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Estimation of Genetic Parameters of Growth Traits in Nigeria Sahelian Goats

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Abstract: Data on 1010 Nigeria sahelian goat kids accumulated for nine years in the Small Ruminant and Multiplication Research Unit, Department of Animal Production, Ebonyi State University , Nigeria, were analyzed for the estimation of genetic parameters of growth traits. The heritability, phenotypic and genotypic, correlations were evaluated for birth, 3, 12 and 18 months live weights. The year of rearing, sex and parity had significant effects except birth type ($p<0.05$) in all the different periods of growth from birth until 18 months of age except birth type which was neutralized at 18 months of age. Sex effects continued at 18 months with males displaying superiority ($p<0.05$) over the females. Live weights traits had high heritability and the correlation was positive and high. This further suggests that selection can be adopted as a technique for improving weaning, yearling and maturity weight by selection for heavier kids from weaning age.

Key words: Heritability, genetic correlations, sahelian goat, growth traits, small ruminant

INTRODUCTION

In Nigeria, goats are reared as vital component of farming activities, especially by small holders. Sahelian goat breeds are very important livestock species of the middle belt ecozone of Nigeria. Ninety five percent of both livestock owners and other farming households keep goats in the zone mainly for meat, as collateral, as a token gift of love during traditional marriage and ceremonies. The goats also generate organic manure for maintenance of soil fertility (Otuma, 2007). Goats ranked second in income generation after cattle (Osinowo, 1992) and its meat is very popular and preferred to other meat especially pork (Otuma, 2006). The keeping of goats has increased by 200% over the past 30 years (Adu *et al*., 1979; Otuma, 2007) indicating vital roles of the animals in the livelihood of the people. Sahelian goat is one of the three major breeds of goat in Nigeria, because of their prolificacy and hardiness. In all, sahelian goats are kept primarily for meat yield and so the production traits of interest are the number of young weaned per breeding dam per year and their growth rate at birth, after weaning and maturity weights (Bradford, 1993). The commonest productive systems for small ruminant in Nigeria are the:

- Cut-and-carry, where forages and other feeds are brought continuously to the confined animals.
- Tethering and free roaming as similarly reported (Djajanegara and Setiadi, 1991; Sodiq *et al*., 1998; Sodiq, 2000 and Bradford, 1993) in other places. High growth is essential for optimal meat yield and is one of the main determinants of productivity of goat (Oshea, 1993). Rapid growth is considered as essential indices in production (Ezekwe and Lovin, 1996). Meanwhile, the birth, weaned and matured weights of these breeds (Sahelian goat) are lower than their counterpart of the Northern breeds. Estimation of genetic parameter of the growth traits is vital in a selection program. Information concerning these traits for these breeds has not been established. The aim of this work was to estimate the genetic parameters of growth traits for this breed and use them in developing a selection programme.

MATERIALS AND METHODS

Location of the study: The study was conducted from 1995 until 2003, at the Small Ruminant Multiplication and Research Unit, Department of Animal Production/ Fisheries, Enugu State University of Science and Technology, of the then Abakaliki Campus, Nigeria. The center is within 7°22[1] North latitudes and 10° 29' East longitudes. The temperature remains within the average of 32°C and lies within the derived Guinea Savannah zone south-Eastern Nigeria (ESUT Metrology, Unit, 1995).

Experimental animals and management: The research concentrated on Sahelian breed of Nigerian goats data on

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1010 kids from 50 births collected over a period of nine years. The animals were raised under semi-intensive system. They were allowed to graze on the University paddock from 3.00-5.00 pm daily and were supplemented with concentrated feed of about 500 g/head/day. Occasionally, the animals were routinely dewormed and deticked. Water was given *ad-libitum*. The animals were identified with a neckband tag. The weight at different ages was weekly taken using a sensitive weighing scale (Avery weighing scale Product).

Traits assessed: The traits evaluated are body weights at birth, 3, 12 and 18 months of age. Data were analyzed statistically according to the analysis of variance procedure using the General Linear Model (GLM) of statistical Product and Service Solution Soft Ware SPSS Inc., Duncans multiple range and turkey's significant difference test (Steel and Torrie, 1980) were used to identify significant differences. Some of the fixed effects include, sex, season of birth, type of birth and dam's parity.

Late rainy season = October to December.
Dry season = January to March.
Early rainy season = April to June.
Main rainy season = July September.

RESULTS AND DISCUSSION

The overall live weights at birth, 3, 12 and 18 months were presented in Table 1. Sex, type of birth, parity and season of rearing had significant effects at various growth stages of the goats ($p<0.05$). However, early rainy and main rainy seasons raised kids had comparable weights superior to the dry and late dry seasons on live weights ($p<0.05$). A different growth trends were maintained at 18 months of age. Types of births had significant effects on the live weights at births, 3 and 12 months of age, but not at 18 months. Sex differences had significant effect with males displaying superior weights until the end of the experiment. Parity effects tend to be declining with increase in age of the dams ($p>0.05$).

