African Journal of General Agriculture
Vol. 5, No. 1, March 31, 2009
Printed in Nigeria

1595-6984/2009 $12.00 + 0.00

http://www.asopah.org

AJGA 2008068/5101

Physiological response of local (West African Dwarf) and adapted Switzerland (White Bornu) goat breed to varied climatic conditions in South-South Nigeria

C. S. O. Otoikhian*, J. A. Orheruata, J. A. Imasuen and O. P. Akporhuarho

c/o Clement Isidahomen**,** Department of Animal Science, Faculty of Agriculture, Ambrose Alli University, P.M.B. 14, Ekpoma, Edo State, Nigeria

(Received October 27, 2008)
(Accepted June 12, 2009)

ABSTRACT: A comparative study was carried out to compare performance and adaptation of two goats genotypes raised in Nigeria, 20 females (10 local and 10 white Bornu x local) were used in this experiment. During the late raining season the goats were monitored for the following parameters: Body Weight (BW),rectal temperature (RT), Body temperature (BT),skin temperature (ST),Respiratory Rate (RR)and Heart Rate(HR)as well as the air temperature (R.T), Body temperature (B.T), Skin temperature (S.T), Respiratory Rate (R.R), And Heat Rate (HR) as well as the air temperature (AT), in the pens in the morning (MR), and afternoon (AR), from June to August, the crossbred (White Borne X West African Dwarf) goats showed a significant gain ; the live weight f1was superior to the local goats at the end of the experiment. The physiological response during the AR was significantly superior to MR for all parameters. The local goats achieve the highest values of BT and ST during the experiment. On average, the physiological rhythms (RR and HR) were higher in crossbred than the local goats. In conclusion, crossbred goats show to be at risk to environmental stress condition in southern Nigeria.

Key Words: Adapted, Local, White Borun, Climatic, South –South

Introduction

Nigeria and especially the southern region have important role in goat production in the Africa continent and the world in general (Ngere *et al*, 1984). In this region, the herd is mainly composed of local breed animals without breed type (Moruppa and Ngere, 1986), which are characterized by good adaptation to environmental conditions but lower productivity rates when compared to the breeds coming from the temperate regions (Odo *et al*, 2000). Some developing countries as well as Nigeria, with the strategies to meet the increasing demand for animal products, introduced exotic genotype with a high degree of specialization such as white Bornu, Red Sokoto and Anglo- Nubian breeds for example.

*To whom correspondence should be addressed. E–mail: megabrosy2k@yahoo.co.uk

For milk production the most used breed in Northern Nigeria is the white Bornu. However, in the southern region, a researcher whose rearing system was mainly based on pasture, breed most extensively the F1 cross between white Bornu and local with the objective to exploit the greater productivity in well adapted animals (Otoikhian, 2005). Although the use of white Bornu goats in the southern part was pronounced in the last few years, it has little studies concerning their ability to tolerate the insulating temperate in the tropical areas.

Odubote *et al* (1993) reported a substantial alteration in the sexual behavior and estrus activity in west Africa dwarf goats under improved management system in south – western Nigeria, It is well known that the stress from environmental conditions scan produce a reduction in reproductive performance as well the meat and milk production (Osakwe and Smith, 2004). Nevertheless the study of environmental response may be suitable to obtain good productive index in these areas, in respect of the animal welfare. The aim of this study was to compare performance and environmental adaptation of local breed and white Bornu local adult goats, raised in the southern area of Nigeria.

Materials and Methods

Experimental conditions: The experiment was carried out at the Ambrose Alli University, teaching and research farm, Ekpoma, Edo State, during the late rainy seasons (June, July, August). This period characterizes the transitions from the rainy (March, April, May) to the dry season (October, November, December) giving room to evaluate the animal response in different climatic conditions.

Animals and Management: In one herd composed of two genetic types (Local and F_1 crossbred white Bomu X Local), each one with ten female goats, ten multi-parous adult, non pregnant and non lactating goats were chosen randomly; ten local (groups 1) and ten F_1 crossbred (group 2). The experimental groups were similar in age (means ± SEM); 2.5± 0.17 vs 2.6 ± 0.16 year ($p>0.05$) and body weight: 38 : 76 ± 5.60 vs 39.99 ± 5.72kg ($p>0.05$). These animals were weighed monthly and kept in the flock. The herd was reared in a Simi-extensive system with the following management; daily, from 10:00am to 4:00pm, the goats grazing on pasture and later they were housed in the pens. Herein at 5.00pm animals received 250g/head of concentrate with 16% of crude protein. Water and salt lick were supplied *ad libintum*, Each pen measured 40x 50m and contained 3 40 x 3m open front shelter. The feed alley and the front shelter was sand with concrete and faced in North – West director.

