Journal of Agricultural Science and Food Technology
Vol. 1 (6), pp. 78-83, November, 2015
ISSN: 2449-1815
Research Paper
http://pearlresearchjournals.org/journals/jmbsr/index.html

Reproductive Performance of the Galla and Toggenburg Goats and their Crosses in Mwingi Sub-county of Kenya

Ndeke AN[1], HM Mutembei[2]*, VT Tsuma[2] and ER Mutiga[2]

Accepted 16 October, 2015

[1]The Andys Veterinary Clinic, P.O Box 253 00606 Sarit Centre, Kenya.
[2]University of Nairobi, P.O Box 29053 00625 Kangemi, Kenya.

ABSTRACT

Retrospective data from 311 goats comprising Galla and Toggenburg and their crosses for seven years was used to determine and compare their reproductive performance in Mwingi. Goats were kept under extensive conditions with natural breeding program. Kidding occurred all year round with a peak in August. The average age at first kidding was 1066.7±37.7 and 976.0±79 days for the Galla x Toggenburg cross and the Toggenburg, respectively. The average kidding intervals were 464.6±28.7, 439.2±39.5 and 371.7±63.1 days for the Galla, Galla x Toggenburg crosses and Toggenburg, respectively. The effect of breed on the litter size and number of services per conception was significant ($p<0.05$). The average litter size were 1.25±0.02, 1.29±0.04 and 1.0±0.07 for the Galla, Galla x Toggenburg crosses and Toggenburg, respectively. The average number of services per conception was 1.6±0.05 and 1.36±0.07 for the Galla and Galla x Toggenburg crosses, respectively. In spite of feed supplementation, the purebred Toggenburg. Performance was significantly lower than that of the Galla and the Galla x Toggenburg crosses. The study indicated that the Galla x Toggenburg cross was a better genotype in terms of reproductive performance in Mwingi and recommended as a better adapted goat in the area than the pure Toggenburg.

Key words: Reproductive indices, Galla goat, Toggenburg goat, Mwingi and Kenya.

*Corresponding author.E-mail: hmutembei@uonbi.ac.ke.

INTRODUCTION

Agriculture is the backbone of Kenya's economy contributing over 25% of the gross domestic product (GDP). It is the lifeline of about 80% of this country's poor and contributes 70% of the national employment (Muriuki, 2001). The livestock sector in particular, contributes about 12% of Kenya's GDP, 40% to the agricultural GDP and employs 50% of the agricultural labor force. Goats form an integral component of the livestock sector in Kenya. The goat population in Kenya is estimated at 27,740,153 and is spread throughout all agro-ecological zones of the country, because of their size and feeding habits (Muriuki, 2009). In view of the decreasing land sizes coupled with the increasing human population, goat rearing is becoming an important livestock keeping enterprise. Compared to other farm animals, goats require lower capital to acquire, they are easy to manage due to their small size and ability to feed on a wide spectrum of forages, have a high fecundity and require small land areas to keep.

There are two indigenous goat breeds in Kenya, the Galla and the East African. Indigenous goats are generally low producers both in terms of milk production and growth (low mature weights). Opportunities exist to improve productivity, adaptation and welfare of these breeds through within-breed selection and crossbreeding. Genetic improvements are small but cumulative, making it a powerful way of increasing efficiency in animal production Nakimbugwe et al., 2002). Improvement by

Table 1. Average age (day) at first kidding for Toggenburg and GallaXToggenburg crosses (Mean±S.E.).

Group	N	Age (day)
Crosses	123	1066.73±37.69
Toggenburg	28	976.04±79

selection is however considered too slow and expensive (Mchau, 1979). It also requires that most of the flocks be officially performance and pedigree recorded if desired levels and rates of genetic improvements are to be achieved (Ahuya et al., 2001). Consequently crossbreeding of some native breeds with selected exotic breeds has generally been accepted in principle and practiced as a shortcut to genetic improvement of indigenous livestock under smallholder farmer management (Kebede, 2000). Goats are good entry points for poverty alleviation and improved livelihoods for rural communities.

