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## CHARACTERISATION OF MULTIVARIATE TRAITS IN SWAZI INDIGENOUS GOATS

M. Okpeku, O. M. Arigbede, A. M. Dlamini, B. N. Dlamini and M. W. Tesema

### ABSTRACT

Swazi goats from two different regions in Swaziland kept in communal systems were characterised based on phenotypic measurements. Objective measurements for 200 goats included body weight (BW), abdominal circumference (AC), body length (BL), chest circumference (CC), face length (FL), neck circumference (NC), neck length (NL), rump height (RH) and height at withers (HW), while qualitative traits included coat colour, coat texture and presence or absence of horns. Seven coat colours were observed across both regions.

Goats with straight coat texture (82%), short hair length (68%) and with horns (84%) were predominantly more. Goats in Manzini region had the lower BW, AC, BL and CC ( $51.77 \pm 1.32$ ,  $61.77 \pm 1.32$ ,  $62.49 \pm 0.66$ ,  $57.96 \pm 1.18$ ) than Shiselweni goats ( $53.09 \pm 1.01$ ,  $71.09 \pm 1.00$ ,  $73.67 \pm 0.94$ ,  $53.83 \pm 0.90$ ). The study provided a reference for phenotypic and genetic diversity for Swazi goats useful for designing genetic strategies for improved production, food security and sustainable utilisation.

### INTRODUCTION

Characterisation of indigenous livestock is fundamental for developing appropriate long-term maintenance strategy and use of genetic variation, and for making policies for future utilization and conservation (Msanga et al., 2012; Nguluma et al., 2018). In Swaziland, there is a dearth of information on available goat characterization and variability. Like it is in most South African States, indigenous populations are subjected to indiscriminate crossbreeding and replacements with exotic breeds; leading to potential loss of inherent and valuable genetic traits (Rischkowsky, et al., 2007).

In Swaziland goats are next to cattle in terms of population and make up an integrated part of small-hold rural agriculture, where they contribute vital protein in food (in the form of meat and milk, farm-labour and manure) and provide financial backup to poor rural farmers (Lebbie and Mastapha, 1985; Lebbie, 1986).

The Swazi goat like most indigenous African goats is known to possess unique adaptive traits including; heat and drought tolerance, some measure of disease resistance; ideal for production in stress inducing tropical environments (Katangole et al., 1996; Nsoso et al., 2004; Okpeku et al., 2011). Despite these qualities, very little is documented regarding genetic attributes of the Swazi goat.

Morphological variation within a species can provide a wealth of information (Brown-Crowder et al., 2001) vital for animal selection and formulation of effective policy for breeding programmes for preservation and improvement (Nsoso et al., 2004). In this report, we present preliminary result of our effort to characterise indigenous Swazi goats.

### PROBLEM STATEMENT

In Swaziland goats occupy an important position in rural agriculture, providing valuable protein in form of meat and milk, supporting poor farmers income and they are particularly suited for grazing

marginal fields prone to draught, thus playing important role in the economic improvement of poor farmers and contributing to poverty alleviation. However there is little or no information about the genetic architecture and productivity of indigenous Swaziland goat diversity. Therefore, in order to establish the extent of genetic variation and/or adaptive phenotypic plasticity of indigenous Swazi goat, we propose to investigate morphometric relationships among indigenous Swaziland goats in an attempt to classify the breeds and strains (within breeds) using multivariate traits analysis.

#### General objective

To determine genetic architecture and production system of indigenous goats in Swaziland.

#### Specific objectives

- i. To characterise indigenous goat production systems in Swaziland using structured questionnaire.
- ii. To characterise genetic structure of Indigenous Swazi goats using multivariate traits

## MATERIALS AND METHODS

#### *Sampling of indigenous goats*

Two hundred indigenous goats were sampled across 2 regions comprising of Manzini and Shiselweni regions, with the hope of covering Hhohho, and Lubombo regions in the next phase of the study. Goats of both sexes (females and males) were sampled randomly from rural communities.

#### *Measurements of visible phenotypes*

Visible variation in coat colour, hair texture and length, present or absence of horns and morphometric traits consisting of: body weight (BW), abdominal circumference (AC), body length (BL), chest circumference (CC), face length (FL), neck circumference (NC), neck length (NL), rump height (RH) and height at withers (HW) were observed and measured. Anatomical reference points are as described by Yakubu et al. (2009). Body weight (kilogram) was also be taken using a spring balance. The height measurement (centimetres) was done using a graduated measuring stick.

