EFFECT OF SEASON AND SEX ON THE BODY MORPHOMETRICS, HEAT TOLERANCE AND FAECAL EGG COUNTS OF WEST AFRICAN DWARF (WAD) GOATS

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ABSTRACT

Eight hundred and twenty (820) West African Dwarf (WAD) goats were sampled randomly on-farm in Ogbomoso agro-ecological zone of Oyo State, Nigeria. Data obtained on body weight, body length, chest girth, height-at-wither, sacral pelvic width, rectal temperature, respiratory rate, pulse rate, heat stress index and faecal egg counts were corrected for age effect and analysed for fixed effect of season and sex using General Linear Model procedure of SAS (2003). Significant effects of season and sex were obtained in all the aforementioned parameters except rectal temperature and pulse rate which were not influenced by sex. Highest values of body morphometrics, physiological parameters and faecal egg counts were recorded during the early dry, late dry and late wet seasons respectively. Female goats had higher body parameters and faecal egg counts and lower breath per minute. It therefore suggests the significant importance of season and sex in the growth and productivity of WAD goats.
Keywords: *Season, Sex, Body morphometric, Heat tolerance, Faecal egg count, WAD goats*

INTRODUCTION

Goat is an important animal in the tropics on account of its numerous uses and several advantages over other livestock. Amongst the three main breeds of goats in Nigeria (Red Sokoto, Sahel and West African Dwarf (WAD)), West African dwarf goat is

the most prevalent in southern Nigeria (Oni, 2003). They are hardy, small, early maturing, prolific, non-seasonal breeder (Osuagwuh and Akpokodje, 1982) and plump, measuring less than 50cm in height and weighing between 20 - 25 kg (Ozoje, 2002) and they are trypanosome tolerant.

Parasitic diseases such as helminth infestation are a continuous serious health problem to WAD goats affecting their productivity (Odubote, 1992). Gastro-intestinal nematode infection is associated with effects on feed intake, gastro-intestinal function and protein turn over (Holmes, 1987). Factors affecting the development and survival of these parasites are mainly environmental, especially seasonal climatic change and certain management practices (Hansen and Perry, 1994). Although, indigenous goat strains and breeds are relatively tolerant or resistance to parasitic diseases and harsh environmental conditions (Okeyo et al., 1998), yet these attributes are usually accompanied by poor growth (Ruvuna *et al.*, 1989).

Heat is a major constraint on animal productivity in the tropical belt and arid areas (Silanikove, 1992). Evidence suggests that hyperthermia in domestic species is deleterious to any form of productivity regardless of breed and stage of adaptation (Finch, 1984). Studies carried out by Butswat, Mbap and Ayibantoye (2000) on Yankassa sheep revealed significant differences between males and females in all the physiological coefficients. The study further showed that sheep's pulse rate and rectal temperature were significantly lower in the hot dry season while respiratory rate was significantly higher in the hot dry season. The most frequently used indices of physiological adaptability to tropical environments are the rectal temperature, pulse rate and respiratory rate (Oladimeji *et al.*, 1996).

Live weight increase in livestock is the gross expression of the combined changes in carcass tissue, organs, viscera and gut fill (Orr, 1982) and it is strongly influenced by several factors amongst which are season and sex of the animal. The climate conditions affect the amount of food and water intake, the availability of potential energy in the ingested forage, the animal heat production system, the net energy available for productivity and body composition of growing animals (Oladimeji, *et al.*, 1996). It is therefore necessary to study how growth, heat tolerance and worm burden (through faecal egg count) of WAD goats are being influenced by seasonal variation and sex of the animal with a view to adding to the existing knowledge.

