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The Performance of Borno White Goat in Agropastoral Management of Semi-Arid North East Nigeria

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Abstract: A study was conducted in semi-arid north east Nigeria between 1995 and 1998 through monthly visits to 950 grazing units of agropastoral goats distributed in three study locations of Jakusko, Dapchi and Jajimaji on performance of Borno white goat breed. Using mature Borno white does events such as births, pre and post weaning mortalities, milk production, growth at (1, 3 and 6 months), linear body measurements, age at first kidding, kidding interval were all recorded or calculated and analysed using the general linear model involving 324 kiddings. The Borno white goat recorded 1.94 kg and 1.92 kg birth weight; 4.82 kg and 4.73 kg (1 month); 8.24 kg and 8.09 kg (3 months) and 12.69 kg and 13.44 kg (6 months) and 2115 kg and 23.25 kg (mature) body weights for males and females respectively. Milk production and composition was 147.50 mL day^{-1}; total solids 10.47, 4.52% protein, 4.59% fat, 5.89% solid non fat, 0.92% calcium, 0.52% phosphorus. Adult percent mortalities were 26.75% and 23.25% for males and females; while percent kid mortalities were 27.59, 26.64,and 25.00% for singles, twins and triplets, respectively. Age at first kidding, kidding interval (days) and litter size were 350.25, 251.92 and 2.04 respectively. Percent frequency of births as singles, twins and triplets were 30.74%, 64.66 and 4.59% respectively. Body weights for males and females were 4.50 kg and 3.49 kg (1 month); 8.80 kg and 9.30 kg (3 months) and 13.70 kg and 13.30 kg (6 months) of age respectively. Linear body measurements for males and females for height at withers (HAW) were 36.75 cm and 33.45 cm (1 month); 42.70 cm and 40.50 cm (3 months); and 46.61 cm and 48.40 cm (6 months) respectively. Heart girth (HG) values were 35.52 cm and 32.37 cm (1 month); 40.76 cm and 37.93 cm (3 months) and 46.20 cm and 43.33 cm (6 months) of age; while Body Length (BL) were 45.57 cm and 41.80 cm (1 month); 53.85 cm and 51.61 cm (3 months) and 61.60 cm and 60.02 cm (6 months) of age respectively. Mature linear body measurements for males and females were 61.43 cm and 65.73 cm heat girth; 55.70 cm and 50.25 cm body length and 59.75 cm and 61.35 cm height at withers, respectively. Results were all different ($p<0.05$) with males recording higher values than females in all parameters at the same age. Productivity index (kg/doe/year) for the Borno white goat was 18.72; while prediction equation for mature body weight was LW = - 12.64 + 0.148 (HG) + 0.195 (BL) + 0.051 (HAW). The productivity and reproductive traits of the agropastoral Borno white goat of semi-arid north east Nigeria are of great prospects for use in the near future; thus the genetic resource of the breed should be conserved.

Key words: Performance, borno white, agropastoral, semi-arid

INTRODUCTION

The value of genetic diversity and variability in Africa has long been recognised[1]. The genetic improvement of the small ruminant is imperative considering the improvement in productivity that has been achieved by changes in management practices. Van Vlaenderan[2], Adu *et al.*[3] and Odubote[4] among other workers, have reported on these improved performances. In order to optimise gains from environmental influences, genetic parameters and attributes of the animal for economic traits should be appraised regularly to enable breeders determine the breeding tools choice. Specifically, there is lack of heritability and repeatability estimates for the Nigerian breeds of goats except for Odubote and Akinokun[5] on West African Dwarf (WAD) and Adu *et al.* on Sokoto Red goat. According to Maule[6] indigenous livestock either pure or crosses might be more productive in their own environment than exotic breeds particularly if granted improved breeding and husbandry techniques as reported (Mgbere, 1995). The Borno white goat breed represents a genetic resource that should not only be conserved for future use in semi-arid Nigerian environment, but also be fully exploited for short term benefit[7,8].

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It is clear that there is lack of data on genetic attributes of Borno white goat, so it becomes necessary to appraise the attributes of this breed and find ways of conserving the genetic diversity with the aim of utilizing the traits to improving goat production in the semi-arid zone. This study attempts to assess the nature of Borno white goat, its performance and prospects under the agropastoral practice of semi-arid north east Nigeria.