#### *Statistical analysis*

General Linear Model (GLM) procedure of SPSS (2014) statistical package was used for the descriptive statistics of the body measurements of goats. Principal components (PC) and discriminant analyses were also done in SPSS to characterise multivariate traits.

## RESULTS AND DISCUSSION

#### *Visible morphometric variations*

Seven coat colours were observed across both regions studied (Figure 1). Black and white coat colour dominated (25%), black and brown coat colour was least common (5%). Goats with straight coat texture (82%), short hair length (68%) and with horns (84%) were predominantly more than those with coarse (18%), long hair (32%) and polled (16%) (Figure 2). Katangole et al. (1996) also reported a mixture of coat colour patterns and presence of horns in Tswana goats. Observed variability could have resulted from farmers unintentional selecting towards these traits as an environmental adaptation mechanism (Monau et al., 2017).

#### *Quantitative variations*

Body weight and body size of Swazi goat showed some degree of variability, with averages of  $51.77 \pm 1.32$  kg in Manzini and  $53.09 \pm 1.01$  (Kg) in Shiselweni population and  $61.77 \pm 1.32$ ,  $62.49 \pm 0.66$ ,  $57.96 \pm 1.18$  and  $71.09 \pm 1.00$ ,  $73.67 \pm 0.94$ ,  $53.83 \pm 0.90$  for AC, BL and CC in Manzini and Shiselweni regions respectively (Table 1). However, FL and NC) were not significantly different across regions. Correlation of significant body measurements (Table 2), were high and significant for BL, CC and NL, suggesting that they are strong predictors of body measurement variability. Observed difference could be due to unequal availability of feed resources. Nsoso and colleagues (2004,) reported an average body weight of  $41.7 \pm 0.5$ kg and heart girth of  $80.5 \pm 0.3$  in mature female Tswana goats, Selolo et al. (2015), reported average BW =  $28.96 \pm 0.37$ kg and BL =  $60.85 \pm 0.29$ cm for South African goats

and Nguluma et al. (2016), BW = 28.97±0.52kg, BL=51.60±0.40cm for Tanzanian goats. More studies on the effect of environment on performance is recommended within and across agro-ecological regions.

**Table 1. Body weight and body measurements of Swazi goats by region**

Variables	Region	
	Manzini	Shiselweni
BW(kg) ±S.E	51.77±1.32 <sup>b</sup>	53.09±1.01 <sup>a</sup>
AC(cm) ±S.E	61.77±1.32 <sup>b</sup>	71.09±1.00 <sup>a</sup>
BL(cm) ±S.E	62.49±0.66 <sup>b</sup>	73.67±0.94 <sup>a</sup>
CC(cm) ±S.E	57.96±1.18 <sup>a</sup>	53.83±0.90 <sup>a</sup>
FL(cm) ±S.E	12.21±0.96	13.09±1.00
NC(cm) ±S.E	23.42±0.62	25.68±0.47
NL(cm) ±S.E	27.57±0.47 <sup>b</sup>	27.42±0.60 <sup>a</sup>
RH(cm) ±S.E	43.56±1.09 <sup>b</sup>	45.89±1.06 <sup>a</sup>
HW(cm) ±S.E	66.51±1.09 <sup>b</sup>	67.23±1.05 <sup>a</sup>

BW=Body weight, AC=Abdominal circumference, BL=Body length, CC=Chest circumference, FL=Face length, NC=Neck circumference, NL=Neck Length, RH=Rump height, HW=Height at wider.

**Table 2. Pearson correlation of significantly different body measurements**

	AC	BL	CC	NL	RH	HW
AC	1	0.569**	0.524**	0.520**	0.033**	0.215
BL	.502**	1	0.527**	0.300	0.190**	0.209*
CC	.590	.576**	1	0.002	0.375**	0.207*
NL	-.199*	.220*	-.004	1	-0.673*	-0.187
RH	-.189	-.396**	-.345**	-.277**	1	0.256**
HW	.206	.209*	.205*	-.194	.262**	1

\*=Significant at P<0.05 \*\* = significant at P<0.01 AC=abdominal circumference, BL=Body length, CC=Chest circumference, NL=Neck Length, RH=Rump height, HW=Height at wider.

