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Ectoparasites of Sheep (*Ovis aries* L.) and Goats (*Capra hirus* L.) in Gombe, Gombe State, Nigeria

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ABSTRACT
A study was conducted in order to determine the prevalence of ectoparasites of sheep and goats in Gombe between March and June 2011. A total of 312 animals comprising of 155 sheep and 157 goats were examined and using the hand picking and hair brushing methods, ectoparasites present on the animals were collected. Of the 312 animals examined, 30 sheep representing 19.4% and 22 goats representing 14.0% were infested. The ectoparasites identified on sheep were Lice: *Damalinia ovis* 6 (3.9%), Ticks: *Rhipicephalus* sp. 5 (3.2%), *Amblyomma* sp. 9 (5.8%), *Boophilus* sp. 10 (6.5%) and Fleas: *Ctenocephalides felis* 8 (5.2%). The ectoparasites identified on goats were Lice: *Damalinia ovis* 6 (3.8%), Ticks: *Rhipicephalus* sp. 8 (5.1%), *Amblyomma* sp. 2 (1.3%), *Boophilus* sp. 5 (3.2%), *Ixodes ricinus* 3 (1.9%), *Hyalomma* sp. 4 (2.5%) and Mites: *Sarcoptes scabiei* 3 (1.3%). Ectoparasite infestations were higher in young animals; 11 (19.6%) in sheep and 15 (22.7%) in goats than in adult animals; 19 (19.2%) in sheep and 7 (7.7%) in goats. Female animals of 21 (24.1%) sheep and 17 (22.4%) goats were more infested than male animals of 9 (13.2%) sheep and 5 (6.2%) goats. Single infestations recorded in 22 (14.2%) sheep and 13 (8.3%) goats were higher than double infestations recorded in 8 (5.2%) sheep and 9 (5.7%) goats. The highest mean ectoparasite burden was 14.0±1.2 per host and the lowest mean ectoparasite burden was 1.6±1.9 per host in both sheep and goats. Chi square test revealed no statistically significant differences in the prevalence of ectoparasite infestations between sheep and goats, in age of sheep and goats, in sex and age of sheep, in single and double infestations of sheep and goats ($p>0.05$) but revealed statistically significant differences in sex of sheep and goats, in sex and age of goats ($p<0.05$). The study concludes that ectoparasites are common to both sheep and goats in Gombe and could affect their health and productivity as well as their economic and market value.

Key words: Ectoparasites, sheep, goats, Gombe, Nigeria

INTRODUCTION

Sheep and goat rearing is one of the most important aspects of agriculture, which has contributed immensely towards the growth and development of the national economy of Nigeria. It contributes significantly in the provision of domestic meat, estimated at over 1626000 t per annum. Sheep and goats play important roles in the livelihood of

farmers as they provide a vast range of products and services, such as meat, milk, hide and skin, hairs, horns, bones, manure, security, gifts, religious rituals and medicine (Sertse and Wossene, 2007; Anyanwu, 1998).

Ectoparasites impinge on sheep and goats and reduce their capacity to provide the above mentioned products and services. Ectoparasites also impede the health of sheep and goats by causing them to loose weight, retard growth and reduce productivity. As a result of their activities, arthropod ectoparasites may have a variety of direct and indirect effects on their hosts (Wall and Shear, 2001; Cornall and Wall, 2015). Ectoparasites particularly ticks are important parasites because of their voracious blood-sucking activity and as vectors of various agents of diseases in both humans and livestock (Hashemi-Fesharki *et al*., 1994; Cumming, 1998). The growing threat of ectoparasites to sheep and goat production and the tanning industry, needs well-coordinated and urgent control intervention (Cornall and Wall, 2015).

Information available on the distribution of ectoparasites in sheep and goats in Nigeria are those of Schillhorn van Veen and Mohammed (1975), Mohammad and Agbede (1980), George *et al*. (1992) all in Zaria, North Western Nigeria, Otesile and Obasaju (1980) in Ibadan, Southern Western Nigeria, Ugochukwu and Apeh (1985) in Nsukka, South Eastern Nigeria, Omudu and Amuta (2007) in Makurdi, North Central Nigeria, Kagira and Kanyari (2001) in Gwagwalada, FCT, North Central Nigeria, Onojafe (2008) in Ethiope, South Southern Nigeria and Obi *et al*. (2014) in Uli, South Eastern Nigeria.

