Uganda Journal of Agricultural Sciences, 2004, 9:543-548
ISSN 1026-0919

Population screening for selection of bucks and does of the Mubende goat in Uganda

J. Oluka, P. H. Petersen[1], G. H. Kiwuwa[2] and F. B. Bareeba[2]

Serere Agricultural and Animal Production Research Institute (SAARI), P.O. Box Soroti, Uganda
[1]Department of Animal Science and Animal Health, The Royal Veterinary and Agricultural University (KVL), Denmark
[2]Department of Animal Science, Makerere University, Kampala

Abstract

Sixty goats of Mubende breed were categorized in the field into large and ordinary size animals on the basis of heart girth. Subsequently, two large and five ordinary bucks as well as 53 does were purchased from the farmers and assembled at Makerere University Agricultural Research Institute, Kabanyolo (MUARIK). Four experimental groups were formed and random within-group mating was undertaken of large bucks x large does, large bucks x ordinary does, ordinary bucks x large does and ordinary bucks x ordinary does. The progenies were evaluated for birth and weaning weights. Of the original 53 mated does, 39 kidded. Only one of the ordinary bucks produced progenies and thereby the intention of having a balanced sample of ordinary and large sized bucks was not achieved. Consequently, a comparison of the genetic difference between the two categories was not feasible. The kids from large dams were 0.27 kg heavier at birth than kids of ordinary dams (p<0.001). The overall development strongly indicated that doe size has lasting effect from birth to yearling weights. However, the differences could not be separated into direct genetic, maternal genetic and non-genetic maternal effects for birth weight.

Key words: Buck size, dam size, kid weights, maternal effects

Introduction

In Uganda, 95% of goats (*Capra hircus*) are indigenous, the major breeds being the Small East African (SEA), Mubende and Kigezi. These indigenous breeds have evolved through generations of adaptation to the local harsh environment. The ability to survive and adapt to harsh conditions as well as growth capacity is a function of the genetic potential of the animals. During the past decade, there has been significant importation of exotic meat and dairy goat breeds for crossbreeding with the indigenous breeds with the objective of increasing meat and milk production. This improvement initiative is being implemented without sufficient information on genetic characteristics of indigenous and exotic breeds under the prevalent local production conditions.

Establishing the genetic potential of the breeds is an important initial step towards improvement and development of the population. However, there is lack of necessary information on performance of indigenous goats under local conditions both on-station and on-farm needed in order to establish breeding programmes for genetic improvement of productivity. Screening of goat populations in the field for large body size is a means of selection of large sized bucks and does. Therefore, this experiment was carried out with an objective of evaluating the effect of screening and selection of Mubende bucks and does based on measurement of heart girth.

Material and methods

A field survey was conducted in the central region of Uganda in order to collect goats from farmers. Through interaction, visual observation and heart girth measurements, 7 bucks and 53 does were collected and assembled at Makerere University Agricultural Research Institute (MUARIK) located 18 km north of Kampala within the tall grassland area typical of the Lake Victoria basin where the study was conducted from 1996 to 1997. The bucks and does were categorized into large size and ordinary size (control) groups according to heart girth measurement of above and below 80 and 76 cm, respectively, based on procedures used by Skea (1986). In total, two large bucks and 26 large does as well as five ordinary bucks and 27 ordinary does were assembled.

Four mating groups were established Ordinary buck x Ordinary doe, Large buck x Large doe, Large buck x Ordinary doe (Reciprocal I) and Ordinary buck x Large doe (Reciprocal II). Oestrus synchronization was carried out on all the does prior to mating using prostaglandin hormone (PGF2a) as ENZAPROST-25**.** Does that did not conceive were re-mated. Only 1 ordinary buck and 2 large bucks were successfully mated with 39 does, of which 13, 22 and 4 were single, twin and triplet deliveries totaling to 69 kids.

All goats were managed on free range with supplementary feeds in form of mixtures of chopped elephant grass and lab lab (*L. pupureus cv. rongai*), and occasional concentrates. Routine drenching with antihelmintics was done monthly. Live body weight and heart girth measurements of the does were taken regularly during mating, pregnancy and post kidding period based on procedures similar to those used by Madubi et al. (1996). Kid were weighed weekly from birth to 52 weeks of age using a 20 kg range Salter® scale within 24 hours after birth prior to suckling or exposure to other feed.

