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Live weight estimation in the indigenous matebele goats using the heart girth circumference

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A R T I C L E   I N F O

A B S T R A C T

This study was carried out to determine if the heart girth can be used effectively to estimate live body weights of the indigenous Matebele goats and help in the development of a heart girth measuring weigh belt. This is aimed at addressing the challenges that farmers face in determining the weight of their goats since they are not able to purchase their own scales. Data was collected using a weighing scale and an ordinary measuring tape from 625 Matebele goats from Matopos Research Institute. The average weight of live animals was 28.8kg. The regression coefficient of the heart girth measured against the body weight was found to be 0.77 and a coefficient of determination of 0.99 indicating a good model and strong relationship between the two variables. This shows that the heart girth can be used in predicting body weight in goats and this is a cost effective, quick and practical way of weight estimation. The live body weight can be estimated using the model: Live weight (LW) = Heart girth circumference $(H)^{0.77}$.

1. Introduction

Goats play a vital role in the livelihoods of rural farmers in Zimbabwe as they are used for numerous purposes such as meat, milk, manure and cash income (Homann et al 2007, Khan et al 2006). Over the past few years there has been a lot of support by different organizations towards developing goat markets in the smallholder sector. This has been coupled with trainings and information dissemination on the value of goats and market /business opportunities with goats. Farmers are being encouraged to improve the management of goats through improved feed and health . Most of the feed and health management practices are very well linked to the weight of the animals (de Villers et al 2009). For instance internal parasites are responsible for most mortalities in the smallholder sector (Homann et al 2007). In order to effectively reduce their impact and also avoid drug resistance, correct dosages should be given (de Villers et al 2009). But this needs to be matched with the weight of the animals as most drugs prescribe that the goat be given so many milliliters per kilogram of weight (de Villers et al 2009). Most importantly recent transactions have been that buyers pay for goats based on their weight. This means that farmers need to have scales or a means of estimating the weight of goats. Digital scales are not affordable and so are salter scales which costs between $300 and $500 each. There is therefore an urgent and for simple and easy means of estimating weight. Many studies have been conducted to use linear body measurements to predict the live weight of a goat especially in Botswana (Nsoso, et al 2009) and Pakistan (Younas et al 2013)). This is established by models which predict the live weight of goats given the heart girth circumference (Alade, Raji and Atiku 2008). The biometric data are statistically analyzed to check if there is any correlation between them and the correlation coefficient (R^2) determines whether the model can be reliably used to predict the live weight of the goats (Alade, Raji and Atiku 2008).

This study therefore seeks to determine the correlation between heart girth circumference using an ordinary tape measure and live weight of the indigenous Matebele goats. With the aim of developing a weigh belt for indigenous goats. The (R^2) values of male vs female goats are also compared to see if there is need for separate models to be used to check for their live weights or just a single model can be used for both male and female goats.

1.1. Objectives

- To determine if the heart girth circumference is a reliable estimator of live weight in the indigenous Matebele goats.
- To determine the variations in the relationship between weight and heart girth between male and female goats.
- To develop a live weight predicting model based on the hearth girth parameter

1.2. Study site

The study was carried out at Matopos Research Station situated 30km South West of Bulawayo in Zimbabwe, at the longitude 28 30'E, latitude of 20 23'. Altitude is low (800m) and the area experiences low erratic rainfall (<450mm) per annum (Homann et al, 2007). The area has very high summer temperatures the hottest month's area temperature 21.6c and 11.4 c, respectively with possibility of severe drought.

2. Materials and methods

Data from 625 Matebele goats was taken over a period of 3 years at Matopos Research Institute. The data was recorded in the form of weight using a 100kg spring balance with 500g increments (Salter Model, Premier Scales, Bulawayo, Zimbabwe). This was taken concurrently with heart girth circumference using an ordinary tape measure in centimeters every month for 3 years and the sex of the goats was also recorded. The heart girth is the chest circumference measures from the bottom most point of the chest in line with the elbow and bisecting the approximate position of the heart (Atta and El Khidir 2004; Slippers, et al 2000). A regression model was developed using the relationship between the heart girth circumference and the weights of the goats. Mean and standard error for the body weight and body measurements were calculated. General regression procedure was used to find the relationship of heart girth circumference and weights of the Matebele goats which can determine the weight using the heart girth, the body weight and regression equation was compared based on coefficient of determination. For comparing equations with unequal number of independent variables, residual mean square

(RMS) was used as a selection criterion to decrease the standard deviation .The data for male and female was analyzed using MINITAB (16) separately to determine if there were any differences in the results and if not determine the best model for all the Matebele goats in general.

3. Results

The variations in weight between the male and female goats are summarized in Table 1 below. The average weight of males was 29kg and a heart girth of 76.7cm, while females weighed 28.6kg and 75. 8cm.

Table 1
The body weight (kg) and heart girth (cm) of male and female goats.

Group	N	Average weight (kg)	Average heart girth (cm)
Males	253	29 [a]	76.7 [a]
Females	372	28.6 [a]	75.8 [a]
All	625	28.8 [a]	76.3 [a]

a means with similar superscript show no significant difference (p>0.05)

The following model was found to fit data best:

Log(live weight) = 0.771 Log(heart girth circumference)

LW=H077   (R2= 0.99 and p<0.010)

The actual average body weight and predicted weight using non-linear regression analysis as found in the study is summarized in Table 2 below:

Table 2
Actual weight (+/- se) and the predicted weight of goats according to sex.

Sex	N	Actual live weight (kg)	Predicted weight (kg)
Males	253	29.0 ± 0.34	27.9
Females	372	28.6 ± 0.21	28.24

A two sample t-test showed that there was no significant difference between the observed and predicted weights of male and the female goats. This shows how precise the heart girth is in predicting weight. The R2 of 0.99 confirms a strong relationship between the two variables.

4. Discussion

For management activities to be effectively implemented by farmers, the live weight is very critical especially for decisions relating to health, breeding and feeding. Prediction of live weight from linear body measurements has been done by Moaeen-un-Din et al (2006) and Atta El Khidir (2004)) and the heart girth was found to be useful in this regard. The high correlation coefficient of 0.99 was found in this study suggesting that heart girth provides a good estimation of live body weight in the absence of a scale. This was comparable to that found by de Villers (year) and Moaeen-un-Din et al (2006) for Teddi goats in Pakistan. . However Suhalia et al (2013) suggest using several linear body measurements like height at withers and body length to reduce or avoid errors. There were no significant differences between actual weight and predicted in this study, and this is similar to the results of Moaeen-un-Din et al (2006) and Hamayun et al (2006). The heart girth is however easy to take and requires minimum handling of the animal (Nesamvuni, et al 2000, Slippers, 2000). It is critical to come up with the specific equations for different breeds as live weight is a function of genetics and the environment. There is need to also perform different assessments between lames and females as there may be differences Suhalia et al (2013). In this study there were no significant differences between male and female goats hence development of the weigh for Matebele goas would be less complex.

5. Conclusion

The findings of this study indicate that the heart girth can be reliably used to estimate live body weight in the indigenous Matebele goats. This model can be used to develop a weigh belt for goats which is expected to be much easier to use and affordable to the smallhoder farmers.

Acknowledgements

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