Sheep and goat rearing is one of the main animal husbandry activities in Gombe and the entire North Eastern region of Nigeria but the distribution, seasonal abundance and population dynamics of ectoparasites of sheep and goats in Gombe and the entire North Eastern Nigeria have been poorly studied. The aim of this study therefore, was to determine the types, prevalence and intensity of ectoparasites infesting sheep and goats in Gombe, Gombe State, Nigeria.

MATERIALS AND METHODS

Study area: The study was carried out within Gombe metropolis. Gombe township lies between Latitude 10^0 08^1 N and 11^0 24^1 E and longitude 11^0 02^1 N and 11^0 18^1E of the Greenwich Meridian (Fig. 1).

The size of the town is 20,265 km^2, with a population of about 200,000 inhabitants. Gombe town is between 400-450 feet, above sea level. The occupation of most of the inhabitants is agriculture which includes; sheep and goat rearing under the extensive and semi-intensive animal husbandry management systems. The annual rainfall ranges between 850-1000 mm, with two distinct seasons. The rainy season which starts from May to October and dry season, from November-April. Average daily temperatures are 34°C in April and 27°C in August. The relative humidity ranges from 70-80% in August and decreases to about 15-20% in December. The natural vegetation is typically that of the Sudano-Sahelian Savannah, which is composed of shrubs, herbs, grasses and sparsely distributed trees. These provide enough grazing/browsing land and pasture for sheep and goat rearing. Cereals such as ground nut, maize, guinea corn, millet and cowpea are predominantly grown in the area and provide enough fodder for the animals (Anonymous, 2003).

Sampling procedure: Three hundred and twelve animals comprising of 155 sheep and 157 goats were sampled from localities within the Gombe metropolis. The animals were sampled randomly and inspected for ectoparasites. Sampling was carried out for a period of three months on weekly basis. Ectoparasites were collected early in the morning and in the evening from the body/skin coat of the animals and not from the ground in order to minimize accidental occurrences from other live stocks (Yakhchali and Hossiene, 2006; Elsaid *et al*., 2013).

Parasitological procedures: The clinical examination for the detection of ectoparasites was performed by multiple fleeces parting in the direction opposite to that in which hair or wool normally rests and visual inspection and palpation of the skin for ectoparasites on all parts of the body of the animal (Yishak *et al*., 2015). Animals were inspected and screened by the use of a hand magnifying lens. Ectoparasites, such as ticks were collected from the body of the animal using the hand-picking and hair-brushing methods described by James-Rugu (2000), with the aid of thumb forceps. The entire body of the animal was inspected and brushed with special attention paid to the ears, the area around the eyes, the axillae and the groin as recommended by Shah-Fischer and Say (1989). Care was taken to ensure that the mouth parts were not left behind during the traction with forceps (Bowman *et al*., 1999). In the case of strong attachment and embedded ticks, the ticks were removed using chloroform by dabbing the ticks and surrounding skin. Lice, fleas and mites were collected by dipping a brush in ethanol before combing and brushing the hair of the animal onto a white blotting paper (Wall and Shearer, 2001). The parasites collected were preserved in 70% ethanol in labeled glass vials. The information recorded on the data sheet included; the serial number, host species (sheep or goat), sex of animal (male or female), age of animal (young or adult), ectoparasite species collected, site of collection, place/location of sampling, date of collection and name of collector.

The age of the animal was determined by the method described by Gatenby (1991) and Steele (1996). Lambs and kids which were less than or equal to one year of age were considered as young and animals which were more than one year of age were considered as adults (Yishak *et al*., 2015).