An analysis of variance (ANOVA) on kid body weights was conducted using fixed effects model of the GLM procedure with least square means (LSM) to test the differences between means (SAS, 2000). Preliminary analyses showed that the buck x doe interaction effect and season effects were not significant. The final model was:

Results

Birth weight
The mean birth weight of kids from large dams was 2.12±0.06 kg, which was significantly higher than that of kids from ordinary dams by 269±0.07 kg (p<0.001) (Table 1,2 and 3). Birth weight was not affected by the size of buck (P>0.05). The mean birth weight of male kids was 2.05±0.05 kg being heavier than females by 0.132±0.065 kg (P<0.05). Single born kids were heavier at birth than twins by 0.303±0.027 kg (P<0.001) and triplets by 0.685±0.118 kg (P<0.001). Twins were also heavier than triplets by 0.382±0.09 kg (P<0.01).

Weaning weight
Kids born by large dams had a mean weaning body weight at the age of 16 weeks of 8.84±0.45 kg which showed no difference from kids from ordinary sized dams though higher by 0.696±0.55 kg (P>0.05). Throughout the pre-weaning period, kids born by large dams were superior in body weight than those from the ordinary does (Fig. 1).

Weaning weight for kids sired by large size bucks were 9.44±0.39 kg showing higher birth weights than the kids from the single ordinary buck (P<0.001). At weaning, male kids continued to be superior to females but this was not significant (P>0.05). However, single born kids persisted to be superior in body weight to both twins and triplets at weaning with a mean body weight of 11.58±0.72 kg, a value that was higher than that of the twins (P<0.001) and triplets (P<0.001) (Table 3). Twins were also heavier than triplets at weaning age (P<0.01).

Yearling weight
At the age of 48 months old, kids born by large does had a mean body weight of 15.40±0.79 kg, which was higher than those from ordinary dams by 2.226±0.95 kg (P<0.05). However, kids from large bucks were significantly heavier (P<0.01) with a mean body weight of 15.17±0.67 kg. In this study, male kids were lighter at the age of 48 weeks old than females by 0.271±0.922 kg, though not significant (P>0.05), which showed females overtaking the males in growth. Litter size continued to influence body weight as singles continued to be superior to twins and triplets though the differences were reducing with twins and triplets showing no difference in weights (Table 3).

Pre-weaning growth rate
The overall population pre-weaning growth rate of kids from birth to 16 weeks old was 55.302±0.16.434 gm. The growth rates of kids from large bucks versus the single ordinary buck were different (P<0.05) but the rate of growth of kids from large dams was higher than the population mean being 59.297±3.997gm^{-day} though not different from those of the ordinary does (Table 3). The pre-weaning growth rate of the male and female kids was no different (P>0.05) but single born kids growth rate was 86.709±6.821, which was higher than twins (P<0.01) and triplets (P<0.01) while twins and triplets did not differ in growth rate.

Discussion

Birth weight
This results of this study has revealed mean kid birth weights comparable to those reported by Sacker and Trail (1966), Kiwuwa (1986a), Kyomo (1978), Nsubuga (1996), Kiwuwa (1986) and Okello (1993) and Kakusya (1976). The study also showed significant effect of the dam on kid birth weight. The significant difference for birth weights between elite and control dams evidently indicates that body size of does has influenced birth weight of kids. Although the differences between the two doe groups were not significant at weaning (Table 1) the overall development strongly indicate that doe size has an lasting effect from birth to yearling weights (Fig. 1).

Table 1 Analysis of variance of kid weights and pre-weaning growth rate

Source	Birth			Weaning (week 16)			Yearling (week 48)		
	Df	*MS*	*P>F*	*Df*	*MS*	*P>F*	*Df*	*MS*	*P>F*
Buck size	1	0.206**ns**	0.0891	1	34.414**	0.0033	1	25.889**	0.0093
Doe	1	1.022***	0.001	1	5.65ns	0.2147	1	51.34*	0.0235
Sex	1	0.283*	0.0474	1	1.127**ns**	0.5770	1	0.799**ns**	0.7705
Litter size	2	1.187***	0.0001	2	56.01***	0.0001	2	33.31*	0.0366
Residual	60	0.0691		46	3.57		40	9.26	

Key: ns= P>0.05; * = P<0.05; ** = P<0.01; *** = P<0.001

Table 2. Least square mean (±SE) kid body weight differences due to effect of doe size, kid sex and litter size (kg)