In Nigeria, the sahelian goats are capable of breeding all the year round (a seasonal). This could be attributed to the facts that in the tropics there is little variation in day length, which are signals that control seasonal rhythms in temperate regions. The results obtained are in agreement with the findings of Ingo (1999), Awemu *et al.* (1999), Bearden and Fuquay (2000) and Das (1993) who demonstrated that environmental factors exerted a significant effects on growth and reproductive performance of animals. In Table 1, it can be observed that the best rearing seasons are the main and early rainy seasons. Explanations for these could be attributed to the lush growth and high nutritional value of the native grasses and forages during this period. To the weaned kids, season of birth played a vital role in growth performance indirectly through its influences on the doe's nutrition and on the amount of milk available to the weaned kids. The Progressive increases in the male weights than the females even after puberty suggests that genetic and hormonal differences between males and females animals have come to manifest their effect. This agreed with the reports of Bell *et al.* (1970) and Das *et al.* (1994) on live weights of different tropical goats. It also reflects the mothering effect and the inherent growth potentials, which continued to manifest its effects on live weights even after birth. This carry over effects of the parents on the growth of the kids agreed with the findings of Wilson (1987) who reported low birth weight of young ewes even at the best season. It is generally known that milk yield increases with parity because older Dams are larger in body and tend to be better milkier due to advances occasioned by physiological maturity (Mtenga *et al.*, 1994). The results are consistent with the findings of Amoah and Gelaye (1990), Das (1993), Wilson and Light (1986), Awemu *et al.* (1994, 1999), Mtenga *et al.* (1994) and Hassain *et al.* (1996) on live weights of ruminants that were significantly affected by type of birth. The disappearance effects of parity at 18 months did not agree with the findings by Wilson and Light (1986) for goat and sheep weight in Central Mali and Awemu *et al.* (1994) for Red sokoto goats in Nigeria who obtained increase in weights even after the third parity. All the live weights in all the ages studied showed variation between singles and twins, which continuously maintained superior weights than the triplets, though it disappeared at the 18th months of age. Robinson *et al.* (1981) reported that for lambs/kids in uterus, as the number of foetus increases the number of caruncles attached to each foetus decreases, thus reducing the feed supply to the foetus

Table 1: Least square means ± SE for birth, 3, 12 and 18 months of body weights of goats kids (kg)

Age	Birth weight	3	12	18
Season of rearing/birth				
Early dry	`1.28±0.01^{a}	9.36±0.21^{a}	10.09±0.56^{a}	18.28±0.30^{a}
Early rainy	1.48±0.62^{b}	10.56±0.27$_{b}$	11.62±0.33^{b}	18.24±0.15^{a}
Main rainy	1.50±0.19^{b}	12.13±0.41$_{b}$	13.48±0.13^{b}	19.47±0.63^{a}
Dry	1.10±0.22^{a}	9.99±0.22$_{a}$	10.14±0.28^{a}	18.92±0.63^{a}
Type of birth				
Single	1.67±0.12^{b}	1242±0.16$_{b}$	13.59±0.21^{b}	18.28±0.27^{a}
Twin	1.41±0.03^{b}	11.51±0.14$_{b}$	11.43±0.27^{b}	18.13±0.22^{a}
Multiple	1.02±0.01^{6}	9.28±0.01^{9}	9.98±0.48^{a}	18.28±0.30^{a}
Parity				
1	1.28±0.31^{a}	9.11±0.18^{b}	13.62±0.13^{b}	18.41±0.27^{a}
2	1.45±0.33^{b}	8.21±0.16^{a}	10.21±0.49^{b}	18.27±0.13^{a}
3	2.09±0.05^{c}	8.01±0.28^{a}	9.55±0.11^{a}	20.33±0.28^{b}
Sex				
Male	1.66±0.28^{b}	12.49±0.22^{b}	13.72±0.18^{b}	20.49±0.13^{b}
Female	1.28±0.13^{a}	10.28±0.13^{a}	10.21±0.13^{a}	16.66±0.01^{a}

abc = Means within a column carrying different superscript are significantly different ($p<0.05$)

Table 2: Heritability Estimate of weight traits of experimental animals

Traits	Heritability estimates
Birth weight	0.41±0.08
3 months	0.45±0.31
12 months	0.45±0.28
18 months	0.42±0.99

Table 3: Genetic and phenotypic correlations for the different body weights

Traits	Birth weight	3 months	12 month	18 months
3 months	0.42±0.27	0.57±0.24	0.76±0.19	0.02±0.09
12 months	0.05±0.10	0.68±0.13	0.86±0.13	0.73±0.24
18 months	0.28±0.03	0.59±0.42	0.73±0.02	0.84±0.18

Genetic correlation above and phenotypic below diagonally

and hence reduction in the birth weights of the lamb or kids. The heritability estimates (h^2) of live weight traits are shown in Table 2. The results show that the weight traits were moderate to high. The high heritability estimate indicates that live weight could be easily improved upon through selection. This is contrary to the findings by Johor and Norton (1977), for Suffolk and Tourghee sheep and wool sheep, respectively. The genetic and phenotypic correlations amongst the weight traits are presented in Table 3. Positive genetic correlations amongst the weight trait indicate good effects amongst the traits at the different age levels. Phenotypic correlation between the weaning and other weight also existed positively. This suggests that weaning and 12 months of age can be used to bring about improvements at 18 month of age. The result varied with the finding by Das (1993) for the Blended goats in Tanzania who obtained moderate heritability, though similar with the findings by on Jamunapari kids at 3 and 12 months. The 12 months live weight is superior to pre-maternal effects that tend to obscure the direct effects of the additive genetic effects of growth. Selection made toward weight at later ages would maximize response in birth weight and reduce dystocia (Martin *et al*., 1980). Selection at later ages is expected to lead to increase in weight desirable of meat animals.

CONCLUSION

The results of the research indicate that in order to improve breeding value of Nigerian Sahelian goats, selection can be based on season of rearings, but more on genetic growth factors. Little changes in weaning weights would bring about expected changes in the subsequent weights by selection for these traits. They are genetically and positively correlated.

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