Helminth Parasites of Goats Slaughtered at Three Abattoirs in Calabar, Cross River State, Nigeria

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Abstract:- **The aim of this investigation was to determine the prevalence rate of endoparasite helminthes in two breeds of goats, West Africa Dwarf (WAD) and Red Sokoto (RS), in the study area. Out of 532 faecal samples examined from slaughtered goats in three abattoirs (Atakpa, Anantigha, and Ikot Eno Obong) in Calabar, 413 (77.6%) were infected with helminth parasites. Red Sokoto goats were more infected (78.35%) than West Africa Dwarf goats (73.2%). The total mean faecal egg counts was highest in Red Sokoto goats 163±10.72, compared to 146.7±11.38 recorded in WAD goats. The three helminthes recovered from 413 faecal samples of goats were *Haemonchus contortus, Trichuris trichiura* and *Taenia spp. H. contortus* had the highest prevalence rate of 49.4%, compared to *T. trichiura* 20.3% and *Taenia* spp 7.9%. Female goats were more infected (82.6%) as against 77.9% in males. Female goats had higher total faecal egg counts of 155.2±3.33 than 127.2±3.01 in male goats. It was found that adult goats were more infected (89.6%) than young ones (75.5%). Months and season have influence on the infection rate of parasites on goats. *H. contortus* prevalence was highest (26.1%) in September, while seasonal prevalence was highest (42.1%) in late rainy season. In this study, since more RS goats were infected than WAD goats, it was recommended that small ruminant goat farmers should concentrate more in the farming of WAD goats because of their resilience to parasitic infection than RS goats, in the study area.**

Keywords: **Helminths parasites, prevalence, WAD and RS goats, Calabar, Cross River.**

I. INTRODUCTION

Among ruminants, cattle, sheep, goats, buffalo, deer, elk, geraffes and carmels, sheep and goats are the smallest and are reared in Nigeria for meat, Milk, skin and sales [1-5]. According to FAO there were about 1,050 million goats worldwide in 2014 with about 300 species known to exist [6]. Africa accounts for about 33.1 % and Nigeria with 49 117 654 heads represents about 4.7% of the world output [7]. Goats have the ability to withstand harsh climatic conditions and contrary to sheep that are grazers, goats are browsers that feed mostly on shrubs and tree leaves in adverse environments with low fertility lands unfit for growing crops [8]. Domestic goat is among the earliest animal domesticated by man and is distributed worldwide with higher concentration in tropical areas and dry zones [9-11]. Goats have been found to contribute significantly to the livelihood of most low income earners in Nigeria, mainly for the provision of animal protein and income [12]. Socio-economic importance is attached to goat such that, in some instances they may be the only realizable wealth of a rural household [13]. Goats are important source of protein for both the rich and poor and a food delicacy highly appreciated during ceremonies and festivals, most especially in the southwestern zone of the country [8]. Goats are excellent meat producers for human consumption in view of its short generation intervals and the absence of religious taboos associated with their meat as they are rich sources of protein and can help bridge the gap of protein malnutrition among consumers [14]. The intestine of goat has been used in making catgut which is still in use as a material for internal human surgical sutures and string for musical instruments [11]. The different indigenous breeds of goats in Nigeria, acclimatized to different ecological zones are the West African Dwarf (WAD), West African long-legged goat and the Red Sokoto [4]. The West African Dwarf goats are more predominant in the south while the Red Sokoto is found in the north [15]. The livestock industry plays a vital role in the economy of Nigeria. It serves as a major source of income and livelihood for majority of Nigerians who are rural settlers and contributes about 5.2% of the National Gross Domestic Product (GDP) [16]. Despite these benefits, helminth infections still cause serious economic losses in Nigeria as a result of reductions in milk production, weight gain, fertility and carcass quality. Ruminants are parasitized by two phyla of helminthes, namely nemathelminthes and platyhelminthes. Nemathelminthes are the round worms which include Haemonchus, Bonostomum, Oesophagostomum and Charbetia. Plathelminthes include cestodes (e.g. Avitellina, Moniezia, Stilesia and Taenia) and trematodes such as Dicrocoelium, Eurytrema, Fasciola and Paramphistomum [17]. Gastrointestinal nematode infections (GIN) are the main prevalent parasitic diseases affecting small ruminant productivity worldwide, especially in tropics and sub-tropics [18-19]. Globally the most common nematode species known to affect small ruminants are *Haemonchus contortus*, *Trichostrongylus colubriformis*, *Teladorsagia circumcincta* and some species such as *Nematodirus* spp, which are not found in sub-Saharan Africa [20]. From the public health point of view, reports of zoonotic meta-cestodes; *Cysticercus bovis* and hydatid cyst [21-23], nematode; *Oesophagostomum* [24-26], and trematodes; *Dicrocoelium dendriticum*, *Eurytrema pancreaticum* and *Fasciola gigantica* [27-28], entering the food chain in Nigeria are of great public