Effects	Birth	Week 16	Week 48
Overall mean	1.998±0.263	8.203±1.889	13.963±3.043
Large-ordinary doe	0.269±0.070	0.696±0.552	2.226±0.945
Male-female kid	0.132±0.065	0.301±0.535	-0.271±0.922
Single-twin	0.303±0.027	3.88±0.258	3.63±0.529
Twin-triplet	0.382±0.091	1.48±0.752	0.81±1.223
Single-triplet	0.685±0.118	5.36±1.010	4.436±1.752

Table 3. Least square means (±SE) for kid body weights and pre-weaning growth rate

Effect	**Body**	**weight (kg)**		**Growth rate (g^{-day})**
	Birth	**Week 16**	**Week 48**	**Week 0-16**
Overall mean	2.00±0.04	8.20±0.04	13.96±0.23	55.302±16.434
Buck size				
Large buck	2.05±0.05^{a}	9.44±0.39^{a}	15.17±0.67^{a}	68.435±3.786^{a}
Ordinary buck	1.92±0.06^{a}	7.56±0.52^{b}	13.40±0.96^{a}	49.703±4.567^{b}
Doe size				
Large doe	2.12±0.06^{a}	8.84±0.45^{a}	15.40±0.79^{a}	59.297±3.997^{a}
Ordinary doe	1.85±0.05^{b}	8.15±0.43^{a}	13.17±0.80^{b}	58.841±4.037^{a}
Kid sex				
Male	2.05±0.05^{a}	8.65±0.43^{a}	14.15±0.77^{a}	60.276±3.933^{a}
Female	1.92±0.05^{b}	8.35±0.45^{a}	14.42±0.80^{a}	57.863±3.930^{a}
Litter size				
Single	2.32±0.08^{a}	11.58±0.72^{a}	16.97±1.37^{a}	86.709±6.821^{a}
Twin	2.01±0.04^{b}	7.70±0.32^{b}	13.35±0.56^{b}	51.266±2.879^{b}
Triplet	1.63±0.08^{c}	6.22±0.69^{b}	12.53±1.14^{b}	39.233±6.081^{b}

Key: a, b,c LSMeans ± SE within an effect in a particular column are significantly different

