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Short Communication

Influence of Age and Body Condition Score on Body Conformation and Testicular Traits of Nguni Goats

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ABSTRACT

The study was conducted to determine the effect of age and body condition score on body conformation and testicular traits using 20 Nguni goats. Bucks aged 1- 4 years were used. The body condition was scored on a scale of 1 to 5. The body linear measurements (heart girth (HG), withers height (WH), body weight (BW) and body length (BL), were measured in centimeters (cm) using flexible tape. The testicular measurements (testicular length (TL), testicular circumference (TC), were measured using flexible tape while testicular width (TW) and testicular weight (TWT) were estimated using the appropriate formulae. The ANOVA was used to analyze the data. The results showed that age had a significant effect ($p < 0.05$) on BL, and WH, and it had a highly significant ($p<0.01$) effect on HG and BW but non-significant difference ($P > 0.05$) on TL, TC, TW and TWT. The results also showed that body condition score had a highly significant effect ($p< 0.01$) on BL, BW, WH, and HG but a non-significant effect ($P > 0.05$) on TL, TC, TW, TWT. The study concludes that age and BCS can be used to improve the body conformation of Nguni bucks.

Goats are mostly kept by smallholder farmers for religious and cultural purposes, while they are also kept for socioeconomic reasons (Taruvinga *et al*., 2022). The Nguni goats are probably more prevalent in Southern Africa than other different forms (Mdladla *et al*., 2016). The Nguni goats are raised for their meat, religious and cultural purposes (Chikwanda and Muchenje, 2017). Body weight regarded as a trait of economic importance in animal breeding, since it assists in animal management such as dosing, feeding, selling, and selecting during breeding (Udoh *et al*., 2021), However at rural level animals are being visually assessed for selection when breeding and selling, correct feeding and to administer correct dosage (Yakubu, 2012). The evaluation of superior male to be used for breeding is of great importance to achieve breeding success (Kerketta *et al*., 2015). Age and body condition score have been used for selection of male goats for breeding (Akpa *et al*., 2013; Ambali *et al*., 2013). However, according to our knowledge there is a limited information on the effect of age and body condition score on body conformation and testicular traits on Nguni goats. Therefore, the study aims to determine the effect of age and body condition score on body confirmation and testicular traits in Nguni goats.

Materials and methods

The study was conducted at Mathuba Genetics, situated in Ha-Ravele village near Makhado in Venda, Limpopo, South Africa with coordinates: 23.1005° S, 29.7397° E. The climate is subtropical. Mild afternoons and chilly evenings define the winters. Typically, winters last from June to August. Summers are warm and frequently humid, with sporadic afternoon thunderstorms. The majority of rainfalls take place from November to March during the summer (Selolo *et al*., 2015).

Nguni bucks at the age between 1 and 4 years old were used in the study. The age of the animals was determined using the dentition estimation method by counting the number of permanent incisors that had erupted on the lower jaw. The animals were reared under semi-intensive

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system, where they were released daily in the morning for grazing and browsing and get supplements in the afternoon when they close them in the kraal. Animals were subjected to vaccination against endemic diseases every season and little to no management against ectoparasites.

This study used a cross sectional study design, where all the measurements were taken once from each individual animal. The census sampling approach was applied in this study. A total of 20 breeding bucks were used in the study. Measurement of linear conformation traits (heart girth, wither height, body length) and testicular dimensions were taken on the day of measurements in centimetres (cm) using flexible tape.

Heart girth is the circumference of the body at a point immediately behind the fore limbs and perpendicular to the body axis. The wither height is the highest point over the scapular vertically to the ground. Body length was measured from the point of shoulder to the ischium. Testicular length was measured as the distance along the caudal surface of the scrotum, from its point of attachment to the tip of the scrotum. Testicular circumference is the maximum dimension around the pendulous scrotum after pushing the testes firmly into the scrotum. Testicular width was taken as the division of testicular circumference by two. Testicular weight (TWT) was determined using Bailey *et al*. (1998) formulae as given below: TWT= 0.5533 x TL x TW^2; Where TWT is testicular weight, TL is testicular length, and TW is testicular width.

Body condition score (BCS) was employed to score the bucks (1-5). The buck's backbone, loin and rump areas which do not have muscle tissue covering them and hence combination of skin and fat deposit account for any cover that was felt around these areas were palpated use examined and then scored. Amount of fat deposit was determined using fingertip pressure which was exerted on the backbone, pin bone and hip bone, respectively.