MATERIALS AND METHODS

The study was carried out in Ogbomoso agro-ecological zone of Oyo State, Nigeria, located approximately at the intersection of latitude $8^{o}15^{l}$ North of the Equator and longitude $4^{o}15^{l}$ East of the Greenwich Meridian and lies between 300 and 600 meters above the sea level. The annual temperature ranges between 25.5^{o}C to 40.0^{o}C and mean annual rainfall is 1247mm. Eight hundred and twenty (820) West African Dwarf goats were sampled on-farm using simple random sample technique under the free range system. This system of rearing is adopted by the people in this community so as

to reduce the competition between humans and goats for food. There was no known deliberate veterinary or ethno-veterinary practice engaged in by the owners. The study lasted for 12 months and was categorized into four (4) seasons: Late dry (January to March), Early wet (April to June), Late wet (July to September), Early dry (October to December). Data were collected twice on body morphometrics, physiological parameters and faecal egg counts in each season. The estimated age of each goat was done through dentition as described by Sastry and Thomas (1980) while data on body weight, body length, hearth girth, height at withers and sacral pelvic width were obtained based on the methods described by Abdullah et al. (2004).

The animals were subjected to two hours of intense sunlight and data collected on each animal between 1300 to 1600hrs include rectal temperature (RT), pulse rate (PR) and respiratory rates (RR). The pulse rate was determined by placing the fingertips on the femoral arteries on the medial aspect of the hind limb for one minute and recorded as beats per minute (beat/min). Respiratory rate was determined by counting the number of flank movements per minute and recorded as breaths per minute. The Rectal temperature was taken on each animal by inserting a disinfected clinical thermometer gently into the rectum for a minute. The relationships between pulse (P) and respiratory rate (R) (from the study) together with their normal average values were used to derive heat stress index (HSI).

$$HSI = \frac{R}{Normal\ Average\ \mathrm{Re}\ spirotory\ Rate} \times \frac{Normal\ Average\ Pulse\ Rate}{P}$$

Fresh faecal sample was taken directly from the rectum of each goat early in the morning (0800-1000hrs). The sample was taken to the laboratory and analyzed for helminth eggs and species using Floatation and McMaster's technique. Data obtained were arcsine transformation for normalization using the methods of Turner (1982). Data on body morphometric, physiological parameters and faecal egg counts were significantly ($p < 0.05$) affected by age of the animal, therefore, preliminary data adjustment was done. Data were analysed for the fixed effect of season and sex using the General Linear Model (GLM) procedure of SAS (2003). The means were separated with the use of Duncan Multiple Range test procedure of the same statistical package. The linear model is as shown below:

Model $Y_{ijk} = \mu + \mathrm{A_i} + B_j + (AB)_{ij+} e_{ijk}$

Y_{ijk} = the parameter of interest,
= the overall mean for the parameter of interest,
A_i = effect of the *ith* season (i = 1 to 4),
B_j = effect of the *jth* sex (j = 1,2),
$(AB)_{ij}$ = interaction effect of the *ith* season and jth sex,
e_{ijk} = random error associated with each record .

RESULTS AND DISCUSSION

Table 1: Least square means of body morphometric as influenced by season and sex of West African Dwarf Goats in Ogbomoso

Variable	obs	BDW(cm)	BDL(cm)	HGT(cm)	CG(cm)	SPW(cm)
Overall	3768	8.85+0.05	40.53+0.09	36.75+0.07	47.37+0.13	12.66+0.04
Season:						
Late dry	870	8.08+0.10^{d}	41.08+0.17^{b}	34.80+0.13^{d}	43.81+0.26^{d}	11.24+0.09^{c}
Early wet	1232	8.58+0.10^{c}	38.63+0.15^{c}	36.79+0.12^{c}	48.59+0.21^{c}	12.89+0.06^{b}
Late wet	875	9.03+0.11^{b}	40.87+0.19^{b}	38.28+0.14^{b}	49.34+0.22^{b}	13.86+0.07^{a}
Early dry	791	9.22+0.12^{a}	42.15+0.19^{a}	37.84+0.15^{a}	50.57+0.26^{a}	13.41+0.08^{a}
Sex:						
Male	1212	8.19+0.08^{b}	39.71+0.15^{b}	36.58+0.12^{b}	46.92+0.20^{b}	12.54+0.07^{b}
Female	2556	9.26+0.07^{a}	41.66+0.11^{a}	37.27+0.09^{a}	49.24+0.15^{a}	13.16+0.05^{a}

abcdef *Means within the same variable in a column with different superscripts are significantly different (P < 0.05)*