health concern. Human infections with these parasites may result in diarrhoea, retarded growth, intellectual and cognitive retardation [29], cystic echinococcosis and cysticercosis [30]. Goat meat is a delicacy in Calabar city and its environs, where goat-pepper-soup joints are crowded by teenagers and adults in the evening due to the rejection of red meat from cow. The aim of this study was to provide epidemiological information on goat's endoparasitism, which will help in instituting sustainable control programmes against these parasites for consumers in the study area.

II. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in Calabar, South Eastern Nigeria. Calabar is the Capital of Cross River State, whose name was derived from the Cross River which passes through the state. Calabar comprised of two local government areas, Calabar South and Calabar Municipality. This area lies on coordinates 40 57' 0" N 80 19' 30" E. The study area has two main seasons; the rainy and dry seasons. The rainy season usually starts in April and ends in October, while the dry season starts in November and ends in March. The Local Government has a sub-equatorial climate and a moderately hot temperature (with an average temperature of 28^0C) which does not fluctuate greatly. It is characterized by frequent and high rainfall as well as high relative humidity. The three abattoirs used for this investigation were Atakpa, Anantigha (in Calabar South) and Ikot Eno Obong (in Calabar Municipality). This study covered six month (July to December, 2019). For the purpose of seasonal analysis of result, the months were divided into Early rainy season (July to August), Late rainy season (September to October), and Early dry season (November to December).

2.2 Sample collection and examination

Goats are slaughtered in the earlier mentioned abattoirs between 6.30 a.m. - 8.30 a.m. The ages of the goats were determined by estimation of the teeth [31], and were grouped into two categories, young (≤ 2 year having two permanent teeth) and (≥ 2 years with more than two permanent teeth). A total of 532 faecal samples were collected, 149 from West African Dwarf (WAD) goats and 383 from Red Sokoto (RS) goats in the three aforementioned abattoirs. After killing the goats and removal of abdominal viscera, faeces were collected from the gastrointestinal tract of each goat. Faecal samples were placed into plastic universal vials before transportation to Biological Science laboratory of Cross River University of Technology, Calabar, for parasitological investigation. The concentration method was used in the study of gastrointestinal helminth parasites [32]. The advantage of this method is that it offers high concentration of parasites and is relatively free of contaminating particulate materials. The faecal egg count per gram (EPG) was determined by the modified McMaster technique, using saturated saline solution to determine the parasitic load [33]. Observed helminth ova and adult were identified using known morphological characteristics [34], before multiplication by a dilution factor of 24 to convert the eggs to egg per gram faeces.

2.3 Data analysis

Data obtained for egg and adult counts were used to show the mean burden of parasites as well as construction of tables. Chi-square analysis was further used to establish the association between parasite egg output and seasons, age and sex.