Ectoparasite identification: Ticks, lice, fleas and mites were identified according to keys and descriptions by Soulsby (1982), Loomis (1984), Urquhart *et al*. (1996), Wall and

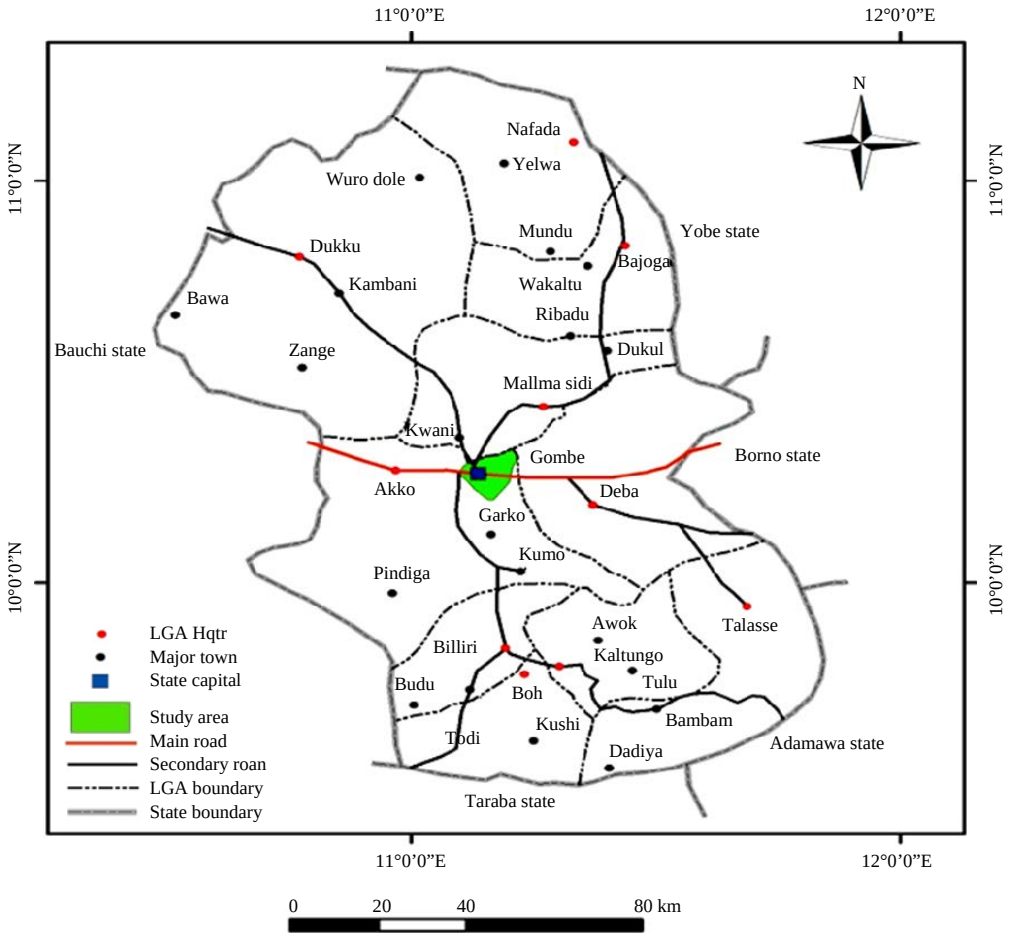

Fig. 1: Map of Gombe State

Shearer (2001) and Walker and Bouattour (2003). Ticks were examined under the light microscope and each morphological character was measured and recorded for identification. Lice, fleas and mites were heated in 5% KOH for 20 min, washed and dehydrated by treating them with different grades of ethanol, then cleared in xylene for 20 min and mounted on the light microscope. Identification was confirmed by the technical assistance of staff of the Veterinary Area Office, Gombe, Gombe State, Nigeria. The ectoparasites collected were stored as voucher specimens in the Biological Sciences Laboratory, Department of Biological Sciences, Gombe State University, Gombe, Nigeria.

Data analysis: Data collected were entered on Microsoft excel spreadsheets and analyzed using the Statistical Package for Social Sciences (SPSS Version 20.0) (SPSS., 1999). Pearson's Chi square test was used to test for any possible association of species, sex and age of animal with ectoparasite infestation. Chi square test was calculated using the formula:

$$X^2 = \frac{\sum (O - E)^2}{E}$$

The study considered 95% confidence interval and 5% precision level. The $p<0.05$ was considered as significance and $p>0.05$ as no significance.