Table 2: Least square means of physiological parameters as influenced by season and sex of West African dwarf goats in Ogbomoso

Variable	obs	RR	RT	PR	HIS
Overall mean	3828	61.6+40.12	40.25+0.01	76.77+0.16	1.75+0.03
Season:					
Late dry	878	65.96+0.26^{a}	40.90+0.01^{a}	73.18+0.35^{a}	1.74+0.050^{a}
Early wet	1262	61.96+0.19^{c}	40.70+0.69^{b}	70.58+0.29^{b}	1.73+0.040^{b}
Late wet	886	59.07+0.24^{d}	40.57+0.13^{c}	68.49+0.29^{d}	1.69+0.030^{d}
Early dry	802	62.40+0.26^{c}	40.66+0.02^{b}	70.27+0.34^{c}	1.70+0.004^{c}
Sex:					
Female	2706	61.42+0.21^{b}	40.85+0.08	75.17+0.28	1.75+0.003
Male	1122	62.77+0.14^{a}	40.96+0.33	76.70+0.19	1.76+0.019

abcdefg *means within the same variable in a column with different superscripts are significantly different (P < 0.05)*

Table 3: Least squares means of faecal egg counts as influenced by season and sex of West African dwarf goats in Ogbomoso

Season	Sex	Observation	Faecal egg count
Late dry	Male	225	469.89+0.67
	Female	520	521.71+0.55
Early wet	Male	273	569.35+0.49
	Female	656	717.88+0.22
Late wet	Male	120	820.88+0.01
	Female	279	1161.70+0.54
Early dry	Male	120	736.29+0.53
	Female	404	860.02+0.75

abcd *means within the same variable in a column having different superscripts are significantly different (P < 0.05)*

Table 4: Least square means of the interaction effect of season x sex on faecal egg counts of West African dwarf goats in Ogbomoso

Variable	Observation	Faecal egg counts
Overall means	3634	749.85+0.29
Season:		
Late dry	879	578.21+0.43^{d}
Early wet	1253	634.73+0.61^{c}
Late wet	850	879.81+0.10^{a}
Early dry	652	588.24+0.85^{b}
Sex:		
Male	1074	631.51+0.92^{a}
Female	2559	799.52+0.27^{b}

abcd *means within the same variable in a column having different superscripts are significantly different (P < 0.05)*

Table 1 revealed a very highly significant effect of season on height-at-wither, sacral pelvic width, body weight, body length and chest girth. The least square means showed that the highest values of all body morphometrics were obtained in the early dry season while the lowest values were observed in the early wet season except body length which was occurred in the late dry season. Significant sex differences in body morphometrics revealed that female goats had the highest values. The heat tolerance attributes showed that season had a very highly significant effect on respiratory rate, rectal temperature, pulse rate and heat stress index of West African Dwarf goats under study (table 2). The least square means revealed that late dry season had the highest physiological values while the lowest were obtained in the late wet season. However, significant effect of sex on respiratory rate revealed that male goats had 1.35 breath/min more than their female counterpart (table 2). Highly significant effect of season on faecal egg counts showed that massive output of helminthes eggs were observed during the late wet period and the lowest in the late dry season. The significant effect of sex on the faecal egg counts showed that male goats had lower faecal egg output than the female goats (table 3). Faecal egg counts were significantly affected by the interaction of season and sex. Generally, male goats had the lowest faecal egg counts during the late dry season (table 4).