Score 1 (very thin): Individual short ribs have a thin covering of flesh. Bones of the chine, loin and rump region are prominent. Hook and pin bone protrude sharply, with a very thin covering of flesh and deep depressions between bones. Bony structure protrudes sharply and ligament prominent.

Score 2 (Thin): Individual short ribs can be felt but are not prominent. Each rib is sharp to touch but have a thicker covering of flesh. Short ribs do not have as distinct an over-hanging shelf effect. Individual bone is the chine, loin and rump regions are not visually distinct but easily distinguishable by touch. Hook and pin bones are prominent but the depression between them is less severe. Area below tail head and between pin bones is somewhat depressed but the bony structure has some covering of flesh.

Score 3 (Moderate): Short ribs can be felt by applying slight pressure. Altogether, short ribs appear smooth, and the over-hanging effect is not so noticeable. The backbone appears as a rounded ridge, firm pressure is necessary to feel individual bones. Hook and pin bones are rounded and smooth. Area between pin bone and around tail head appears smooth without sign of fat deposit.

Score 4 (Fat): Individual short rib is distinguishable only by firm palpation. Short ribs appear flat or rounded, with no overhanging shelf effect. Ridge formed by backbone in chine region is rounded and smooth. Loin and rump region appear flat. Hooks are rounded and the space between them is flat. Area of tail head and pin bones is rounded with evidence of fat deposit.

Score 5 (Obese): Bony structures of backbone, short ribs and hook and pin bones are not apparent; subcutaneous fat deposit very evident. Tail head appears to be buried in fat tissue.

Statistical package for social sciences (IBM SPSS, 2021) version 28.0 was used for data analysis. Analysis of Variance (ANOVA) was used to determine the effect of age and body condition score body conformation and testicular traits. Shapiro-wilk test was used to test the normality of the data. Least significant difference (LSD) was used for mean separation.

Following general linear model was followed: Yijk = μ + Ai + Ck+ Eik, Where, Yijk is estimates of the given measurable characteristics, μ is over all mean, Ai is effect of i^{th} age, Ck is effect of kth body condition score, and Eik is random error.

Results

Table I shows the influence of age on body conformation and testicular traits of Nguni goats. The

Table I. Influence of age (year) on body conformation and testicular traits of (Mean±SEM) Nguni goats.

Traits	1 Year (n=6)	2 Years (n=6)	3 Years (n=5)	4 Years (n=3)
BL	61.00 ± 2.27^{b}	64.33±3.12^{b}	66.20±4.24^{ab}	75.33±0.33^{a}
BW	27.17± 2.12^{b}	30.50±2.86^{b}	36.80±4.33^{b}	50.67±0.67^{a}
HG	72.83± 1.87^{b}	78.50±1.77^{b}	78.40±3.53^{b}	89.67±1.20^{a}
WH	59.67±1.20 ^{c}	61.67±1.91^{bc}	68.60±3.83^{ab}	71.67±1.20^{a}
TL	10.83± 0.31	10.83±0.31	11.00±0.77	10.33±0.33
TC	22.17± 0.54	22.17±0.91	20.60±1.25	22.33±0.33
TW	11.08± 0.27	11.08±0.45	10.30±0.62	11.17±0.17
TWT	740.65± 47.14	744.35± 61.94	673.04± 103.69	712.53± 21.56

BL, body length; BW, Body weight; HG, heart girth; WH, wither height; TL, testicular length; TC, testicular circumsference; TW, testicular width; TWT, testicular weight; $^{a, b, c}$ means within the same column and factor with different superscripts differ significantly; SEM, standard error of the mean.

results showed that age had a significant effect ($p<0.05$) on BL, and WH, and a highly significant effect ($p<0.01$) on HG and BW. The results also showed that age had a non-significant effect ($p>0.05$) on TL, TC, TW and TWT.

Table II shows the influence of body condition score on body conformation and testicular traits of Nguni goats. The results showed that body condition score had a highly significant effect ($p<0.01$) on BL, BW, WH, and HG and a non-significant difference ($p>0.05$) on TL, TC, TW, TWT.

Table II. Influence of body condition score on body conformation and testicular traits of Nguni goats.