RESULTS

Number of animals examined: A total of 312 animals comprising of 155 sheep and 157 goats were examined. Of the 312 animals examined, 30 (19.4%) sheep and 22 (14.0%) goats were infested with ectoparasites, with an overall prevalence of 52 (16.7%). The differences in ectoparasite infestations between sheep and goats ($X^2 = 1.62$, df = 1, $p>0.05$), in age of sheep and goats ($X^2 = 3.13$, df = 1, $p>0.05$) and in single and double infestations of sheep and goats ($X^2 = 1.26$, df = 1, $p>0.05$) were not statistically significant. However, the difference in ectoparasite infestations in sex of sheep and goats was statistically significant ($X^2 = 10.8$, df = 1, $p<0.05$).

Table 1: Prevalence of ectoparasites in sheep in Gombe, Nigeria (n = 155)

	Sex-specific prevalence ♂ = 68 ♀ = 87			Age-specific prevalence a = 56 b = 99				
Ecto-parasites	No. of animals infested (%)	No. of ectoparasites collected	Mean intensity±SE	No. of animals infested (%)	No. of ecto-parasites collected	Mean intensity±SE	Range	Predilection site
Lice								
Damalinia ovis	6 (3.9)	19	3.2±1.2	6 (3.9)	19	3.2±1.2	1-8	Back, belly
	♂3 (4.4)	♂9	♂3.0±0.32	a 2 (3.6)	a 12	a 6.0±0.90		
	♀ 3 (3.4)	♀10	♀3.3±0.5	b 4 (4.0)	b 7	b 1.8±0.48		
Ticks								
Amblyomma sp.	9 (5.8)	13	1.4±1.8	9 (5.8)	13	1.4±1.8	1-3	Ears,
	♂1 (1.5)	♂2	♂2.0±0.20	a 4 (7.1)	a 4	a 1.0±0.24		inter-digital
	♀8 (9.2)	♀11	♀1.4±0.8	b 5 (5.1)	b 9	b 1.8±0.48		spaces
Rhipicephalus sp.	5 (3.2)	10	2.0±0.72	5 (3.2)	10	2.0±0.20	1-5	Udder,
	♂1 (1.5)	♂2	♂2.0±0.20	a 3 (5.4)	a 6	a 2.0±0.32		thigh,
	♀4 (4.6)	♀8	♀ 2.0±0.40	b 2 (2.0)	b 4	b 2.0±0.24		testes, ears
Boophilus sp.	10 (6.5)	14	1.4±0.90	10 (6.5)	14	1.4±0.90	1-3	Ears, testes,
	♂4 (5.9)	♂6	♂1.5±0.20	a 5 (8.9)	a 8	a 1.6±0.48		udder
	♀6 (6.9)	♀8	♀1.3±0.50	b 5 (5.1)	b 6	b 1.2±0.32		
Fleas								
Ctenocephalides felis	8 (5.2)	16	2.0±0.10	8 (5.2)	16	2.0±0.20	1-5	Back, belly,
	♂8 (4.8)	♂16	♂2.0±0.10	a 2 (3.6)	a 5	a 2.5±0.24		ears, udder
	♀0 (0.0)	♀0	♀0.0±0.00	b 6 (6.1)	b 11	b 1.8±0.72		
Total	30 (19.4)	72	2.4±5.60	30 (19.4)	72	2.4±5.60	1-8	Body/skin
	♂9 (13.2)	♂35	♂3.9±2.10	a11 (19.6)	a 35	a 3.2±2.60		coat
	♀21 (24.1)	♀37	♀1.8±1.20	b19 (19.2)	b 37	b 2.0±2.80		

♂: Male, a: Young, ♀: Female, b: Adult

Prevalence of ectoparasites in sheep: Five species of ectoparasites were identified which were Lice: *Damalinia ovis* 6 (3.9%), Ticks: *Rhipicephalus* sp., 5 (3.2%), *Amblyomma* sp. 9 (5.8%), *Boophilus* sp. 10 (6.5%) and Fleas: *Ctenocephalides felis* 8 (5.2%). Ectoparasite infestations were higher in young sheep 11 (19.6%) than in adult sheep 19 (19.2%) and in female sheep 21 (24.1%) than in male sheep 9 (13.2%) (Table 1). Single infestations were recorded in 22 (14.2%) sheep and higher than double infestations recorded in 8 (5.2%) sheep. Chi square test revealed no statistically significant differences in ectoparasite infestations between male and female sheep (($X^2 = 3.07$, df = 1, $p>0.05$), between young and adult sheep ($X^2 = 0.0007$, df = 1, $p>0.05$) but a significant difference between single and double infestations ($X^2 = 7.30$, df = 1, $p<0.05$).

