

EFFECT OF SIRE BREED ON PROGENY PERFORMANCE IN NIGERIAN INDIGENOUS BREED OF GOATS

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ABSTRACT

This study was carried out at the Small Ruminants Unit of the National Animal Production Research Institute, Shika, Zaria, Nigeria. The study utilized 12 bucks aged 9 and 15 months, belonging to three Nigerian indigenous goat breeds: Red-Sokoto (RS); Sahel (SH) and West African Dwarf (WAD). The research objective was to explore the influence of sire genotype on key parameters including birth weight, litter size, weaning weight, kid mortality, gender distribution, and the type of kidding in goats with particular focus on sire genotype. The result of the study revealed a significant difference in birth weight of kids sired by each breed ($P < 0.05$), with Sahel bucks producing kids with the highest birth weight. The study found no significant variation in weaning weight among three breeds ($P > 0.05$). Kid mortality rates were significantly affected by sire genotype ($P < 0.05$). Interestingly, the study found no significant effect of sire genotype on kid gender ($P > 0.05$), but notable variations were observed in the gender distribution among different genotypes. Red Sokoto and West African Dwarf genotypes showed a higher proportion of male kids, while the Sahel genotype displayed a higher proportion of female kids. Moreover, effect of sire breed on litter size was not statistically significant ($P > 0.05$) even though Red Sokoto displayed a higher rate of twin births compared to singleton and triplet births. In conclusion, understanding the effect of sire breed on these vital aspects of goat reproduction is crucial for effective breeding programs and improving overall productivity. The findings underscore the significance of considering sire genotype in breeding decisions, aiming for enhanced birth and weaning weights, reduced kid mortality, and an understanding of gender distribution and kidding patterns for sustainable goat farming practices.

Keywords: Sire breed, Progeny, performance, Goats

INTRODUCTION

Sire fertility is a crucial aspect of caprine reproduction, given the practice of breeding multiple does with a single buck (Okere *et al.*, 2020). Therefore, assessing sire fertility prior to breeding is of utmost importance for achieving breeding success. The evaluation of potential breeding male fertility can be carried out in the field through mating ability assessment (Tanga *et al.*, 2021). Moreover, sire performance can be evaluated through the use of multiple sires in a herd. In such cases, comparing kid weights and ratios is a reliable method to assess sires for progeny performance, provided that each kid's

sire is known. Evaluating buck and doe kid ratios in combination is essential for sire evaluations (Hoflack *et al.*, 2006; Getachew *et al.*, 2022).

Conducting male breeding soundness examinations is a crucial aspect of goat farming. Evaluating the reproductive capacity of bucks through a general examination is a valuable tool for improving the fertility of flocks/herds and preventing contagious or hereditary diseases (Tibary *et al.*, 2018).

Performance testing is an essential method for comparatively evaluating animals for economic production traits. In the meat goats' industry, reproduction, growth, and carcass merit

are the primary economic traits of interest. However, pedigree and visual appraisal for conformation serve as the primary basis for animal selection in most meat goats' herds (Browning and Leite-Browning, 2009).

Progeny testing is a vital tool for evaluating animals for genetic merit as parents. It is a well-known fact that the quality of offspring is the only reliable test of an animal's breeding worth. Progeny testing involves estimating the breeding value of an animal based on the performance of its progeny. Recognizing that the breeding value of an animal lies in the quality of its progeny, breeders should be encouraged to select breeding stock more rationally, rather than solely based on external appearance (Mahal *et al.*, 2012).

It is common practice among goat raisers to castrate male kids at an early age for economic and social reasons. This practice results in scarcity of quality breeding bucks, and it reduces the chances of assessing the breeding soundness and fertility of the buck (Hussain, 2004). It is a well-established fact that selecting good quality bucks can improve birth weight, body weight gain, weaning weight, and milk yield of does. This improvement can reduce kid mortality to a considerable extent, leading to an increase in overall production potential (Abubakar *et al.*, 2022).