MATERIALS AND METHODS

Study: The study was under taken in the semi-arid part of north east Nigeria, situated approximately between latitude 11°40'-12°22'N and longitude 10°-12°20' E and covers an area of 34,000 Km^2. The area has clearly defined wet and dry seasons. Rainfall period is short and uni-modal with a range of 241mm-419 mm with a peak between June-August. Mean annual temperatures range from 21.9°C-35.5°C with a daily maximum of 40°C and a daily minimum 0f 22°C.. Vegetation is typical of semi-arid areas with extensive grassland interspersed with few species of Acacia and Balanites. The shrub layer is dominated by scattered Salvadore species, while the grass layer consists of Aristida, Cenchrus and Pennisetum species.

Study locations: Jakusko, Dapchi and Jajimaji were selected for detailed studies. These locations differ in ecological niche with Jakusko in the southern part, Dapchi in the central while Jajimaji in the northern part of Yobe state. Jakusko and Dapchi are areas, favoured by the agropastoralists for settlement because of the relatively good grazing especially the after harvests in the inland valleys of the 'Fadama' and on fields in upland areas. Jajimaji is relatively an open woodland characterised by annual grass species due to short rainy season, thus pastoral and transhumans livestock owners predominate in the area. Cultivation of crops is done but not on a scale as large as Jakusko and Dapchi.

Animal management: The grazing units of goats in the study area consist of Borno white and Sokoto red breeds. The grazing units of sheep and goats were allowed to roam freely and graze on natural pastures and browse tree and shrubs during the day and were confined at night. Breeding was not controlled as males and females mingle together through out the seasons of the year. Milking was not done as kids were allowed to suckle their mothers at at all times. Kids weaned themselves when the dam dries off. Animals were only supplemented with crop residues made of stalks, stovers husks and haulms of sorghum, millet, cowpea, groundnut and also pods and fruits of browse trees like Faidherbia and Ziziphus species during the drt season which is the period of feed scarcity. Sheep and goats were supplemented with potash (Kanwa) a local mineral salt and were occasionally or not treated with endo and ecto parasite drugs. Watering of animals was done throughout the day in streams, ponds and where bore hole water is made available.

Data collection and analysis: Data were collected over a period of three years (June, 1995 to June, 1998) through monthly visits to 958 grazing units of goats distributed as follows; Jakusko 322, Dapchi 319 and Jajimaji 317. At the beginning of the study all mature does were identified based on phenotypic features of Borno white breed and tagged. Kids born during the study period were identified based on sex, type of birth and birth weight and were also tagged. Similarly, events such as frequency of birth as singles, twins, triplets, abortions, survivals, pre-weaning mortalities were also recorded. Lactating does were identified, milk yield was measured through milking randomly selected does and milk composition was also recorded and analysed during period of study. Analysis was carried out for 283 kidding. Parameters evaluated were Age at First Kidding (AFK), Kidding Interval (KI), Birth Weight (BW), evi(TB), Birth Frequency (BF), Productivity per Doe (PD), growth i.e. body weights at 1, 3 and 6 months and also at maturity. Linear measurements at 1, 3 and 6 months and at maturity (12.56-18.46 months) were also recorded and analysed and prediction equation for live weight was developed. The general linear model[9] was used for analyses and means were separated using Duncan's[10].

RESULTS

Table 1 gives the summary of the productive performance of Borno white goat in semi-arid north east Nigeria. Birth weights (kg) for both male and female were 1.94 and 1.92 respectively. Results were not significantly ($p< 0.05$) different. Body weights (kg) at 1, 3 and 6 months and at maturity were 4.82, 8.24, 12.00 and 21.25 for both male and female respectively. Results were not significantly ($p<0.05$) different. Mature live weight gains (g day^{-1}) were 164.00 and 150.00 for both male and female, respectively. Values were significantly ($p>0.05$) different with males gaining heavier and thus growing faster than females at maturity. Milk production in females showed that the Borno white goat produces 114.75 mL day^{-1} of milk and the milk composition recorded 10.47% total solids, 4.52% protein, 4.59% fat, 5.89% solid non fat, 0.92% calcium and 0.52% phosphorus respectively. Values were generally above average and thus are

superior. Linear body measurements (cm) for the Borno white goat breed for both male and female at maturity were 61.43 and 65.75 heart girth, 50.70 and 50.75 body length and 59.75 and 61.35 body length respectively. Results were significantly ($p>0.05$) different for heart girth and body length, but were similar ($p<0.05$) for height at withers. Mature seasonal body weights (kg) were + 2.07 and + 2.96 for both male and female and were similar ($p<0.05$). Prediction equation for body weight for the breed Table 1 showed that there is high correlation (r2 = 0.95) between Heart Girth (HG), Body Weight (BL) and Height At Withers (HAW) with live weight (kg). Using the three linear body measurements for the breed, it is possible to estimate body weight of the breed at mature age in the absence of a weighing scale from the equation.