Dairy goats have consequently been introduced in various areas of Kenya as a poverty alleviation strategy. Various exotic breeds, the Toggenburg, the German Alpine and the Saanen have been introduced in various parts of the country by non-governmental organizations (NGO). The criterion for introducing a particular breed in a particular area has been lacking, and has been primarily dependent on the NGO operating in that area. The German Alpine was introduced by the German Technical Cooperation (GTZ) in Nyeri, Embu, and Kirinyaga, and the Toggenburg by FARM Africa (an NGO started to help rural farmers in Kenya and Ethiopia) in the Meru and Kitui Counties. Although there have been many research and development programs that have introduced genetically improved goats within the country, their productivity in these new environments and production systems have not been well documented. This study seeks to provide a baseline report on the reproductive performance of the Toggenburg goats and their crosses in the areas under study.

MATERIALS AND METHODS

The study was carried out in Nzeluni division, Mwingi district, Kitui County. Mwingi district is located between 400 to 1800 m above sea level and at 00° 56' 00" S latitude and 38° 04' 00" E longitude. The climate is hot and dry for most part of the year and is characterized by erratic and unreliable rainfall. The region experiences two rainy seasons with long rains falling between March and May and the short rains between November and December. The average annual rainfall is between 400 to 700 mm, which makes the area less productive and unreliable for most farming activities. The area is grouped under agro ecological zone V. Most of the land lies between the arid and semi-arid climate. A retrospective study was used to determine the reproductive performance of the Galla goat, Toggenburg and their crosses. Data on reproductive performance of goats of various genotypes was collected from farm records of participating farmers in a community based on dairy goat genetic improvement and health care program initiated by FARM Africa and the Government of Kenya (GoK) in Mwingi and Kitui districts.

Group records from seven farmer groups were obtained for the study. A brief non structured interview with the chairpersons of the farmer group was conducted. Seven year (2006 to 2013) retrospective data from farmer groups were obtained. These were compared to those obtained from the central breeding station (KMGBA) for the pure Toggenburg. Information from these records was put on Microsoft Excel spread sheets then transferred to Genstat Discovery (Copyright 2011, VSN International Ltd.). Qualitative and quantitative data collected were analysed using Analysis of Variance and The Least Significant Difference (LSD) was used to determine differences among the means for the various reproductive indices studied.

RESULTS

The farmer groups comprised of between 19 to 25 members; 79.65% of them were females and 20.3% males. Records of 311 goats; 160 Galla goats, 123 Galla x Toggenburg crosses and 28 pure Toggenburg goats were available for the period 2006 and 2013. Of these, 478 birth records were used for the study; 60, 31 and 9% for the Galla (n=286), Galla x Toggenburg crosses (n=148) and for the pure Toggenburg breed (n=44). The Galla and the Galla x Toggenburg crosses goats were kept under extensive management system while the pure Toggenburg goats were kept under intensive management system. Breeding of the goats was by natural service. For the Galla goats and Galla x Toggenburg crosses breeding was by hand mating. However, the pure Toggenburg goats were kept together with their bucks throughout the year and mated freely whenever on heat. The average ages at first kidding for the Galla x Toggenburg crosses and the Toggenburg are presented in Table 1 and the average kidding intervals in days for the Galla breed, Galla x Toggenburg crosses and Toggenburg breed are presented in Table 2. There was 23.43% (67/ 286), 29.05% (43/148) and 0% twinning rate in the Galla goats, the Galla x Toggenburg crosses

Table 2. Average kidding interval (day) among goats of the three genotypes (Mean±S.E.).

Group	N	Kidding interval (day)
Crosses	28	439.2±40.42
Galla	53	464.6±30.51
Toggenburg	11	371.7±29.39

*Significantly different at p<0.01.

Table 3. Average litter size by goat genotype (Mean±S.E.).