Prevalence of ectoparasites in goats: Seven species of ectoparasites were identified which were Lice: *Damalinia ovis* 6 (3.8%), Ticks: *Rhipicephalus* sp., 8 (5.1%), *Amblyomma* sp. 2 (1.3%), *Boophilus* sp. 5 (3.2%), *Ixodes ricinus* 3 (1.9%), *Hyalomma* sp. 4 (2.5%) and Mites: *Sarcoptes scabiei* 3 (1.3%). Ectoparasite infestations were higher in young goats 15 (22.7%) than in adult goats 7 (7.7%) and in female goats 17 (22.4%) than in male goats 5 (6.2%) (Table 2). Single infestations were recorded in 13 (8.3%) goats and higher than double infestations recorded in 9 (5.7%) goats (Table 3). Chi square test revealed significant differences in ectoparasite infestations between male and female goats ($X^2 = 8.69$, df = 1, $p<0.05$), between young and adult goats ($X^2 = 7.32$, df = 1, $p<0.05$) but no significant difference between single and double infestations ($X^2 = 1.26$, df = 1, $p>0.05$).

DISCUSSION

The overall prevalence of 16.7% recorded in this study is higher than that of Kagira and Kanyari (2001) who reported a prevalence of 10.0% in sheep and goats in Gwagwalada area of FCT Abuja, Nigeria but lower than 45.95% reported by Ugochukwu and Apeh (1985) in Nsukka, Enugu State, South Eastern Nigeria, 55.1% reported by Ohaeri and Ugwu (2013) in Michael Okpara University of Agriculture, Umuidike, animal husbandry farm at Umuahia, Abia State, South Eastern Nigeria and 68.1% reported by Obi *et al*. (2014) in Uli, Anambra State, South Eastern Nigeria.

The 19.4% prevalence reported in sheep in this study is higher than 13.1% reported by George *et al*. (1992) in Zaria, Kaduna State, North Western Nigeria, 18.52% reported by Ugochukwu and Apeh (1985) and 8.7% reported by Ohaeri and Ugwu (2013) but lower than 47.0% reported by Onojafe (2008) in Ethiope West Local Government Area of Delta State, South Southern Nigeria and 69.8% reported by Obi *et al*. (2014).

The 14.0% prevalence reported in goat in this study is higher than 3.7% reported by George *et al*. (1992) in Zaria, Nigeria but lower than 61.70% reported by Ugochukwu and

Table 2: Prevalence of ectoparasites in goats in Gombe, Nigeria (n = 157)

