General linear model analysis of behavioural responses of Boer and Tswana goats to successive handling

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ABSTRACT
The purpose of this experiment was to evaluate the behavioural response of Boer goats and Tswana goats to successive handling. Boer goats and Tswana goats were subjected to aging and tail restrain during handling. Behavioural response was recorded through the vocalisation score (VS), crush score (CS), flight speed (FS), and flight time (FT) scores twice a week for eight weeks. A total of thirty six Boer goats and Tswana goats were used in this experiment. The results indicated that the Tswana goats were the most temperament (p < 0.05) and Boer goats were the calmest. Behavioural scores significantly increased throughout the experiment.

Key words: Behavioural responses, Evaluate, Experiment, Goats, Successive handling.

INTRODUCTION
Goats (Capra hircus) are important domestic animals in many parts of the world. They are generally reared for milk, meat, and skin. Goats provide their owners as well as consumers with a broad range of products. They also played a significant socio-economic role in the social life of many African people, being used as gifts, dowry, in religious rituals and rites of passage (Peacock, 1996; Ng’ambi, 2011). Boer goats and Tswana goats are one of the indigenous goats reared for meat production in South Africa. In South Africa, indigenous goats are reared by most communal farmers under small holder production system (Ndou, Muchenje, and Chimonyo, 2010). These small ruminants are very adaptable and can grow under harsh conditions.

Handling goats refers to how goats are touched, moved, and interacted with during husbandry procedures. These handling practices can all induce stress either psychologically or physically (Rosenvold and Andersen, 2002). An understanding of animal behaviour will facilitate handling, reduce stress, and improve both handler safety and animal welfare. The way in which farm animals are handled by their stock persons, and the fear of people that they can consequently develop, has a major impact on their welfare, regardless of what type of housing system is used (Rushem, et al., 1999).

Less attention is given to the behaviour of goats during handling, especially in developing countries where most of the goats are reared under extensive production system. The understanding of the behaviour of goats during handling, loading and transportation may be of value in the development and management strategies aimed at improving the health and productivity of goats (Minka et al., 2009). The response of an animal to handling and transportation will largely depend on the complex interaction of genetic factors, previous experience of the animal and the handler (Minka, et al., 2009; cited from Grandin, 1997).

The paper aims at analysing the behavioural response of Boer goats and Tswana goats to successive handling. In the study, it was hypothesized that successive handling has an effect on goat behavioural responses. The study utilises Generalised Linear Model (GLM) under experimental method to study the behaviour of goats under successive handling.

MATERIALS AND METHODS
The study was conducted at a farm in Mafikeng located at 25° 51’ 0” S and 25° 38’ 0” E, at an altitude of 1260m above sea level. The area receives an average annual rainfall of about 559 mm and most of the rainfall is received in the hot-wet season (summer). The mean temperature of the area ranges between 22°C – 30°C annually. The vegetation type in Mafikeng is bushveld and the Mafikeng Bushveld consists of important species that are suitable for small stock production.

Thirty six goats, twenty from each of the genotypes, Boer goats and Tswana goats, randomly selected from the herd of twenty three goats were used in the study. The goats were kept in a large, partially sheltered open pen that complies with the welfare standards of animals. During the study, goats had daily access to the grazing camps, but were kraaled in the afternoon. Water was provided ad libitum in drinking troughs. The goats were kept in one pen. The pen

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also had non-experimental goats; this is done so as to give goats the opportunity to develop normal social behaviour. For identification, the experimental goats were painted in both sides with their unique identity number. This ensured that the same goats were used throughout the observation period.

Twice a week (Tuesdays and Thursdays) for eight weeks between July and September 2013, the behavioural response of Boer goats and Tswana goats to basic handling procedures were observed. Goats were subjected to aging and tail restrain during handling. The behavioural responses were measured through vocalization scoring (VS), crush scoring (CS), flight speed (FS), and flight time (FT). Vocalization scoring was compiled through a yes (1) or no (2) scoring for each goat. The goats crush scores were compiled using a four-point scale (1= very quiet, no resistance; 2= has to be forced to move; 3= refuses to move and sprawls; and 4= similar to 3, but very excited) when the goats were forced to move from their pen and into the crush pen (Ndou et al., 2010). Flight speed was compiled through a ranking scale such as 1= walked, 2= trotted, and 3= ran, when goats were released from the crush pen. Flight time was measured using a stop watch to determine the period of time it takes a goat to cover a certain distance (4m) after been released from the crush pen.

The data was analyzed using the General Linear Model (GLM) procedure of SAS (2003) to determine the effect of the breed and handling on the VS, CS, FS and FT. Mean comparison was done using the probability of difference (PDIFF) procedure (SAS, 2003). Differences detected at the 0.05 level or less being considered statistically significant. The following statistical model was used:

\[ Y_{ijk} = \mu + B_i + D_j + (BxD)_{ij} + \epsilon_{ijk} \]

Where \( Y_{ijk} \) is the observation on any of the behavioural activities; \( \mu \) is the overall mean; \( B_i \) = breed effect; \( D_j \) = day of handling effect; \( (BxD)_{ij} \) breed by day interaction effect; \( \epsilon_{ijk} \) is random error term, assumed to be distributed normally with mean of 0 and variance, \( \sigma_e^2 \).