Physiological Parameters: Monthly, for four days consecutively. At 8.00am (Morning Reading) and at 5.00pm (Afternoon Reading: AR), Body and Skin temperature and the Respiratory and Heart rate were recorded. The Body temperature (BT) was taking with a rectal digital thermometer. Skin temperature (ST) was measured by a digital thermometer. Each reading was made at constant depth compression in the right side of animal. The ST was obtained by mean of the two measurements. Respiratory (RR) and Heart rates (HR) were measured using a stethoscope. The air temperature (AT) and the humidity (HU) were recorded using a digital thermo – hydrometer before and after each daily measurement of the physiological parameters. All parameters were taken in the pea.

Statistical Analysis: All descriptive data were analyzed using the GLIN procedures for repeated measure analysis of variance (ANOVA) of SAS program software. The factor used in the model for analysis of physiological parameters included genetic type (Local while Bornu x Local),months the to August), daily reading (MR and AR) Difference among months in the same breeds within each daily reading the t-test was used. While the difference as mean ± SEM and difference were taken as statistically Significant from $p< 0.05$.

Results

The data on live body weights of the goats are presented in Table 1.

Body Weight

Table 1: Live weight (mean + SEM) of F, and local goats recoded during the experiment.

Month	FI	Local
June	39.99 ±0.646b	38.58±0.51b
July	38.62±0.51c	38.05 ± 0.51b
August	41.83 ±0.65a	38.93±0.69a

Means in same row with difference superscript differs significantly at $p< 0.05$. The results revealed that the crossbred goats showed a significant gain ($p<0.05$). The live weight of F1 was superior to the local ($p<0.05$) at the end of the experiment.

Physiological Parameters

Monthly and Genetic Response the result of comparison among months within and between genetic type in the same daily reading (MR or AR) are presented in Table 2 and 3 Skin and Body Temperature: in the afternoon both temperature presented a significant Increase from June to August ($p< 0.05$). Thus in July the highest values (ST: 38 66 ± 0.8^{o}C) of the experiment were detected in local goats. From July to August the AR showed again a decrease in temperature ($p<0.05$) except for the ST in local animals. In the morning, the greatest mean temperature were observed in June ($p<0.05$ in the month, BT, of local breed was significantly lower than the F1 which also has similar trend with the results observed for RT. Also in both breed the temperature showed a decrease from June to July – August period ($p<0. 05$).

Table 2: Skin and Rectal Temperature (MR) of local and F1 crossbred goats

Month	Local		F1 Crossbreed	
	ST	RT	RT	RT
June	37.55c	38.25b	3650a	36.65b
July	38.66b	39.56a	35.90b	36.45a
August	39.51a	38.50b	36.20a	36.50a

Means in the same raw with difference superscript are statistically difference from each other.

Table 3: Skin and Rectal Temperature (AR) of Local and crossbred goats.

Month	LOCAL		F1 CROSSBRED	
	ST	RT	ST	RT
June	39.50^{b}	39.85^{b}	38.80^{a}	39.00^{a}
July	40.00^{a}	40.45^{a}	38.70^{b}	38.70^{b}
August	39.50^{b}	40.20^{a}	38.35^{c}	38.50^{c}

Means in the same raw with difference superscript are statistically difference from each other.

Table 4: Respiratory Rate of Local and Crossbred

	LOCAL		F1 CROSSBRED	
	RR		RR	
Month	MR	AR	MR	AR
June	17^{c}	20^{c}	30^{c}	40^{c}
July	20^{a}	25^{a}	60^{a}	70^{a}
August	18^{b}	24^{b}	50^{b}	40^{b}

MR = Morning reading, AR = Afternoon Reading, RR =- Respiratory Rate
Means in the same row with different superscript are statistically different at $P<0.05$

Respiratory and Heart Rate: Respiratory rate and the heart rate recorded during July ($P<0.05$) as shown in Table 4 and 5 was superior when compared to the other months. F1 goats showed the highest values of RR in this month. For this genotype the RR reading in the morning showed a slow increase from June to August. Also the RR recorded in August differs between genotypes. The HR data in the afternoon showed a significant increase from June to July in local bred and for F1 from July to August. The highest value was recorded in August. During MR the HR and RR of the crossbreds became progressively greater during the experiment.