Group	N	Litter size*
Crosses	148	1.291±0.03
Galla	286	1.255±0.02
Toggenburg	44	1.000±0.00

Table 4. Average number of services per conception for the Galla and Galla Toggenburg Crosses (Mean±S.E.).

Group	N	Number of services per conception*
Crosses	144	1.361±0.05
Galla	277	1.606±0.05

*Significantly different at p<0.01.

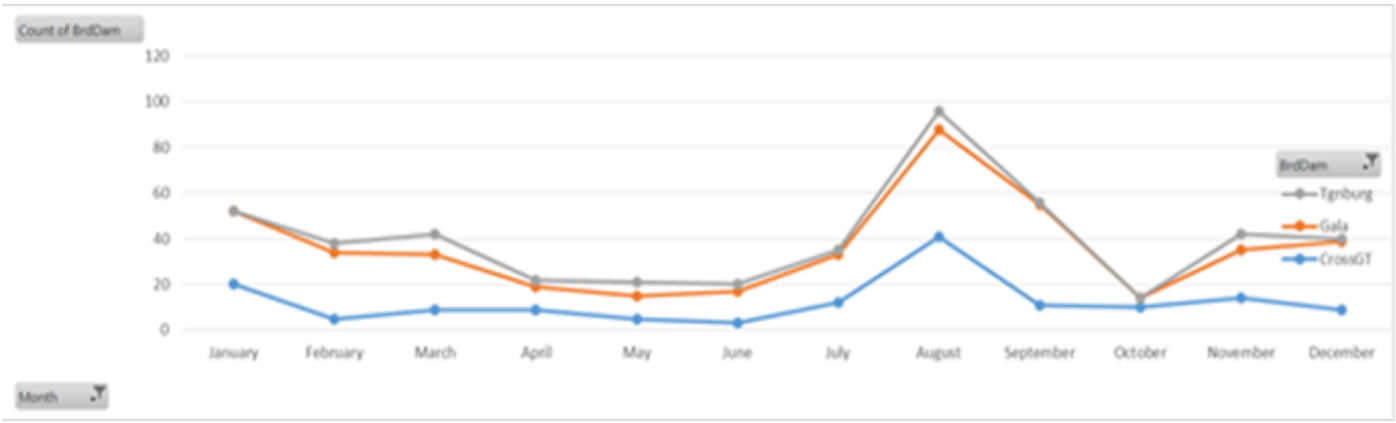

Figure 1. Monthly distribution of births per breed.

the Toggenburg goats, respectively. The average litter sizes for the Galla, Galla x Toggenburg crosses and Toggenburg are presented in Table 3. The average number of services per conception for Galla breed and Galla x Toggenburg crosses are presented in Table 4. The breed had a significant effect on this index (p<0.01). The pattern of parturition for all the goats did not indicate any seasonality other than showing some peak patterns in some months; parturitions occurred all year round with the high and low peaks observed in August (20%) and in October (2%), respectively (Figure 1).

DISCUSSION

Retrospective data was used for this study to document the reproductive indices of the studied goat breeds. Other previous authors have used similar data to study and document reproductive indices for other animals (Mutembei et al., 2000). From the data collected there was significant breed effect on the number of services per conception and the litter size within farmer groups. The farmer group had also an effect on the age at first kidding and litter size. This could be attributed to the

different management strategies within farmer groups. Eighty percent of the group members in this study were women, who in addition to the project requirements that targeted to empower them towards poverty alleviation also as demonstrated by other authors, women have keener observation on expected project targets than their male counterparts (Verbeek et al., 2007; Kosgey et al., 2008; Ogola et al., 2010).