Upon selection, individuals with advantageous or "adaptive" traits have the potential to achieve greater success in terms of reproductive capacity, thus contributing more offspring to the succeeding generation. Through proper selection, traits can be used as a tool for genetic basis in order to increase the prevalence of those traits. The progeny inherits these traits from their parents, which leads to a higher prevalence of those traits (VanVleck *et al.*, 1987; Baiden *et al.*, 2007). It is important to estimate the

heritability of traits, as this determines genetic potential and the rate at which future progress can be made through selection (Aaron *et al.*, 1987). Genetic correlations between traits are also significant, as they provide information on how one trait will respond when selection is made for another trait (Koots *et al.*, 1994; Abubakar *et al.*, 2022). Expected progeny differences have been widely used in beef cattle, resulting in tremendous gains in performance through targeted selection by producers at all levels. These tools, if effectively utilized, can produce similar gains in the goat industry (Mahal *et al.*, 2012).

This study aimed to determine the effect of sire breed on some productive parameters of the progenies among three Nigerian indigenous goat breeds.

MATERIALS AND METHODS

Experimental Animals

A total of 12 virile bucks and 36 primiparous does, consisting of four bucks and 12 does each from Sahel (SH), Red Sokoto (RS), and West African Dwarf (WAD) goat breeds, aged between nine and fifteen months, and weighing between 19.5 and 25 kg were used in this study. The WAD goats were obtained from flocks belonging to traditional goat keepers around village market communities of Ibadan, Oyo state, Nigeria, while the Red Sokoto goats were obtained from around village markets of Zaria communities of Kaduna state, Nigeria. The Sahelian goats were obtained from Sokoto state, Nigeria.

Grouping of animals

The experimental animals were grouped as presented in the Table 1 below. In every pen, 12 primiparous does were kept against 4 virile male (sire) for mating.

Table 1: Allotment of Experimental Animals

Breed	Sire	Dam	Total
Sahel	4	12	16
Red Sokoto	4	12	16
West African Dwarf	4	12	16

Housing, Care and Handling of Experimental Animals

Upon arrival of the goats, the animals were housed at the concrete-floored, covered with wood saw dust of the Small Animal Research Unit of the National Animal Production Research Institute (NAPRI), Shika, ABU, Zaria for acclimatization for a period of two (2) weeks. They were weighed, dewormed with Levamisole for possible gastrointestinal parasites known to be endemic in the study area. At different times, they were also administered *Peste des petit ruminants* (PPR) and Haemorrhagic septicaemia vaccines, all purchased from National Veterinary Research Institute, Vom, Plateau state, Nigeria. On daily basis, the animals were fed with belted hay grasses (*Digitaria simutsi*, *Brachairia residensis*, *Brachiaria decumbensis*) cultivated within the study area. The feeds were also supplemented with concentrate mixture that comprises of *Maize*, *maize offal*, *Groundnut cake (GNC)*, *Bones*, *Salt*, *Cotton seed cake (CSC)* and wheat offal grower's mash. Clean water was given to the animals at liberty till the end of the experiment.

RESULTS AND DISCUSSION

Effect of Sire Genotype on the Birth Weight, Weaning Weight and Mortality of the Kids

The impact of sire genotype on the birth weight, weaning weight, and mortality of kids investigated across the three genotypes shows a significant ($P < 0.05$) effect of sire genotype on the birth weight of kids. Table 1. Sahel goat sired kids had an average birth weight of 1.91 kg which was higher than those of Red Sokoto and WAD goats sired kids who had 1.78 kg and 1.46 kg, respectively. However, weaning weight did not show significant ($P > 0.05$) variation among the three breeds studied. However, Sahelian bucks' offspring had numerically higher weaning weight (6.125 kg) than those sired by Red Sokoto (5.92 Kg) and WAD (5.51 kg) bucks. This result is consistent with the findings of Goonewardene *et al.* (1998) and Merlos Brito *et al.* (2008) on Nubian bucks sired kids. However, the finding of this study on the effect of sires on birth weight of progenies was in variance with the findings of Stemmer, *et al.*, (2009) on Nubian Sires crossed with local breeds of goat and also the findings of Steinbach (1988) on Portevine sires crossed with

Measurement of Kid Crop

The total kid crop per group was determined. The number of kids born alive, and sex were also determined and recorded.