III. RESULTS

Table 1 shows prevalence of gastrointestinal helminth parasites and mean egg count per gram of faeces among breed of goats. Of the 532 goat faecal samples examined from Atakpa, Anantigha and Ikot Eno Obong slaughter abattoirs, 413 (77.6%) were infected with helminthes parasites, comprising of 109 (73.2%) and 304 (78.4%) of West Africa Dwarf (WAD) and Red Sokoto (RS) goats respectively. Three helminth parasites isolated from WAD and RS goats were 43.6 and 51.7% for *Haemonchus contortus*, 17.4% and 21.4% for *Trichuris trichiura* and 12.1% and 6.3% for *Taenia* species respectively (Table 1). Red Sokoto goats had a higher prevalence rate of 78.35% endoparasitic helminthes compared to 73.2% in West Africa Dwarf goats. There was statistical significant difference ($x^2 = 6.3$, df = 2, $p < 0.05$) in the prevalence of helminth parasites between breed of goats. Higher worm burden per animal was recorded in *H. contortus* 213.0±15.89 in RS goats, but lower 180.8±16.66 in WAD goats. The mean egg count per gram of faeces of *T. trichiura* was higher 164.8±16.1 in RS goats, but lower 118.0±12.59 in WAD goats. With respect to Taenia spp., the mean faecal egg count was higher 135.3±11.87 in WAD goats but lower 109.6±17.4 in RS goats. However, the total mean faecal egg count was higher 163.7±10.72 in RS goats compared to 146.7±11.38 recorded in WAD goats. Table 2 illustrates the mean faecal egg count per gram of faeces according to sex of goat. In female goats, the mean egg counts were highest for H. contortus (272.0±17.3) and lowest for Taenia spp (56.0±9.07. For male goats, the mean egg counts were also highest for H. contortus (100.8±9.99) and lowest for Taenia spp (46.4±5.96). H. contortus had a higher prevalence for both sexes (53.3% for males and 61.6% for females). T. trichiura and Taenia spp have a higher prevalence for males (17.3% and 7.4%) respectively, but lower for females (15.2% and 5.1%) respectively. Female goats had a higher total egg count 155.2±3.33 than 127.2±3.01 in male goats. There was statistical significant difference ($x^2 = 9.3$, df = 2, $p < 0.01$) in the prevalence of intensity of eggs per gram of faeces in both sexes. (Table 2).

Table 1: Prevalence of GI helminth parasites and mean egg count per gram of faeces among breed of goats in Calabar abattoirs

Helminth eggs recovered	Prevalence (%)	EPG	Prevalence (%)	EPG	Total Pre-valence (%)
	West Africa Goat (WAD) n = 149	Mean±SEM	Red Sokoto (RS) n = 383	Mean±SEM	WAD + RS n =532
Haemonchus contortus	65 (43.6)	180.8±16.66	198 (51.7)	213.0±15.89	263 (49.4)
3Trichuris trichiura	26 (17.4)	118.0±12.59	82 921.4)	164.8±16.1	108 (20.3)
Taenia spp	18 (12.1)	135.3±11.87	24 (6.3)	109.6±17.4	42 (7.9)
Total	109 (73.2)	146.7±11.38	304 (78.35)	163.7±10.72	413 (77.6)

Table 2: Prevalence of helminth parasites and mean egg count per gram of faeces according to the sex of goat

Helminth eggs recovered	Prevalence (%) Male (n = 394)	EPG Mean±SEM	Prevalence (%) Female (n = 138)	EPG Mean±SEM
Haemonchus contortus	210 (53.3)	100.8±9.99	85 (61.6)	272.0±17.33
Trichuris trichiura	68 (17.4)	216.0±11.08	21 (15.2)	135.5±10.91
Taenia spp	29 (7.4)	46.4±5.96	8 (5.1)	56.0±9.07
Total	307 (77.9)	127.2±3.01	114 (82.6)	155.2±3.33

In age related prevalence of eggs in faeces, adult goats have a total higher prevalence of 89.6% than young goats with 75.5%. The adult mean egg counts of *H. contortus* are still highest in adult and young goats (66.9±9.81 and 39.4±8.04) respectively. Adult goats have significantly higher prevalence rate of 59.0%, 20.6% and 9.2% eggs in their faeces than 53.2%, 16.7%, and 5.6% in young goats' faeces. However, the mean egg counts for *T. trichiura* and *Taenia* spp are higher in adult goats 46.2±5.65 and 60.8±7.36 respectively, than in young goats having 44.3±7.89 and 51.2±3.99 respectively.

Table 3: Prevalence of GI helminth parasites and mean egg counts per gram of faeces according to age of goats slaughtered in Calabar abattoirs

Helminth eggs recovered	Prevalenc (%) Young goats n = 216	EPG Mean±SEM	Prevalence (%) Adult goats N =316	EPG Mean±SEM
Haemonchus contortus	115 (53.2)	39.4±8.04	189 (59.0)	66.9±9.81
Trichuris trichiura	36 (16.7)	44.3±7.89	65 (20.6)	46.2±5.65
Taenia spp	12 (5.6)	51.2±3.99	29 (9.2)	60.8±7.36
Total	163 (75.5)	52.3±6.01	283 (89.6)	62.8±4.84