Table 1: Productive performance of borno white goat

Production traits	Male	Female	Sem
Birth weight (kg)	1.94	1.92	0.00
Body weight (kg):			
1 month	4.82	4.73	0.00
3 months	12.69	13.44	0.01
6 months	21.15	23.25	1.37
mature liveweight gain (g day^{-1})	164.00	150.00	
Milk yield (ml,day)	114.75		
Milk composition (%):			
Total solids	-	10.47	-
Protein	-	4.52	-
Fat	-	4.59	-
Solid non-fat	-	5.89	-
Calcium	-	0.92	-
Phosphorus	-	0.52	-
Mature linear body measurements (cm):			
Heart girth	61.43	65.73	3.84
Body length	55.70	50.25	3.94
Height at withers	59.75	61.35	2.47
Adult mortality (%)	26.75	23.25	3.46
Mature body weight (kg)	27.04	21.38	4.98
Mature seasonal body weight change (kg)	2.07	2.96	0.01

Prediction equation for live weight: LW = - 12.64 + 0.148 (HG) + 0.195 (BL) + 0.051 (HAW) A, b, c, Mean within the same row having different superscripts differ ($p>0.05$), LW = Predicted live weight (kg), HG = Heart girth (cm), BL = Body length (cm), HAW = Height at withers (cm), -12.64 = constant, r = Co-efficient of correlation = 0.95, Error of HG = 0.03, BL = 0.39 and HAW = 0.036

Table 2: Reproductive performance of borno white goat

Reproductive traits	Values
Age at first Kidding (days)	350.25
Kidding interval (days)	251.92
Litter size	2.04
Frequency of type of birth (%):	
Singles	30.74
Twins	64.66
Triplets	4.50
Kid mortality (%):	
Singles	27.59
Twins	24.64
Triplets	25.00
Productivity index (kg/doe/year)	18.72

A, b, c, Means within the same column having different superscripts differ ($p>0.05$)

Table 2 gives a summary of the reproductive performance of the Borno white goat. Age at first kidding was 350.25 days, while the kidding interval was 251.92 days and the litter size was 2.04. Percent frequency of type of birth for the the Borno white breed was 30.74% singles, 64.66% twins and 4.50% triplets respectively. Values were significantly ($p>0.05$) different with the breed being very prolific and well adapted by producing more twins than singles or triplets. Mortality patterns for the Borno white breed of goat in this study showed singles dying more in number 27.59% followed by triplets 25.00% then lastly twins 24.64%. Results for singles were different ($p>0.05$) from twins and triplets, while twins and triplets were similar ($p<0.05$). Thus these attributes of lower mortality of kids born twins and triplets should be attributed to high heritability and prolific potentials of the breed and the adaptability in the semi-arid environment. Productivity index (kg/doe/year) for the Borno white goat under this study recorded 18.75 which is above average for small ruminants.

Table 3 gives a summary of body weights (kg), linear body measurements (cm) and live weight gains (g day^{-1}) for Borno white breed at 1, 3 and 6 months age under agropastoral management of semi-arid north east Nigeria. Body weights (kg) were 3.37, 7.87 and 12.21 for 1, 3 and 6 months of age respectively. The values for live weight gains (g day^{-1}) at 1, 3 and 6 months were 135, 167 and 200 respectively. The corresponding linear body measurements (cm) of Height At Withers (HAW) were 35.74, 47.85 at 1, 3 and 6 months, respectively. Corresponding values for the three age categories for Heart Girth (HG) were 34.23, 44.80 and 52.10, while the values for Body Length (BL) at the same age were 44.10, 60.98 and 71.56, respectively.