Skeletal dimensions especially body length, shoulder width, heart girth and height at withers are good indicators of live weight and condition score and they are highly correlated with dressing percentage (Jeffrey and Berg, 1972). The overall mean value of body weight obtained in this study falls within the range reported by Abdullah *et al* (2004); Oseni and Ajayi (2008) on the same breed in the same environment. The significant effect of season on body morphometrics in this study agrees with the reports of Otuma (2004). The highest values of body weight and other linear body measurements as obtained during the early dry season could be as a result of low incidence of both ecto and endo parasites which lowers productivity and also this period coincides with massive harvesting of annual crops such as maize, yam, cassava, sorghum etc. The left overs are fed to the animals. The significant effect of sex agrees with the findings of Hassan and Ciroma (1991); Abdullah *et al* (2004) on Red Sokoto and West African Dwarf goats respectively. The significant

effect of sex on body morphometrics in favour of female goats in this study was also reported by Oseni and Ajayi (2008) and Katongole, Sebolai and Madimabe (1996) in WAD goats and Tswana goats respectively. Even though, significant sex effect favouring female goats was observed, the small sample size of male goats in the study area did not permit real comparison. Male goats of four months and above are disposed of as early as possible from the flock either for sales or consumption.

Heat is a major constraint on animal productivity in the tropical and arid areas (Silanikove, 1992). The significant seasonal differences in the physiological parameters are in agreement with the findings of Marai *et al* (2007). Increased physiological parameters during the late dry season is not surprising because, this period is characterized with high ambient temperature and relative humidity which could go beyond the comfort zone of the animals thereby resulting in variation in the heat energy produced and heat energy dissipated. Oladimeji *et al* (1996) also reports appreciable differences in rectal temperature, respiratory rate and pulse rate during the hot dry season over cold dry season among Yankasa sheep. The significant effect of sex on only respiratory rate in the present findings is in line with the reports of Oladimeji *et al* (1996) and Butswat *et al* (2000) among sheep of different breeds. Reasons such as hormonal profile and aggressiveness on the part of male animals could be adduced to this.

Helminthes constitute one of the most important constraints to ruminant livestock production in the tropics (Fabiyi, 1987) and most especially West African dwarf goats (Fakae, 1990). The species of helminthes (*Heamonchus contortus*, *Oesophasgostomum columbianum, Trichuris globulosa, Ostertagia circumcincta, Marshallagia marshalli, Fasciola gigantica, Gaigeria pachyscelis, Cotylophoron cotylophorum, Bunostomum trigonocephatum, Trichuris gigantica, Fasioloides magna*) discovered in this study agrees with the findings of Fakae and Chiejina (1993) in the extensively managed goats in eastern Nigeria and Faizal *et al* (1999) in crossbred goats managed extensively in the dry zone of Srilanka. Significant seasonal differences in the egg per gram of faecal output have been reported in the literatures (Tsado, Alemede and Adewale, 2008).

The difference in the prevalence rate of nematodes during different seasons could be attributed to difference in preferred ambient conditions such as rainfall, temperature, humidity for the development of the worms. The highest observation of egg per gram of faecal output in the late wet season observed in this study is not surprising, in that rainy season provides the optimal environment for proliferation of diseases and parasites affecting both grasses and animals. Fakae (1990) also observes escalating worm burdens and faecal egg counts during the wet periods. The observed lowest faecal egg counts during the dry period could be due to the arrested development of worm eggs and reduced infestation rates (Bekele, Mugewa and Scholtens, 1987). The highest faecal egg count in female goats obtained in this study agrees with previous observations of Scrivner (1964), Umoh, Shaibu and Akerejola (1982) and Waruiru et al. (1994) but at variance with the reports of Knight, Vegors and Lindahl (1972). They concluded that ewe lambs generally harboured higher worm loads than ram lambs.

CONCLUSION

This experimentation was carrier out to study how growth, heat tolerance and worm burden (through faecal egg count) of WAD goats are being influenced by seasonal variation and sex of the animal with a view to add to the existing knowledge. It was observed that the highest values of body weight and other linear body measurements as obtained during the early dry season could be as a result of low incidence of both ecto and endo parasites which lowers productivity and also this period coincides with massive harvesting of annual crops such as maize, yam, cassava, sorghum etc. The left overs are fed to the animals. Highest significant seasonal and sex differences in body morphometrics, physiological parameters and faecal egg counts observed is an indication that season and sex are significant determinant of growth and productivity in West African Dwarf goats.

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