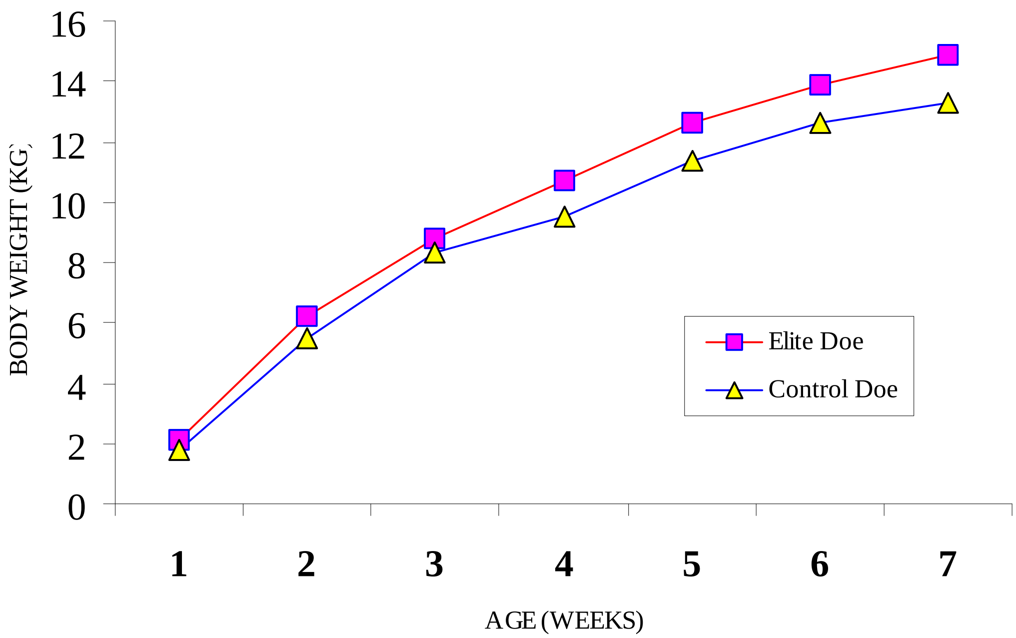

Fig. 1. Growth curves of Mubende goat kids by doe size

These differences may be due to direct additive genetic effect of the dams, genetic maternal effect and/or non-genetic maternal effects, i.e. the higher birth weights of kids from large sized dams could result from a combination of the dam's own additive genetic effect and its ability to provide a conducive intra-uterine environment through the supply of nutrients during the intra-natal the periods. The genetic and non-genetic mothering ability during the pre-weaning period could positively contribute to an advantage for the large kids throughout the first year Ahuya, 1987). However, it was not possible to clearly separate these effects due to the inadequate experimental design in this context. As only one of the ordinary bucks produced progenies, the intention of having an adequately balanced sample of large and ordinary bucks was not achieved and consequently a comprehensive comparison of the genetic difference between the two categories was not feasible. And also since only one single ordinary buck was used in the study against two large bucks, the observations attributed to buck size effect are not conclusive.

These findings are, however, in general agreement that both dam and sire body weights influence birth weight of a breed but with a greater influence exerted by the adult weight and age of the dam (Berhanu *et al.*, 1991; Ruvuna *et al.*, 1988; Das, 1993). Does should therefore be mated when their ages and weights are adequate enough if higher birth weights are to be achieved. Ewes that were mated at a young age produced low birth weight lambs (Wilson, 1987). Older dams have an advantage of higher parities associated with progressively heavier birth weight (Das and Acharya, 1980; Inyangala *et al.*, 1990; Osnowo *et al.*, 1994; Gebrelul *et al.*, 1994; Nagpal and Chawla, 1985; Wilson and Murayi, 1988). However, the birth weight values in this study were generally lower than those reported for the blended goats at Malya in Tanzania probably due to a high component of Boer crossbred blood in the composite cross (Das, *et al.*, 1993).

As a side effect of this study it was found that male kids were heavier than female kids at birth and weaning, whereas females were heavier at 48 weeks (Table 2). Likewise single born kids were significantly heavier than twins at birth, weaning and 48 weeks (Table 1 and 2). These again were heavier than triplets, respectively. (Table 2). Whereas the sex effect was only significant at birth, the effects of litter size were significant throughout the first year of life (Table 1). Similar results have been found in other studies (e.g. Das *et al.*, 1989). The higher birth weight of males than females as observed in this study agrees with those of Bell *et all*, (1970) who attributed it to hormonal differences between the sexes. Similarly, the differences birth weight among singles, twins and triplets as found in the study agree with other studies that sex of kid influenced birth weight (Das *et al.*, 1991; Abunie, 1992; Mourad and Anous, 1994) with male kids being heavier (Morand-Fehr, 1981a; Sivaiah *et al.*, 1988; Wilson, 1958). Multiple births have been observed to influence birth weight in many studies (Kyomo, 1978; Prakash and Singh, 1985; Das, 1989; Das, 1993) with single born kids being heavier than twin or triplet (Abunie, 1992). Birth weight was also found to decrease with litter size (Das, *et aL., 1996*). The low birth weight of kids from multiple birth has been associated with fewer number of placental carbuncles to each fetus thus reduced supply of nutrients from the mother and that reduced nutrient intake of ewes during the end of the first trimester had restricted placental growth that resulted in decreased fetal growth and lamb birth weight.

Weaning and pre-weaning growth rate

Weaning weight reflects mothering ability due to dam maternal effect as well as direct additive genetic effects (growth potential). The maternal genetic and maternal environment effects reduce towards the weaning period leaving the direct genetic component to continue in the post-weaning period at yearling age (Table 1). The weaning period is, therefore, critical as there is increasingly little protection from the dam and the kid is exposed to the environment stress, which can limit growth (Das, et al, 1996). The reduced influenced of the dam as noted in the study at weaning is associated with the tendency of maternal influence to increase the component of variance at early pre-weaning period causing a lowering of the additive direct genetic effect (Thrift *et al.,* 1973). However, due to the imbalance of the of the sample sizes of dams and bucks, and more so, the single ordinary buck used, the estimation of direct genetic and maternal genetic effects were not possible. Pre-weaning growth rate is determined by both genetic and environmental factors (Das, *et al.,* 1996). The findings agree with other studies showing that birth type influences pre-weaning growth. This is related to the competition for milk from the dam noted especially among flocks reared under free-range pasture since this effect was not seen among kids reared solely on artificial feeding (Das, *et al.,* 1996).