The reported age at first service for the Galla x Toggenburg crosses of 849.31 ± 37.75 days varies from others for other dairy goats introduced in Kenya. Mbai et al. (2001) reported 599 days the German Alpine crosses in Central Kenya. The difference could be due to breed or management practices and the fact that German Alpines were crossed with the Small East African Goats and not the Galla goat. The German Alpine and the Small East African goat have been documented to be superior breeds compared to the Galla and the Toggenburg goats (Njoro, 2001). Fluctuating feed availability due to inconsistent rainfall in Mwingi and lack of supplementation for these goats may have also contributed to the higher age at first service for this breed in Mwingi. Also it is well recognized that the nutritional status of animals have significant influence on their reproductive performances (Lassoued et al., 2004) and supplementations applied during nutritional management strategies can modulate the oestrous cycle and affect reproductive performances (Fatet et al., 2011). Animals that are well fed have better growth rates and reach puberty before the animals fed poorly (Noakes et al., 2001).

It was not possible to determine age at first service for the Galla goat and the Toggenburg breed mainly because no records were kept for the Galla goats in Mwingi prior to the introduction of the goat improvement program by the project and the fact that Toggenburg goats were always kept together with their bucks and farmers did not see the need to observe when the doe first came on heat. This management strategy of keeping Toggenburg does with the buck was to safeguard from reproductive losses due to skipped heats because the newly introduced breed was highly valued by farmers. This study reported age at first kidding for the Galla x Toggenburg crosses of 1066.73 ± 37.69 days. This is significantly higher than those reported for the German alpine crosses in Kenya (Mbai et al., 2001), for the Norwegian crosses in Tanzania (Kiango, 1996) and for the Kamorai X Small East African Goat crosses in Tanzania (Das and Sendalo, 1990).

The cooler climate of the Eastern highlands of Kenya may have favoured the Toggenburg goats which are fairly hairy animals, a fact that predisposes them to heat stress in the hot temperatures of Mwingi hence depressing their performance in that area. It has been shown that heat stress depresses reproductive performance by increasing the anoestrus period (Abassa, 1995). The reported age at first kidding for the pure Toggenburg (976.04 ± 79 days) was not significantly different ($p<0.01$) from that of the Galla goat but it was higher than that reported for the Toggenburg in Kongwa and Babati in Tanzania (Kiwuwa, 1986). The breed did not significantly affect age at first kidding within Mwingi ($p<0.01$). Poor nutritional status was an investable factor in the semi-arid climatic conditions of Mwingi that definitely affected ages at first service and kidding for the goats in this area; both parameters are directly interrelated unless otherwise disrupted by any factors that disrupt conception and pregnancy (Sachdeva et al., 1973; Mutembei et al., 2000).

The observation that no significant differences between breeds could mean the breeds and their crosses were equally adapted in Mwingi. This was a bit surprising because it was expected the newly introduced pure Toggenburg breed could be less adapted. Increased attention of this breed by farmers may have cushioned it against environmental and nutritional stresses. The reported average kidding interval for the Galla x Toggenburg crosses in Mwingi (439.2 ±39.5 days) was significantly ($p<0.01$) longer than those reported for the German alpine crosses in Central Kenya (Mbai et al., 2001), for the Alpine x Small East African goat in Rwanda (Wilson and Murray, 1988), for Blended x Galla crosses (Das and Sendalo, 1989) and Norwegian crosses (Kiango, 1996) in Tanzania. The kidding interval of the Toggenburg in Mwingi (371.7 ± 29.39 days) was higher than those observed by Ahuya et al. (2009) in Meru (302±117 days). The Galla goat had significantly longer kidding intervals compared to those reported previously for Galla goats in Northern Kenya (Kiwuwa, 1986). These differences may be due to either breed effects or management differences.

The average litter size for the Galla breed was 1.25 kids/ kidding and compared well with that reported by Abassa (1995) for Sub Saharan Africa's native goats (1.05 to 1.87 kids). The reported twinning rate for the Galla and the Galla x Toggenburg crosses also agrees with those reported by Abassa (1995) in goats in sub-Saharan Africa under traditional rearing systems.