Measurement of Body Weight and Litter Size

Kid birth weight, weaning weight and litter size at birth and weaning were measured and recorded. Birth weights were recorded within 12 hours of birth while the weaning weight was done 12 weeks after birth. Dams' weight at kidding and weaning were also measured and recorded. The weights measured using handheld mobile electronic weighing scale for the kids at birth and customized mega electronic weighing scale for the dams and kids at weaning (Browning, 2009).

Statistical Analysis

The data were analyzed variance (ANOVA) using the SAS software (Version 9.4) and significant differences among the means were tested using Tukey's test. The effect of sire genotype on type of kidding and kid sex were tested using the Chi Square Test.

local goat breeds. However, Browning *et al.* (2011), observed a significant heterosis in birth weight, ranging from 3.44% to 5.12%, in hybrid crosses between three meat goat breeds, namely Boer, Kiko, and Spanish.

Kid mortality showed significant ($P < 0.05$) variation across the different genotypes (Table 2). West African Dwarf sired kids had the least kid mortality rate of 10.2%, whereas the highest rate was recorded in kids sired by Sahelian bucks (25%). However, the progenies of mating between Red Sokoto sire and Red Sokoto doe had a much higher kid mortality rate (52.6%) compared to kids sired by other genotypes in table 2. Conversely, kids sired by the same bucks mentioned above with different breeds of does revealed a highly reduced incidence of pre-weaning mortalities. This finding highlights the significant role of heterosis in curbing pre-weaning mortalities of kids, which is consistent with the findings of Ebozoje and Ngere (1995) in a study that determined the incidence of pre-weaning kid's mortalities in WAD goats and Red Sokoto half breeds.

Table 1: Influence of sire genotype on birth weight, weaning weight and kids' mortality of pure-bred kids

Sire Genotype	RS	SH	WAD	SEM	LOS
Growth Parameters number					
Kid's birth weight (kg)	1.785 ^a	1.911 ^a	1.466 ^b	0.042	**
Kid's weaning weight (kg)	5.921	6.864	5.514	0.299	NS
Kid's mortality (%)	0.254	0.170	0.163	0.032	NS

Mean with different superscripts (^{a, b}) across the groups (row) indicate significant difference, P<0.05

RS = Red Sokoto goat; SH = Sahel goat; WAD = West African dwarf goat

Table 2 showed that kids sired by Red Sokoto bucks versus Red Sokoto does, Sahelian bucks versus Sahelian does, and WAD bucks versus WAD does recorded 52.6%, 25%, and 10.2% pre-weaning mortalities, respectively. Conversely, kids sired by the same bucks mentioned above with different breeds of does revealed a highly reduced incidence of pre-

weaning mortalities. This finding highlights the significant role of heterosis in curbing pre-weaning mortalities of kids, which is consistent with the findings of Ebozoje and Ngere (1995) in a study that determined the incidence of pre-weaning kid's mortalities in WAD goats and Red Sokoto half breeds.

Table 2: Influence of sire genotype on birth weight, weaning weight and kids' mortality of crossbred kids

Parameters	RS vs SH	WAD vs SH	SH X RS	WAD vs RS	RS vs WAD	SH vs WAD	SEM	LOS
Kid's Birth Weight	2.333 ^a	1.917 ^{bc}	1.939 ^b	1.586 ^{bcd}	1.393 ^d	1.500 ^d	0.042	**
Kid's Weaning Weight	7.061 ^{ab}	6.500 ^{ab}	8.236 ^a	4.844 ^{ab}	6.613 ^{ab}	6.131 ^{ab}	0.299	*
Kid's Mortality	0.055 ^b	0.125 ^{ab}	0.071 ^b	0.277 ^a	0.125 ^{ab}	0.187 ^{ab}	0.032	*

Mean with different superscripts (^{a, b}) across the groups (row) indicate significant difference, P<0.05

RS = Red Sokoto goat; SH = Sahel goat; WAD = West African dwarf goat

Effect of Sire Genotype on Kid's Gender

The study investigated the impact of sire genotype on kid gender. The results indicated that there was no significant effect of sire genotype on kid sex, as evidenced by the P-value (>0.05) in Table 3 and 4. However, it was observed that in the Red Sokoto sire group, there was a higher percentage (22.82% or 34) of male kids compared to females (12.08% or 18). This trend was also observed in the West African Dwarf (WAD) goat. Conversely, in the Sahel sire group, more female kids were delivered than male. Overall, the study revealed that male kids were produced in greater numbers across the three genotypes in the present study.