Yearling and mature weights

At later period, the influence of the dam is lost and only the direct additive genetic potential is carried to the later periods of age. Therefore, due to the influence of maternal effects at pre-weaning period, selection would best be done at post weaning period at 6 moths of age. Selection at yearling age would be desirable for meat animals though would be associated with increased maintenance costs for breeding animals (Das *et al,* 1996).

Conclusion

The significant difference for birth weights between elite and control dams evidently indicates that body size of does has influenced birth weight of kids. Although the differences between the two doe groups were not significant at weaning (Table 1) the overall development strongly indicate that doe size has a lasting effect from birth to yearling weights (Fig. 1). These differences may be due to direct additive genetic effect of the dams, genetic maternal effect and/or non-genetic maternal effects. However, it was not possible to separate these effects due to the inadequate experimental design. As only one ordinary buck produced progenies, a balanced sample of large and ordinary bucks was not achieved and consequently the genetic difference between the two categories was not feasible.

The study concludes that maternal effects are important in influencing birth and weaning weight of kids but the imbalance in sample sizes of breeding bucks and does made the estimation of genetic effects unfeasible. Further studies using adequate numbers and balanced sample sizes of bucks and does are needed for better estimate genetic effects of both the dams and bucks.

Acknowledgement

This study was funded by the project on Enhancement of Research Capacity (DANIDA-ENRECA) and the National Agricultural Research Organization (NARO). We most sincerely appreciate the support.

References

Abunie, B.B. , 1992. Productive and reproductive performance of Tanzanian indigenous goats and their crosses with Kamorai and Boer. *M.Sc. Thesis.* Sokoine University of Agriculture, Tanzania. 175pp. 60 - 92.

Ahuya, C. O., 1987. Estimation of direct additive, maternal additive, heterotic effects from crossbreeding goats in Kenya. *MSc Thesis. Texas A & M University College Station.*

Berhanu Belay, Mtenga, L. A. and Kifaro, G. C., 1991. Effect of genetic and non-genetic factors on growth performance of Small East African (SEA) goats and its crosses. *Proceedings of the 18th Scientific Conference of the Tanzanian Society of Animal Production, Arusha, Tanzania 24-26 Sep. 1991. pp 20-32.*

Das, S. M., 1993. Reproductive parameters and productivity indices of Blended goats at MalayaTanzania. *In: Nyeko, J. H. P., Ocen, G. W. (Eds) Proceedings of the IFS Scientific Workshop for East African Grantees (Animal Production). 19-22 April 1993 Kampala,Uganda. pp 38-49.*

Das, S.M., Rege, J.E.O., and Mesfin Shibre. 1996. Phenotypic and Genetic Parameters of Growth Traits of Blended Goats at Malya, Tanzania. *Small Ruminant Research and Development in Africa. Proceedings of the Third Biennial Conference of the African Small Ruminant Research Network UICC, Kampala, Uganda 5-9 Dec, 1994. pp 63-69.*

Das, N., Joshi, H. B. and Bisht, G. S. 1989. Pre-weaning body weights and linear body measurements in Barbari and Jamnapari kids under intensive management system. *Indian Journal of Animal Sciences. Uttar Pradesh, India. Vol. 59. No. 11 pp 1450-1454.*

Das, S.M., Bee, J.K.A., Said, R. and Sendalo, D.S.C., 1991. Early growth performance of meat goats in the semi-arid region of Northern Tanzania. *Proceedings of the 16th Scientific Conference of the Tanzanian Society of Animal Production, AICC, Arusha, Tanzania. 26 - 28 September, 1989.* TSAP Conference Series, 16: 12 - 19.

Dass, G. .S. and Acharya, R.M., 1980. Growth of Binakeri sheep. *Journal of Animal Science,* 31, 1 - 7.

Gebrelul, S., Leon, S., Sartin, M. and Mtche, I. 1994. Genetic and non-genetic effects on growth and mortality of Alpine, Nubian and crossbred kids. *Small Ruminant Research*, 13, 169 - 176.

Inyangala, B.A.O., Rege, J.E.O. and Itulya, S., 1990. Growth traits of Dorper Sheep. I. Factors affecting growth traits. In: Rey, B., Lebbie, S.H.B. and Reynolds, L. (eds.), *Proceedings of Small Ruminant Research and Development in Africa,* ILCA, Nairobi, Kenya. pp505 -515.

