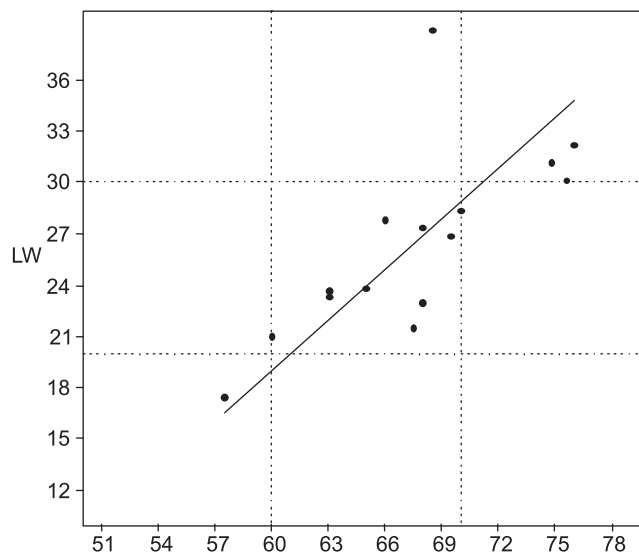


Fig. 1. Linear fit for live weight (LW) and thoracic girth (TG) in the RMA analysis. RMA Regression. TG vs. LW, t statistic: 3.746, Slope a: 0.991, p(uncorrel): 0.002, Intercept b: -40.54, Permutat. p: 0.002, Std. err. a: 0.190, p(a=1): 0.964, Std. err. b: 166.62, 95% bootstrapped confidence intervals:, Chi squared: 0, a: [0.398; 1.305], r: 0.720, b: [-61.16; -1.369], R^2 : 0.519

would be preferable because of difficulties of the proper animal restraint during measurements. This, thus, reduces the practical usefulness of other body measurements in conjunction with chest girth.

SUMMARY

Body measurements (withers height, body length, thoracic girth, thoracic depth, hip width and hip length) were taken and correlated with live weight from 15 adult ewes managed under the traditional farm conditions in Southern Zambia. Live weight was estimated using a linear model. Coefficient of determination (R^2) values computed for the body measurements oscillated from 0.01 (thoracic depth) to 0.52 (thoracic girth). It was concluded that chest girth is a useful tool in predicting weight of fat-tailed ewe. The predictive equation for the live weight determination from thoracic girth, $LV \text{ (kg)} = 0.991 \text{ TG (cm)} - 40.43$, can be considered satisfactory.

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