## CONCLUSION AND RECOMMENDATION

The Swazi goats possess various environmental adaptive traits like presence of horns, mixed coat colour and exhibit genetic diversity that can be exploited for future breed improvement. This is the first known characterization of Swazi goat and can be used as a benchmark for further investigations. Further studies should be performed to genetically characterise a larger proportion of the indigenous Tswana goat breed for improved food security and increased productivity to benefit resource poor farmers.

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## LITERATURE CITED

Brown, I.E., Hart, S.P., Cameron, M., Sahlu, T. and Goetsch, A.L. (2001) Effects of dietary tallow level on performance of Alpine does in early lactation. *Small Ruminant Research* 39, 233–241.

Katongole, J.B.D., Sebolai, B. & Madimabe, M.J., 1996. Morphological characterization of the Tswana goat. In: S.H.B Lebbie and E. Kagwani (ed.) *Small Ruminant Research and Development in Africa*. Proc. 3rd Biennial Conference of the African Small Ruminant Research Network, UICC, Kampala, Uganda, 5-9 Dec. 1994. pp. 43-46.

- Lebbie S H B and Mastapha P R. 1985. Goat production in the Swaziland middleveld. In: R T Wilson and D Bourzat (eds.), Small ruminants in African agriculture. International Livestock Centre for Africa, Addis Ababa, Ethiopia.
- Lebbie S H B. 1986. The Swazi small ruminant production system: The case of the goat. In: K O Adeniji and J A Kategile (eds.), Proceedings of the workshop on the improvement of small ruminants in Eastern and Southern Africa. Organisation of African Unity/International Development Research Centre, Nairobi, Kenya.
- Monau, P. I., Visser, C., Nsoso, S.J. & Van Marle-Koster, E., 2017. A survey analysis of indigenous goat production in communal farming systems of Botswana. *Trop Anim Health Prod.* 49(6), 1265-1271.
- Msanga, Y.N., Mwakilembe, P.L. & Sendalo, D., 2012. The indigenous cattle of the Southern Highlands of Tanzania: Distinct phenotypic features, performance and uses. *Livest. Res. Rural Dev.* 110, 1-24
- Nguluma, A. S., Huang, Y., Zhao, Y., Chen, L., Msalya, G., Lyimo, C., Guangxin, E., & Chenyambuga, S. W.. 2018. Assessment of genetic variation among four populations of Small East African goats using microsatellite markers. *S. Afri. J. Anim. Sci.* 48(1), 117-127
- Nguluma, A. S., Msalya, G. & Chenyambuga, S. W., 2016. Phenotypic variation among four populations of small East African goats of Tanzania. *Livest. Res. Rural Dev.* 28 (136). Retrieved April 4, 2018, from <http://www.lrrd.org/lrrd28/8/ngul28136.html>
- Nsoso, S.J., Podisi, B., Otsogile, E., Mokhutshwane, B.S. & Ahmadu, B., 2004. Phenotypic characterization of indigenous Tswana goats and sheep breeds in Botswana: Continuous traits. *Trop Anim Health Prod.* 36, 789-800.
- Okpeku M., Yakubu A., Peters S.O., Ozoje M.D., Ikeobi C.O., Adebambo O.A. and Imumorin I.G (2011). Application of multivariate principal component analysis to morphological characterisation of indigenous goats in Southern Nigeria. *Acta Agriculture Slovenica*98(2):101-109
- Rischkowsky, B., Pilling, D., & Scherf, B., 2007. Status of animal genetic resources. In B. Rischkowsky, & D. Pilling (Eds.), Part 1: The state of agricultural biodiversity in the livestock sector — The state of the world's animal genetic resources for food and agriculture (pp. 23–49). Rome: FAO, Commission on Genetic Resources for Food & Agriculture
- Selolo, T.C., Mashiloane, M .L., Norris, D., Ng'ambi, J. W. & Brown, D., 2015. Morphological differentiation of indigenous goats in different agro-ecological zones of Vhembe district, Limpopo province, South Africa. *Indian J. Anim. Res.* 49, 527-531.
- SPSS. 2014. Statistical Package for Social Sciences. SPSS Inc., 444 Michigan Avenue, Chicago, IL60611
- Yakubu, A., Kuje, D. and Okpeku, M. (2009). Principal components as measures of size and shape in Nigerian indigenous chickens. *Thai Journal of Agricultural Science*, 42 (3):167-176.