Kyomo, M.L., 1978. Meat from goats in Tanzania. *Ph.D. Thesis*, University of Dar es Salaam, Tanzania. 272pp. Morand-Fehr, P. 1981a. Growth. In: Gall, C. (Ed.), Goat Production. Academic Press, London, UK. pp. 253 - 283.

Nagpal, S. and Chawla, D.S. 1985. Non genetic factors affecting body weight in crossbred goats. *Indian Journal of Animal Science,* 52, 1193 - 1197.

Kakusya, G.R.E. 1976. A study of the reproductive performance of the indigenous Uganda goat with reference to oestrus detection and control under indoor and outdoor management system. *MSc. Thesis, Makerere University, Kampal*a.

Kiwuwa, G.H., 1986. Breeding strategies for small ruminant production in Eastern and Southern Africa I. Breed characters and general performance. *In: Adeniji, K.O.,Kategile, J.A. (Eds) Proceedings of the workshop on the improvement of small ruminants in Eastern and Southern Africa, Nairobi Kenya. 22- August, 19986. pp 31-38.*

Madubi, M.A., Kifaro, G.C., Chenyambuga, S.W. 1996. Physical Characterisation of Three Strains of Small East African Goats in Tanzania. *Proceedings of the 23rd Scientific Conference LITI-Tengeru, Arusha, 20th - 22nd August 1996. TSAP Conference Series Vol. 23,(1996). pp 102-115.*

Mason, I.L. and Maule, J.P. , 1960. The Indigenous Livestock of Eastern and Southern Africa. *Technical Communication No. 14. Common Wealth Bureau of Animal Breeding and Genetics. Edinburgh, UK. pp 112-123.*

Nsubuga, H.S.K., 1996. Small Ruminants: Goats and sheep in Uganda. In: Lebbie, S.H.B. and Kagwini, E. (eds.), Small Ruminant Research and Development in Africa. *Proceedings of the 3rd Biennial Conference of the African Small Ruminant Research Network. UICC, Kampala, Uganda.* 5 - 9 Dec. 1994. pp1 - 4.

Okello, K.L., 1993. Study of the reproductive, growth, mortality and browsing behaviour of Mubende goats under station management in central Uganda. In: Nyeko, J.H.P. and Ocen, G.W. (eds.), *Proceedings of the IFS Scientific Workshop for East African grantees; (Animal production), 19 - 22 April, 1993, Kampala, Uganda*. International Foundation for science. pp115 - 121.

Osnowo, O.A., Abubakar, B.Y., Olayewi, M.E., Balogun, R.O., Onifade, D.S., Adewuyi, A.A., Trimnel, A.R. and Dennar, F.O., 1994. Pre-weaning performance of Yankasa sheep under intensive management. In: Lebbie, S.H.B., Rey, B. and Irungu, E.K. (eds.), Small Ruminant Research and Development in Africa. *Proceedings of the 2nd Biennial Conference of the African Small Ruminant Network, A.I.C.C, Arusha, Tanzania.* 7 - 11 Dec. 1992. ILCA/CTA. ILCA, Addis Ababa, Ethiopia. pp65 - 68.

Prakash, B.J. and Singh, B. , 1985. Reproductive efficiency of Chiangthang goats. *Asian Journal of Dairy Research.,* 4, 76 - 80.

Ruvuna, F., Cartwright, T.C., Blackburn, H., Okeyo, M. A. and Chema, S. 1988. Gestation length, birth weight and growth rates of indigenous goats and their crosses in Kenya. *Journal of Agricutural Science. UK. Vol. 3. No. 2 pp 363-368.*

Sacker, G.D., and Trail, J.C.M. , 966. Production characteristics of a herd of east African Mubende goats. *Tropical Agriculture,* 43, 43-51.

SAS. 2000. Statistical Analysis Systems Version 8. SAS Institute Inc., Cavy, NC27513, USA.

Skea, I.W., 1986. Keeping goats in Kenya. Ministry of Livestock Development, Kenya. 1986. pp57.

Wilson, P.N., 1957. Studies on the browsing and reproductive behaviour of the East African dwarf goat. *East African Agricultural Journal no. 23 pp 138-147.*

Wilson, R.T. and Murayi, T., 1988. Productivity of the Small East African goats and its crosses with Anglo-Nubian and the Alpine in Rwanda. *Tropical Animal Health and Production* 20: 219 - 228.