It was however unexpected that the Toggenburg goats in Mwingi had 0% twinning rate in spite of the breed managed better by farmers than the Galla breed and its crosses. It is worth noting that Toggenburg goats were in addition kept together with the bucks a practice meant to reduce reproductive wastages of missed heats and non-optimized litter sizes. The non-twinning rate by the Toggenburg goats may be attributed to their long hair coat which could have led to heat stress within the high environmental temperatures of Mwingi. This has been

explained earlier by Armstrong (1986), who postulated that heat, like other environmental stresses, may interfere with the hypothalamo-hypophyseal gonadal system resulting in disruption of the normal pattern of gonadotropin secretion. Heat stress also may alter ovarian function directly or indirectly through other organs involving metabolic interactions, which change the balance of feedback control of the hypothalamo-pituitary-ovarian system.

This eventually affect follicular development, ovulation and twinning rate (Sodip et al., 2003). It is recommended that such goats need flushing with feeds of high energy diet to increase chances of multiple births (Sachdeva et al., 1973). Kidding occurred all year round in all the breeds with an observed peak in August. This agrees with reports by Mbai et al. (2001) in central Kenya. The goats were therefore non seasonal breeders in Kenya as also was observed by Sodiq et al. (2003) for other goats in tropics. The number of services per conception for the Galla x Toggenburg crosses was 1.361 ± 0.05. These results are in agreement with those reported for the German alpine crosses in Kenya (Mbai et al., 2001). Reports on number of services per conception for local African goat breeds is widely scarce but this results indicates this goat is of good fertility rate. There was a significant breed effect on this index which could be attributed to practice of hand mating practiced in Mwingi. This practice can easily influence the index as the observation of heat and timing of service were dependent on farmer knowledge and level of experience. This may also explain why the crosses were bred fewer times than the Galla. However, as is expected with crossbreeding, the progeny in this study had better levels of fertility than their parents (Fatet et al., 2011).

The Galla x Toggenburg crosses performed better ($p<0.01$) than the Galla and Toggenburg goats (litter size, kidding interval, and number of services per conception). Thus, with improved management the Galla x Toggenburg crosses have the potential to perform well in Mwingi. In spite the harsh climatic conditions of Mwingi, the Toggenburg goats had a shorter kidding interval and can therefore be used for Galla goat crossing in Mwingi because also their crosses with the Galla performed better when compared with the pure Toggenburg goats The study recommends use of Toggenburg bucks for genetic improvement of the the Galla goat in Mwingi sub-county of Kenya.

CONCLUSION

The study revealed that in spite the harsh climatic conditions of Mwingi, the Toggenburg crosses were well adapted and performed better when compared with the pure Toggenburg goats. Thus, the study recommends use of Toggenburg bucks for genetic improvement of the Galla goat in Mwingi sub-county of Kenya.

REFERENCES

Abassa KP, 1995. ILCA working document – Reproductive losses in small ruminants in Sub-Saharan Africa: Review. http://www.fao.org/Wairdocs/ILRIx 546DE/x546OeOO.htm. Accessed 10 December, 2015.

Ahuya CO, AM Okeyo C, Hendy, 2001. Community-based livestock improvement: A case study of FARM-Africa's goat improvement project in Meru, Kenya. Paper presented at the 28th Tanzania Society of Animal Production, Scientific Conference, Tanesco Training Institute, Morogoro, Tanzania, 7-9 August 2001.

Ahuya CO, Ojango JMK, Mosi RO, Peacock CP, Okeyo AM, 2009. Performance of Toggenburg dairy goats in smallholder production systems of the eastern highlands of Kenya. J. Small Rum. Res. 83: 7-13.

Armstrong DT (1986). Environmental stress and ovarian function. Biol. Reprod. 34: 29-39.

Das SM, Sendalo DSC (1990). Comparative performance of improved meat goats in Malya, Tanzania In*:* Proceedings of the First Biennial Conference of the African Small Ruminant Research Network held at ILRAD, Nairobi, Kenya, 10-14 December 1990. pp. 445-452.

Fatet A, Rubio MTP, Leboeuf B (2011). Reproductive cycle of goats. Ani. Reprod. Sci. 124:211-219.