	Sex-specific prevalence ♂ = 81 ♀ = 76			Age-specific prevalence a = 66 b = 91				
Ectoparasites	No. of animals infested (%)	No. of ectoparasites collected	Mean intensity±SE	No. of animals infested (%)	No. of ecto-parasites collected	Mean intensity±SE	Range	Predilection site
Lice								
Damalinia ovis	6 (3.8)	38	6.3±2.20	6 (3.8)	38	6.3±2.20	1-14	Back,
	♂2 (2.5)	♂8	♂4.0±0.64	a 3 (4.5)	a 20	a 6.7±0.96		shoulders
	♀4 (5.3)	♀30	♀7.5±1.60	b 3 (3.3)	b 18	b 6.0±0.64		
Ticks								
Amblyom-ma sp.	2 (1.3)	28	14.0±1.20	2 (1.3)	28	14.0±1.20	1-3	Ears,
	♂0 (0.0)	♂0	♂ 0.0±0.00	a 1 (1.6)	a 18	a 18.0±0.10		shoulders,
	♀2 (2.7)	♀28	♀14.0±1.44	b 1 (1.1)	b 10	b 10.0±0.10		testes
Rhipice-phalus sp.	8 (5.1)	16	2.0±0.10	8 (5.1)	16	2.0±0.10	1-4	Inter-digital
	♂3 (3.7)	♂5	♂1.7±0.24	a 6 (9.1)	a 13	a 2.2±1.24		spaces, ears
	♀5 (6.6)	♀11	♀2.2±0.72	b 2 (2.2)	b 3	b 1.5±0.24		
Boophilus sp.	5 (3.2)	10	2.0±0.60	5 (3.2)	10	2.0±0.60	1-2	Belly, ears,
	♂0 (0.0)	♂0	♂0.0±0.00	a 0 (0.0)	a 0	a 0.0±0.00		inter-digital
	♀5(6.6)	♀10	♀2.0±0.50	b 5 (5.5)	b 10	b 2.0±0.40		spaces
Hyalomma sp.	4 (2.5)	12	3.0±0.64	4 (2.5)	12	3.0±0.64	1-2	Testes,
	♂0 (0.0)	♂0	♂0.0±0.00	a 4 (6.1)	a 12	a 3.0±0.10		udder, ears,
	♀4 (5.3)	♀12	♀3.0±0.64	b 0 (0.0)	b 0	b 0.0±0.00		thigh
Ixodes ricinus	3 (2.0)	8	2.7±0.50	3 (2.0)	8	2.7±0.50	1-2	Udder,
	♂0 (0.0)	♂0	♂0.0±0.00	a 3 (4.5)	a 8	a 2.7±0.10		thigh, testes,
	♀3 (4.0)	♀8	♀2.7±0.56	b 0 (0.0)	b 0	b 0.0±0.00		shoulders
Mites								
Sarcoptes scabiei	3 (2.0)	9	3.0±0.40	3 (2.0)	9	3.0±0.40	1-2	Back, thigh,
	♂2 (2.5)	♂7	♂3.5±0.32	a 3 (4.9)	a 9	a 3.0±0.10		testes
	♀1 (1.3)	♀2	♀2.0±0.16	b 0 (0.0)	b 0	b 0.0±0.00		
Total	22 (14.0)	121	5.5±0.96	22 (14.0)	121	5.5±0.96	1-14	Body/skin
	♂5 (6.2)	♂20	♂4.0±0.93	a15 (22.5)	a 80	a 5.6±0.40		coat
	♀17 (22.4)	♀101	♀5.9±0.76	b 7 (7.7)	b 41	b 5.9±0.30		

♂: Male, a: Young, ♀: Female, b: Adult

Table 3: Prevalence of single and double infestations of ectoparasites in sheep and goats in Gombe, Nigeria

Type of infestation	Ectoparasite	Sheep (%) (n = 155)	Goat (%) (n = 157)	Total (%) (n = 312)
Negative	None	125 (80.6)	135 (80.0)	260 (83.3)
Single	*Damalinia ovis*	3 (1.9)	2 (1.3)	5 (1.6)
	Amblyomma sp.	4 (2.3)	2 (1.3)	6 (1.9)
	Rhipicephalus sp.	2 (1.3)	3 (1.9)	5 (1.6)
	Boophilus sp.	5 (3.2)	0 (0.0)	5 (1.6)
	Ctenocephalides felis	8 (5.2)	0 (0.0)	8 (2.6)
	Sarcoptes scabiei	0 (0.0)	3 (1.9)	3 (0.96)
	Ixodes ricinus	0 (0.0)	3 (1.9)	3 (0.96)
Subtotal		22 (14.2)	13 (8.3)	35 (11.2)
Double	*Damalinia ovis*+*Rhipicephalus* sp.	3 (1.9)	0 (0.0)	3 (0.96)
	Amblyomma sp.+*Boophilus* sp.	5 (3.2)	0 (0.0)	5 (1.6)
	Damalinia ovis+*Hyalomma* sp.	0 (0.0)	4 (2.5)	4 (1.2)
	Rhipicephalus sp.+*Boophilus* sp.	0 (0.0)	5 (3.2)	5 (1.6)
Subtotal		8 (5.2)	9 (5.7)	17 (5.4)
Total		30 (19.4)	22 (14.0)	52 (16.7)

Apeh (1985), 85.0% reported by Onojafe (2008), 19.0% reported by Ohaeri and Ugwu (2013) and 70.7% reported by Obi *et al*. (2014).

The five ectoparasite species reported from sheep in this study have been reported by previous researchers. Otesile and Obasaju (1980) reported *Damalinia ovis*, *Rhipicephalus* sp., *Amblyomma* sp. and *Ctenocephalides canis*, Ugochukwu and Apeh (1985) reported *Damalinia ovis* and *Ctenocephalides canis*, George *et al*. (1992) reported *Damalinia ovis*, Omudu and Amuta (2007) reported *Amblyomma* sp., *Boophilus* sp., *Ctenocephalides* sp., Onojafe (2008) reported *Damalinia ovis* and *Rhipicephalus* spp. and Ohaeri and Ugwu (2013) reported *Damalinia caprae*, *Rhipicephalus* spp. and *Boophilus annulatus*.