There exists a plethora of studies on goat species which have revealed that male offspring are often more numerous than female offspring

(Tölü *et al.*, 2007). It has been observed that the age of the buck can have an effect on the gender of the kid offspring, even if the buck has a low probability of siring male progeny (Tölü and Savas, 2007). The probability of producing more female offspring increases with the age of the buck, which is typically above 3.5 years, due to lower testosterone levels compared to younger sires (Gomes *et al.*, 2021). The observation in the present study, which produced more male than female offspring, could be due to the higher number of younger bucks (8 to 12 months) that were used to sire the kids. However, in the Sahel sire group, there were more female kids than male kids. The cause of this deviation may be attributed to factors other than the one previously advanced.

Table 3: Kid Crop According to Breed/Genotype

BREED	SEX		LITTER TYPE			TOTAL
	M	F	Single	Twin	Triplet	
SH x SH	5	7	1	11	0	12
RS x RS	11	8	4	12	3	19
WAD x WAD	18	9	4	23	0	27
SH x RS	8	5	4	9	0	13
SH x WAD	8	8	3	10	3	16
RS x SH	10	9	7	12	0	19
RS x WAD	14	2	0	16	0	16
WAD x SH	3	5	4	4	0	8
WAD x RS	11	7	0	12	6	18
Total	88	60	27	109	12	148

RS = Red Sokoto goat; SH = Sahel goat; WAD = West African dwarf goat; M = male; F = female.

Table 4: Influence of Sire Genotype on Kid Gender of Pure-Bred Kids

Sire Genotype	Kid Gender		Total
	Female	Male	
RS	12.08 (18)	22.82 (34)	34.90 (52)
SH	14.77 (22)	13.42 (20)	28.19 (42)
WAD	14.77 (22)	22.15 (33)	36.91 (55)
Total	41.61 (62)	58.39 (87)	100.00 (149)

Chi Square test (Sire effect on Kid sex) $X_{2, 0.05} = 0.2111^{ns}$

Effect of Sire Genotype on litter size

The study found that sire genotype did not have a significant impact ($P > 0.05$) on the litter size, as indicated in Table 5. It was observed, however, that the Red Sokoto genotype had a higher rate of twin births compared to singleton and triplet births, with 26.86% (40) twins, 6.04% (09) singletons, and 2.01% (03) triplets. Similarly, in the Sahel genotype sired kids, 20.81% (31) were twins, while 2.01% (03) were triplets and 5.37% (08) were singletons. The

WAD genotype sires had 26.86% (40) twins, 6.04% (09) singletons, and 8.05% (12) triplets. In general, all three genotypes had a higher rate of twin births compared to singleton and triplet births, with the exception of WAD bucks, which had a higher rate of triplet births compared to SG and RS sire group. In general, bucks from all three genotypes sired more twins than singletons or triplets. This finding is in agreement with the work of Browning *et al.* (2011).

Table 5: Influence of Sire Genotype on Type of Kidding

Sire Genotype	Type of Birth			Total
	Single	Twin	Triplet	
RS	6.04 (09)	26.85 (40)	2.01 (03)	34.90 (52)
SH	5.37 (08)	20.81 (31)	2.01 (03)	28.19 (42)
WAD	6.04 (09)	26.85 (40)	8.05 (12)	36.91 (55)
Total	17.45 (26)	74.50 (111)	12.07 (18)	100.00 (149)

Chi Square test (Sire effect Vs type of birth) $X_{4, 0.05} = 0.8938^{ns}$

CONCLUSION

In conclusion, it was shown that sire genotype positively affect kids crops, birth and weaning weights and kids mortality, where as it did not have effect on kid's gender and type of kidding or litter size. Hence, the effects of sire breed selection on progeny performance in Nigerian indigenous goat breeds are substantial and offer significant opportunities for enhancing the productivity and sustainability of goat farming in the country.

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