Table 5: Heart rate (HR) of Local and Crossbred goats.

	LOCAL		F1 CROSSBRED	
	HR		HR	
Month	MR	AR	MR	AR
June	67^{c}	69^{c}	75^{c}	83^{c}
July	69^{b}	71^{b}	83^{b}	85^{b}
August	73^{a}	73^{a}	85^{a}	95^{a}

MR = Morning reading, AR = Afternoon Reading, RR =- Respiratory Rate
Means in the same row with different superscript are statistically different at $P<0.05$

Discussion

Live weight recorded during the experiment did not show a reduction in body mass in either genetic type. Literature on goats reported a marked depression of food intake and weight when animal were exposed to high temperatures of tropical areas (Akusu and Egbunike, 1990). Goats living in harsh environments represent a climax in the capacity of domestic ruminants to adjust to such areas where water sources are widely distribute and food sources are limited by their quantity and quality, the air temperature registered in the pens throughout the experiment demonstrated that the upper critical temperature (up to 40^{o}c) of goats was not raised (Alderson, 1992). Also in this period the effect rainfall provide the greatest food offer of pasture in the region (Adu *et al*, 1987).

These facts interpreted the performances reported in the study. The increase in physiological response showed during AR in both genetic types were expected (Abegaz and Gemeda, 2002). It can be considered as a protective mechanism of homeostasis against stress due to exercise and heat increment of digestive process. Such factor associated with an increment of solar radiation justified the highest values recorded in the afternoon from July to August. Ogebe *et al*, (1996) showed a negative correlation between rainfall and physiological parameters in Nigerian Dwarf goats. These authors observed an increase in physiological response from raining to dry season an d suggested that rainfall is associated with high atmospheric moisture, which could reduce the amount of heat stress.

In spite of the greatest values in the afternoon previously mentioned, the experiment BT means recorded in both genetic types were in accordance with the standard values proposed for goats (39 – 40^{o}c) in neutral thermal condition (Alderson, 1992). Some author (Barhanu *et al*, 1994 and Derma and Noakes, 1994) demonstrated in several stress conditions that BT exhibited minimal variations. During the last part of the experiment the goats showed clinical signs of stress in the afternoon. Both pulses (RR and HR) surpassed the mean values of goats (HR: 70-75bpm and RR : 25 – 40bpm, as reported by Derman and Noakes, 1994). In the same daily reading the ST means were quite close to BT, showed a less efficiency to dissipate the increase of temperature observed in this period. In genetic comparison, the local goats achieved the highest values of temperature thought the experimental period. The lower thermal stress in the F_1 cross can be interpreted by the presence of white coat and skin pigmented in the animals. It is known that the effects of penetration of solar radiation are a function not only of the colour but also of the structure of the coat. Thus short haired animals, such as the local goats used in this research showed susceptible to higher increase of RR and HR. Berbigier (1988), reviewing results of some of experiences conducted in an experiment with local and F_1 Alpine x local kids, reported that the greater productivity of crossbreds did not affect their tolerance of diurnal temperatures. However in F_1, weight of heart and lungs were higher than local goats probably consequence of intense thermo-regulation activity.

Results of reading conducted in the morning permitted description of the animal after the nocturnal inactivity phase. It is important to point out that in all animals the physiological observation did not show sign of stress and mean values of parameters were within the limits of tolerance (Berhanu *et al*, 1994). In both groups, body and skin temperatures displayed a slight decrease (0.5 – 1.0^{o}C) from July to August. This loss of heat was probably the residue effect of animal reaction to a progressively fall of temperature during night. The increase of solar radiation and of clear days is usually associated to a cooling effect in the nocturnal period. Apparently, crossbred goats exhibited higher responsiveness to exposure to morning environmental conditions. During transition from rainy to dry season rates values raised. The cause of these results is difficult to explain. However, the presence of the response only in F_1 would seen to indicate that their traits is were involved.