Traits	BCS 2 (n=10)	BCS 3 (n=6)	BCS 4 (n=4)
BL	59.00± 1.71^{b}	69.83± 1.47^{b}	75.00± 0.41^{a}
BW	25.70±1.30 ^{c}	38.00± 1.73^{b}	49.25± 1.49^{a}
WH	59.30± 0.84^{b}	68.17±3.07 ^{b}	71.00± 1.08^{a}
HG	72.90± 1.61^{c}	80.83± 0.40^{b}	88.75± 1.25^{a}
TL	11.00± 0.21	10.67± 0.67	11.00± 0.29
TC	22.40± 0.37	20.50± 1.26	22.50±0.25
TW	11.20± 0.19	10.25±0.63	11.13± 0.13
TWT	766.50±31.00	645.63±95.29	718.50±16.37

For abbreviation and statistical details, see Table I.

Discussion

In meat animals, size and conformation are crucial characteristics (Moaeen-ud-Din *et al*., 2022), their exceptionally high level of productivity in terms of growth and abundance is essential (Fomum, 2015). The selection of fertile bucks for breeding is the primary goal of animal breeding procedures (Duc *et al*., 2015). Firstly, the study focused on determining the influence of age on body conformation and testicular traits. The results of this study indicated that age had a significant influence on body length and withers height, and a highly significant influence on heart girth, and body weight but non-significant influence on all the testicular traits. Four years old bucks had high mean values of body length, body weight, heart girth, and withers height as compared to one year old bucks. The findings of the current study agree with those of Akpa *et al*. (2013) in Red Sekoto goats, and Ambali *et al*. (2013) in local goats of Rohilkhand, who stated that age significantly influenced body weight, body length, heart girth, and withers height. This study also agrees with Ouchene-Khelifi and Ouchene (2021) who stated that body weight, body length, and withers height were significantly influenced by age in Arabia bucks in Algeria. This study disagrees with the study conducted by Akpa *et al*. (2013), Ambali *et al*. (2013), Ouchene-Khelifi and Ouchene (2021), and Kerketta *et al*. (2015) who discovered that age had a significant influence on testicular traits. The difference in this study can be due to environmental conditions, breed, management procedures, nutritional level, and sample size. The findings of this study suggests that an increase in age may result in an increase in body conformation. Age had an influence on body conformation but did not have an influence on testicular traits of Nguni goats.

On determining the influence of body condition score on body conformation and testicular traits of Nguni goats. The results indicated that body condition score had a highly significant influence on body length, body weight, withers height and heart girth, and non-significant influence on all the testicular traits. Bucks with BCS 4 had high mean values of body length, body weight, withers height, and heart girth as compared to bucks with BCS 2 and 3. This study agrees with the study of Akpa *et al*. (2013), Ambali *et al*. (2013), and Kerketta *et al*. (2015), who stated that body condition score significantly influenced body length, body weight, heart girth, and withers height on Red Sekoto goats in Nigeria and local goat of Rohilkhand region in India respectively. This study also agrees with Ouchene-Khelifi and Ouchene (2021) who stated that body weight, body length, and withers height were significantly influenced by body condition score in Arabia bucks in Algeria. This study disagrees with Akpa *et al*. (2013), Ambali *et al*. (2013), Ouchene-Khelifi and Ouchene (2021), and Kerketta *et al*. (2015), who stated that body condition score significantly influenced testicular traits on Red Sekoto goats in Nigeria, Arabia bucks in Algeria, and local goat of Rohilkhand region in India respectively. The difference in this study might be due to the different environmental conditions, breed, management procedures, nutritional level, and sample size.

Conclusion

The current study concludes that age and body condition had influences on body conformation, with consistent improvement in the traits as the animal aged and body condition score increased from score 2 to 4. Bucks with a higher body condition score were proportionally bigger in size (heart girth, withers height, body length) and weighed more (body weight) than bucks with a lower body condition score. Age and body condition score did not influence the testicular traits, no consistent improvement in the traits as the animal aged and body condition score increased from score 2 to 4. This concludes that age and body condition score can be used as a determinant factor for selection of Nguni bucks.

DECLARATIONS

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Ethical statement

This study was approved by the University of Limpopo's Animal Research Ethics Committee (AREC), that provided a certificate with AREC number: AREC/42/2023:UG.

Statement of conflict of interest

The authors have declared no conflict of interest.

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