Table 3: Body weights at 1, 3 and 6 months; linear body measurements (cm); liveweight gains (g day^{-1})

	Age (Months)					
	1		3		6	
Production traits	Male	Female	Male	Female	Male	Female
Body weight (kg)	4.50	3.40	8.80	9.30	13.70	13.30
Liveweight gain (g day^{-1})	127.50	138.40	170.98	162.69	212.76	194.56
Linear body measurements (cm):						
Height at withers	36.75	33.45	42.70	40.56	46.16	48.40
Heart girth	35.52	32.37	40.76	37.93	46.20	43.33
Body length	45.57	41.80	53.85	51.61	61.60	60.02

DISCUSSION

Birth weight for male and female obtained for Borno white goat were higher than those recorded for Sokoto red goat[11]. This shows that the Borno white goat is superior in this regard and has high potentials to be exploited for improved small ruminant production in the region. However, results in this study were lower than what was recorded for male and female for Mozambiquen, Zimbabwen and Tanzanian goats under traditional management[12-14]. Body weights at 1, 3 and 6 months and at maturity for the Borno white breed were lower than those recorded by Mckinon and Rocha[15] on Mozambiquen goats; Lyatuu *et al.*[13] on Tanzanian goats. Values were higher than those reported for Sokoto red goat[11]. Mature live weight gains (g day^{-1}) for male and female (164.00 and 150.00) for Borno white breed were relatively high and are comparable with gains reported on station and under traditional conditions in Nigeria and tropics[11-14,16]. Milk yield and composition for the Borno white goat were lower than those reported for West African Dwarf goat does on station[17]. However, they are comparable with values reported for other breeds of goats under traditional management in Nigeria and Sub-Saharan Africa[3,18,19]. Linear body measurements for the Borno white goat in this study are comparable with those recorded for Sokoto red and Kano brown goats and goats indigenous to northern Nigeria[19,20]. Thus the Borno white breed of goat should be conserved due to these attributes for improved small ruminant production in the region. Mature seasonal body weights changes for the Borno white goat in this study are comparable with those recorded for Sokoto red and West African Dwarf goats kept under traditional system in sub-humid zone of Nigeria[3,21,18]. The prediction equation for mature body weight for the Borno white goat showed that there is high correlation (r2 = 0.95) between Heart Girth (HG), Body Length (BL) and Height At Withers (HAW) with body weight (kg). `Thus using the linear body measurements for the breed, it is possible to estimate body weight of the breed at mature age in the absence of a scale.

The age at first kidding, kidding interval and litter size for the Borno white goat breed obtained in this study are comparable to what was reported on West African Dwarf goats which recorded 375.60 days, 375.68 and 1.74, respectively[4] in sub-humid zone of Nigeria. Similarly, the values obtained under this study are also comparable with those reported for Boar goats in Tanzania and Tswana goats in Bostwana[14]. The percent frequency for type of birth showed that the Borno white goat is very prolific and well adapted to its semi-arid environment twins being more frequent followed by singles and least triplets. This pattern is comparable to what was reported for Sokoto red and West African Dwarf goats under agropastoral management of sub-humid zone of Nigeria[18,22]. However, higher frequency has been reported for Tanzanian and Burkinabe goats[14,23]. Kid mortality values for the Borno white goat showed lower mortality of kids born twins and triplets as compared to higher values that have been reported for Sokoto red and West African Dwarf goats in sub-humid agropastoral condition of Nigeria[4,22,24]. Higher kid mortality values have been reported also for other breeds of goats in sub-Saharan Africa[14,25,26]. Thus these attributes of lower kid mortality for twins and triplets could be attributed to high heritability and prolific potentials if the breed and the adaptability it has in the semi-arid environment. These should be conserved by breeders and exploited by nutritionist for improved small ruminant production in the region. The higher and heavier values of the Borno white breed with respect to linear body measurements and live weight body gains recorded in this study are comparable to those reported for West African Dwarf goat and other breeds of goats kept under traditional management of Nigeria and sub-Saharan Africa[4,11,26]. Similarly, values obtained for the breed are comparable to those recorded for Nigerian breed of sheep and goats[19,20]. However, values were lower than those reported for Tswana goats in Botswana[26].

CONCLUSION

Considering the genetic and adaptability characteristics of Borno white goat, the breed deserves attention in the national small ruminant breeding programmes in Nigeria especially the semi-arid zone. The demand for greater and more efficient meat and milk production continues in the country. The challenge to the animal breeders and nutritionist therefore is to improve potentials for meat and or milk production to a satisfactory level without sacrificing the adaptational qualities. This may be achieved through the formulation of a purposeful national breeding and nutrition programme that will allow for long term genetic selection within the breed. Thus with significant improvement in nutrition and management coupled with selection for better performance in the harsh environment. Borno white goat has great prospects for use in the near future. Further the breed could be exploited using cross breeding with other genotype of goat so as to exploit heterosis of the reproductive traits of the breed.

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