Moreover, in the morning readings recorded in June appear to be more affected by the highest humidity shown during this month. Especially in F_1, the BT and ST as well as RT registered in this period were superior to the other months and quite close to the afternoon values. These results are not in agreement with other authors (Ogebe *et al*, 1996), who concluded that at the onset of rain animals became more comfortable environmentally. Nevertheless, the literature had little information about the crossbreds used in this work. It is however possible that the moisture elevation influenced that ability for thermal dissipation in F_1 characterized with a greater demand by the local breed.

Conclusion

It was concluded therefore that the local goats are more susceptible to climatic stress than White Bornu crossbreds. The greater ability of crossbred goats to tolerate the change in environment conditions in the Southern part of Nigeria may be due to various factors such as their prominent white coat colour and skin pigmentation. Also the result has implies the view of gene interaction between both breeds.

References

Abegaz, S. and D Gemeda (2002). Genetic and phenotypic parameters of growth, reproductive and survival performances of Horrow sheep at Balco Agricultural Research Center. Research fellowship Report, animal Genetic Resources group, international livestocks Research Institute (ILRI), Addis Ababa, Ethiopia, Feb.2002.pp.132.

Adu, I.F, A.Odeniyi and B.B. Taiwo (1990). Reproduction characteristrics of a herd of WAD goat at Ubiaja, Bendel State of Nigeria, July 20th-24th, 1987.

Akusu M.O and G.N. Egbunike (1990). Pre-weaning performance of kids of the west Africa Dwarf (WAD) goat in their native environment. Bull. Hith Prod. Afr. 38:pp.399.

Alderson, G.L.H. (1990) genetic conservation of Domestic livestock, CAD international, Wallingford, Uk p.242. Berbigier, p (1988) Bioclimatologie des ruminants domestiques en zone tropicale pp. 135-138 in: INRA (Editor), Paris, 237P.

Barhanu, B.; L.A. Ntenga and G.C Kifaro (1994). studies on some factors affecting reproductive performance and mortality rate of small East Africa goats and their crosses. SRNET Newsletter. No, 26: pp 8-14.

Derman, K.D and T.D Noakes (1994). comparative aspects of exercise physiology. In: Hodgson, D.R, Rose, R.J (Eds), The Althletic horse: Principle and practice of equine sports medicine. Philadelphia. W.B Saunders, pp. 13-25.

Moruppa, S.M. and L.O. Ngere (1986). Biometrics studies on Bornu White and Red Sokoto (Maradi) goat breeds. Paper presented at the 11th Annual conference of Nig. Soc. For Anim. Shilka-Zaria, Nigeria.

Ngere, L.O.,I.F. Adu and A.O.Okubanjo (1984). The indigenous goat of Nigeria. Anin. Genet. Res Infor. FAO/UNEP, Rome-Italy 3:pp 1-9.

Odo, B.I., S.O. Alaku and S.L.O meje (2002). Contribution of small Ruminant sheep and goat to meat supply in Enugu State, Nigeria. J. Applied Anim. Res. 18, Pp. 165-169.

Odubote, I.K.J.O. Akinokun and A.A Ademosun (1993). Productive characteristic of West Africa Dwarf goats under improved management system. In Ayeni, A.Oand Bosman, H.G. (Eds), system of goat and production, processing ofan international workshop held at Obafemi Awolowo University, Ile-Ife, 6-9th July, 1992. Pp.202-205.

Ogbed P.O, B.K. Ogunmodede and L.R. McDowell (1996). Behavioral and physiological responses of Nigeria Dwarf goat to seasonal change to the humid tropics. Small. Rum Res. 22:Pp. 213-217.

Osakwe, I.I and J.W. Smith (2004). performance of sheep and goat grazing purpureum and panicum maximum in gliricidia sepium Alley plots in: Oguniji, J.O. Osakwe, I.I., Ewa U.U., Alaku, S.O.;Otuma; M.O. and Nweze. B.O. (Eds) of the proceedings of the 9th Annual conference of animal Science Association of Nigeria, Sept. 13th -16th 2004, at Ebonyi State University, Nigeria. Pp 122-125.

Otoikhian, C.S.O. (2005). Upgrading the productivity of the West Africa Dwarf (WAD) goat with White Bornu (WB) goat. A PhD.thesis, Ambrose Ali University, Ekpoma, Nigeria.