The seven ectoparasite species reported from goats in this study have been reported by previous researchers. Otesile and

Obasaju (1980) reported *Damalinia ovis*, *Amblyomma* sp. and *Sarcoptes scabiei*, Ugochukwu and Apeh (1985) reported *Boophilus decoloratus* and *Amblyomma variegatum*, George *et al*. (1992) reported *Sarcoptes scabiei*, Omudu and Amuta (2007) reported *Amblyomma* sp., *Boophilus* sp., *Hyalomma* sp., *Rhipicephalus* sp., *Ctenocephalides* sp. and *Sarcoptes scabiei*, Onojafe (2008) reported *Ctenocephalides* spp. and Ohaeri and Ugwu (2013) reported *Damalinia ovis* and *Rhipicephalus* spp.

However, some of the ectoparasites reported by these researchers were not reported in this study. This may be due to differences in the season/months of study, number of animals examined, agro-climatic zone of the study area, as well as the agro-climatic conditions of the area such as rainfall, temperature, relative humidity, topography and composition of soil type and type of management system.

The present study was carried out in Gombe, Gombe State, North Eastern Nigeria which falls within the sudano-sahelian savanna agro-climatic zone. A total of 312 animals (155 sheep and 157 goats) were examined from March-June, 2011. The animals were reared under the extensive animal husbandry management system. Otesile and Obasaju (1980) conducted their research in Ibadan, Oyo State, South Western Nigeria which lies within the southern guinea savanna agro-climatic zone. A total of 1920 animals (960 sheep and 920 goats) reared under the extensive animal husbandry system were examined over a period of one year, covering the wet and dry seasons. Ugochukwu and Apeh (1985) conducted their study in Nsukka, Enugu State, South Eastern Nigeria which falls within the southern guinea savanna agro-climatic zone. A total of 148 animals (54 sheep and 94 goats) were examined from January to December, 1983. The animals were managed under the extensive animal husbandry system. George *et al*. (1992) carried out their research in Zaria, Kaduna State, North Western Nigeria which lies within the northern guinea savanna agro-climatic zone. The sampled animals were those brought to the Veterinary Entomology Laboratory, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, for diagnosis, over a ten years period. Omudu and Amuta (2007) examined a total of 90 animals (45 sheep and 45 goats) in Makurdi, Benue State, North Central Nigeria which falls within the northern guinea savanna agro-climatic zone. The sampled animals were free roaming animals within the Makurdi metropolis. Onojafe (2008) carried out his study in Ethiope West Local Government Area of Delta State, South Southern Nigeria which falls within the tropical rain forest agro-climatic zone. The animals were kept under the extensive animal husbandry system. Ohaeri and Ugwu (2013) between August and December, 2008, examined a total of 98 animals (26 sheep and 72 goats) in Umuahia, Abia State, South Eastern Nigeria which lies within the southern guinea savanna agro-climatic zone. The sampled animals were animals in the Michael Okpara University of Agriculture, Umuidike animal husbandry farms at Umuahia, reared under the intensive animal husbandry system of management. Obi *et al*. (2014) examined 68 sheep and 92 goats (160 animals) kept under the extensive animal husbandry system of management in Uli, Anambra State, South Eastern Nigeria which lies within the southern guinea savanna agro-climatic zone.

These areas present varying agro-climatic conditions such as rainfall, temperature, relative humidity, soil type and topography. These varying agro-climatic conditions could be responsible for the observed differences in the prevalence and ectoparasite species composition in sheep and goats between this study and other previous studies.