RESULTS AND DISCUSSION

The study evaluated the behavioural response of Boer goats and Tswana goats to successive handling. The flight time of the Boer goats (3.54 ± 0.14) was higher (\( P< 0.05 \)) than that of Tswana goats (3.08 ± 0.14). During the experiment, flight time increased among the two different genotypes. Breed and day interaction effect on flight time are presented in Figure 1. Flight time of Boer goats and Tswana goats increased with an increase in day of handling. Differences (\( P < 0.05 \)) were noted among the two genotypes with higher frequencies (7.29) of vocalisation exhibited by Boer goats and Tswana goats showing the least (2.08). Vocalisation score decreased for all the breeds on successive days of handling. (Fig. 1)

Differences (\( P < 0.05 \)) of flight speed were observed among Boer goats and Tswana goats with Boer goats showing the highest frequency of walking (19.79) and trotting (16.67) behaviour. Tswana goats had the highest frequency of running (26.04) behaviour (Fig 2). Flight speed showed to decrease with most frequencies of walking observed during successive handling. (Fig.2).

The crush scores of the two genotypes are presented in Figure 3. Differences (\( P < 0.05 \)) were observed among two genotypes with higher frequencies of very quiet; no resistance (1) exhibited by Boer goats. Level 4 scale (similar to 3, but very excited) was not observed in Boer goats. Tswana goats had higher frequencies of level 2, 3, and 4 which are 17.71, 8.33 and 1.04 respectively (Fig.3).
In the present study, higher negative behavioural ratings for Tswana goats were observed than for Boer goats. The basis for general differences in behavioural responses of the two genotypes may be multi-factorial. The behavioural responses of goats depend on genotype, the environment, and previous experiment. Similar results were reported by Ndou et al. (2010), who found higher negative behavioural ratings for Nguni and Xhosa lob-eared goats than for Boer goats. According to Madodana et al. (2011), differences in behavioural response may be caused by genetic predisposition as well as conditions, experience, quality and quantity of human contact and handling procedure.

Boer goats, exhibiting calmer temperament indicates that they are easy to handle and handling is time consuming. Boer goats were bred from the indigenous goat breeds of South Africa and due to selective breeding and improvement; Boer goats are reported to be docile and highly adaptable. Therefore, this suggests that temperament can be improved by crossbreeding to produce offspring that are tame. There is reduced risk of injury to the handler as goats do not frustrate the handler and thus resulting in increased animal productivity and welfare. Increased handling reduces difficulties in handling and the likelihood that the animals would threaten or attack the handler.

Differences in flight time are due to the differences in the animal’s temperament. Boer goats had the highest flight time in the current study. This would suggest that the Boer goats were less fearful to the handler. Tswana goats exhibited lower flight times in the current study, indicating that Tswana goats were nervous and fearful to the handler. These goats
were likely to pose danger not only to themselves but also to the handler if they react inappropriately during the routine handling. Flight time of all goats increased throughout the experiment during successive handling. This is however contrary to Ndou et al. (2010) who observed a decrease in flight times for all goats throughout the experiment. An increase in flight time shows that goats were gentled during handling and this lead to a decrease in behavioural ratings throughout the experiment.

The decrease in vocalisation score throughout the experiment indicates that the goats adapted to the handling procedures. This indicates that the handler was no longer a novel object to the experimental animals and the goats approached more slowly (Jackson and Hackett, 2007). Studies have shown that gentled animals are more willing to approach humans and lead the animals to accept aversive handling procedures because animals lose interest in an object or person, with increasing exposure and investigation time. Rushen et al. (1999) reported that goats handled at a younger age remained closer to a human observer and vocalised less when isolated than kids either handled at six months of age or not handled.

The present study indicates that the Tswana goats had higher flight speeds than Boer goats. Causal reasons may be due to the fact that Tswana goats were nervous and more fearful to the handler due to previous handling experience and/or goats being handled negatively. Poor handling leading to an increased fear of humans by farm animals is likely to lead to a number of other undesirable effects besides production. The most likely of this is the increased risk of injury, to both the animals and the stock person (Rushen et al., 1999). The amount and timing of handling of goats is important in reducing such fearfulness.

Differences in flight speeds may also be due to animals’ temperament. Boer goats had the lowest flight speed in the current study. This suggests that Boer goats were less fearful to the handler. Madodana et al. (2011), indicated that animals that show such characteristics have been reported to cope more successfully with routine on-farm handling compared to those with higher flight speeds. Animals gently handled flee from the handling facilities slowly by walking or trotting than animals negatively handled.

CONCLUSION

The Boer goats were the calmest while the Tswana goats were the most temperamental. The results from this study suggest that gentled goats were less stressed and do not affect the general ease of handling. Goats negatively handled results in fear and are aggressive and may cause injury to the handler or themselves during successive handling procedures. Fear of animals to the handler may results in increased losses in productivity, increased handling difficulties, and diminished animal welfare. Increased gentle handling of goats from a young age can help animals reduce fear of humans and thus resulting in better overall health, increased productivity, and meat quality.

REFERENCES