Kebede WA (2000). Do smallholder farmers benefit more from crossbred (Somali x Anglo-Nubian) than from indigenous goats? Doctoral Dissertation Submitted for the degree of Doctor of Agricultural Sciences of the Faculty of Agricultural Sciences Georg-August University of Goettingen.

Kiango SM (1996). Studies on factors affecting performance of dairy goats and on socio economic aspects of dairy goat production in Tchenzema and Dareda wards in Tanzania. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania, p.184.

Kiwuwa GH, 1986. Breeding strategies for Small Ruminant production in Eastern and Southern African. Breed characters and general performance. In: Improvement of Small Ruminant in Eastern and Southern Africa (Edited by Ademiji, K. O. and Kategile, J. A.), OAU/IDRC, Nairobi, Kenya. pp. 31-38.

Kosgey IS, GJ Rowlands, JAM van Arendonk, RL Baker, 2008 Small ruminant production in smallholder and pastoral/ extensive farming systems in Kenya. J. Small Rum. Res. 77: 11-24.

Lassoued NM, Rekik M, Mahouachi M, Hamouda B (2004). The effect of nutrition prior to and during mating on ovulation rate, reproductive wastage, and lambing rate in three sheep breeds. Small Rum. Res. 52:117-125.

Mbai K, Krause AK, Munyua SJM, Von der Ohe W, Wabacha JK (2001). Improved livelihoods of rural poor in central province through the rearing of dairy goats II: Goat health, reproductive performance and economic performance. Presented at the annual scientific conference of the Kenya Veterinary Association, April 2001.

Mchau KW, 1979. Influence of Boer goats for crossing with Tanzanian goats. MSc thesis, University of Dar es Salaam, Tanzania. p.92.

Muriuki HG (2001). Smallholder dairy production and marketing in Kenya. In Smallholder dairy production and marketing—Opportunities and constraints. Proceedings of a South–South workshop held at NDDB, Anand, India.pp.13-16.

Mutembei HM, Mutiga ER, Tsuma VT (2000). A retrospective study on some reproductive parameters of German Shepherd bitches in Kenya.J. South Africa Vet. Assoc. 71 (2): 115 -117.

Nakimbugwe HN, Semambo DKN, Ndumu DB, 2002. The animal breeding act as a strategy and instrument in streamlining animal breeding activities in Uganda. In. Proceedings of the seventh World Congress on

Genetics applied to Livestock Production. Vol. 33, Montpellier France August pp. 373-376.
Njoro NJ, 2001. Community initiatives in livestock improvement:a case for Kathekani, Kenya. Intermediate Technology Development Group Eastern Africa (ITDG-EA) Report 2001.http://archive.unu.edu/env/plec/cbd/Montreal/papers/Njoki-Njoro.pdf accessed 10/12/2015).
Noakes D, Parkinson TJ, England GCW (2001). Arthur's Veterinary Reproduction and Obstetrics. 8th Edition, Elsevier Ltd., London, p. 864.
Ogola T DO, Nguyo WK, Kosgey IS (2010). Dairy goat production practices in Kenya: Implications for a breeding program. Livest. Res. Rural Develop. 22 (1): 16
Sachdeva K, Sengar O, Singh S, Lindahl I (1973). Studies on goats. I: Effect of plane of nutrition on the reproductive performance of does. J. Agric. Sci. 80: 375-379.
Sodiq A, Adjisoedarmo S, Tawfik ES (2003). Reproduction rate of Kacang and Peranakan Etawah goats under village production systems in Indonesia. International Research on Food Security, Natural Resource Management and Rural Development. Deutscher Tropentag-Göttingen, 8-10 October 2003.
Verbeek E, Kanis E, Bett RC, Kosgey IS (2007). Socio-economic factors influencing small ruminant breeding in Kenya. Livest. Res. Rural Develop. 19: 1-6.
Wilson RT, Murray T (1988). Productivity of the small East African goat and its crosses with Anglonubian and the Alpine in Rwanda. Trop. Anim. Health Prod. 20: 219-228.