This study indicates that sheep were more susceptible to ectoparasite infestations than goats. This is in agreement with the reports of Barmon *et al*. (2010), Amuamata *et al*. (2012) and Yishak *et al*. (2015) but contrary to Yakhchali and Hossiene (2006), Onojafe (2008), Mulugeta *et al*. (2010) and Obi *et al*. (2014) who reported goats to be more infested than sheep. According to Amuamata *et al*. (2012) and Yishak *et al*. (2015), the higher prevalence of ectoparasites in sheep than in goats could be attributed to the better body habit of self grooming, licking, scratching, rubbing and grazing behavior in goats, which could contribute to rapid ectoparasites elimination. Although, sheep were more infested than goats in terms of prevalence, goats had more ectoparasite species on them than sheep. Goats are browsers, prefer bushes/shrubs, tree leaves and rough browse plants and need more space to roam about freely during browsing, thus could be more exposed to a variety of ectoparasite species.

Ticks were the most common ectoparasites in this study. This concurs with the findings of Osman (1997), Yakhchali and Hossiene (2006), Onojafe (2008), Mbuh *et al*. (2008), Mulugeta *et al*. (2010), Ohaeri and Ugwu (2013) and Yishak *et al*. (2015) but contrary to Obi *et al*. (2014), who reported fleas to be the dominant ectoparasites in both sheep and goats. Elsaid *et al*. (2013) reported ticks as the most frequent ectoparasites in sheep and fleas as the most ectoparasites in goats. These findings underscore that advisability of including sheep and goats in acaricide application programmes designed for the control of tick-borne diseases in cattle at the same locality or area.

The predilection sites of these ectoparasites have been reported in previous studies. Founded *Damalinia caprae* on neck, trunk, hind legs and pelvic of goats and *Ctenocephalides canis* on legs and tail. Yakhchali and Hossiene (2006) reported ticks on the tail, ears and testis of goats and *Damalinia ovis* and *Damalinia caprae* around the neck and back area of sheep. Mbuh *et al*. (2008) reported genital distribution of ticks on sheep and goats with more ticks concentration around the scrotum of males. Ohaeri and Ugwu (2013) reported *Damalinia ovis* on head, neck and trunk of sheep and head and neck of goats, *Rhipicephalus* spp. on head, neck, abdomen,

trunk, leg, tail and pelvic of sheep and goats, *Boophilus* sp. on abdomen, trunk and pelvic of sheep. The predilection sites of these ectoparasites are likely areas where capillary blood can be reached easily.

The occurrence of more infestations in females than in males agrees with the findings of Neog *et al*. (1992), Chakrabarti (1994), Jonsson (2004), Yakhchali and Hossiene (2006), Mbuh *et al*. (2008), Barmon *et al*. (2010); Obi *et al*. (2014) and Yishak *et al*. (2015). Lloyd (1983) reported that higher level of prolactin and progesterone makes females more susceptible to infestation as a result of pregnancy and lactation. Thus, it could be hypothesized that some hormonal influence is associated with the higher prevalence of ectoparasitic infestations in females than in males.

The present study reports that young animals were more susceptible to ectoparasite infestations than adults. This finding agrees with the reports of Otesile and Obasaju (1980), Lehmann (1993), Yacob *et al*. (2008) and Barmon *et al*. (2010) but contrary to Yakhchali and Hossiene (2006), Obi *et al*. (2014) and Yishak *et al*. (2015), who reported higher prevalence in adult animals than young animals. The wool and hair of the young animals is not fully developed to be able to protect them from ectoparasite infestations. Lehmann (1993) attributed the greater susceptibility of young animals to ectoparasites infestations to a higher ratio of accessible surface to body volume and poor grooming behaviour.

The higher prevalence of single infestations to double infestations concurs with the report of Brito *et al*. (2005) who recorded four single infestations, three double infestations and one triple infestation as against seven single infestations and four double infestations recorded in the present study. According to Mohammad and Agbede (1980), the effects of ectoparasite infestations are more pronounced when infestation is heavy and mixed. Thus, the more single infestations recorded in this study implies that the effects of infestations were not so pronounced on the animals.

CONCLUSION

This study concludes that sheep and goats in Gombe are potential hosts or carry ectoparasites which could be of veterinary and medical importance. These ectoparasites can also attack humans, thus the cohabitation of humans with sheep and goats which is a common practice in the study area (Gombe) should be strongly discouraged. Females and young animals are the more susceptible groups to ectoparasite infestations. Thus, good sanitation and hygiene should be employed in animal pens and houses. Proper and adequate care is advocated to improve the health of the animals and proper veterinary attention should be given to animals. This will help reduce and control ectoparasite infestations.

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