Table 4 illustrates the monthly and seasonal recovered adult helminth parasites in goat faeces slaughtered in Calabar abattoirs. A total of 2232 (16.2), 8688 (62.9) and 2880 (20.9) egg per gram of goat faeces were recovered for *Taenia* spp, *H .contortus* and *T. trichiura* respectively. The prevalence of adult *H. contortus* was highest (62.9%) compared with those of *T. trichiura* (20.9%) and *Taenia spp* (16.2%). Equally, adult H. contortus prevalence was highest (26.1%) in September during the late rainy season (Table 4). Figure 1 shows the mean prevalence of adult helminth parasites recovered from faeces of slaughtered goats in Calabar abattoirs. Images of adult *H. contortus*, *Taenia* spp and egg of *T. trichiura* recovered from goat faeces are shown in Plates 1, 3, and 3 respectively.

Table 4: Total monthly and seasonal prevalence of adult helminthes recovered in goats faeces slaughtered in Calabar abattoirs

Season	Month	*Taenia spp* EPG	Prevalence (%)	*Haemonchus contortus* EPG	Prevalence (%)	*Trichuris trichiura* EPG	Prevalence (%)	Total EPG and prevalence (%)
Early Rainy	July	384	17.2	1728	19.9	192	6.7	2304 (16.7)
Season	August	288	12.9	2088	24.0	336	11.7	2712 (19.7)
Late Rainy	September	768	34.4	2304	26.5	528	18.3	3600 (26.1)
Season	October	432	19.4	1296	14.9	360	12.5	2088 (15.1)
Dry	November	216	9.7	864	9.9	576	20.0	1656 (12.0)
Season	December	144	6.5	408	4.7	888	30.8	1440 (10.4)
Total		2232	16.2	8688	62.9	2880	20.9	13800 (100)

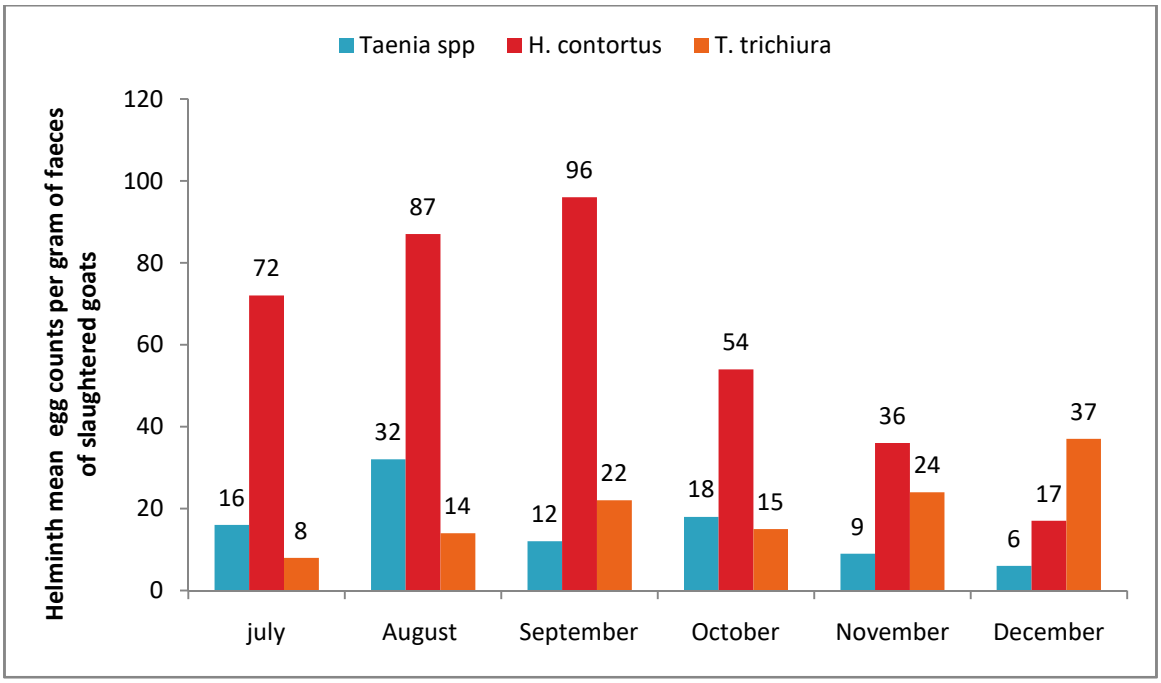

Fig.1: Monthly mean egg counts of helminth parasites per gram of faeces recovered.

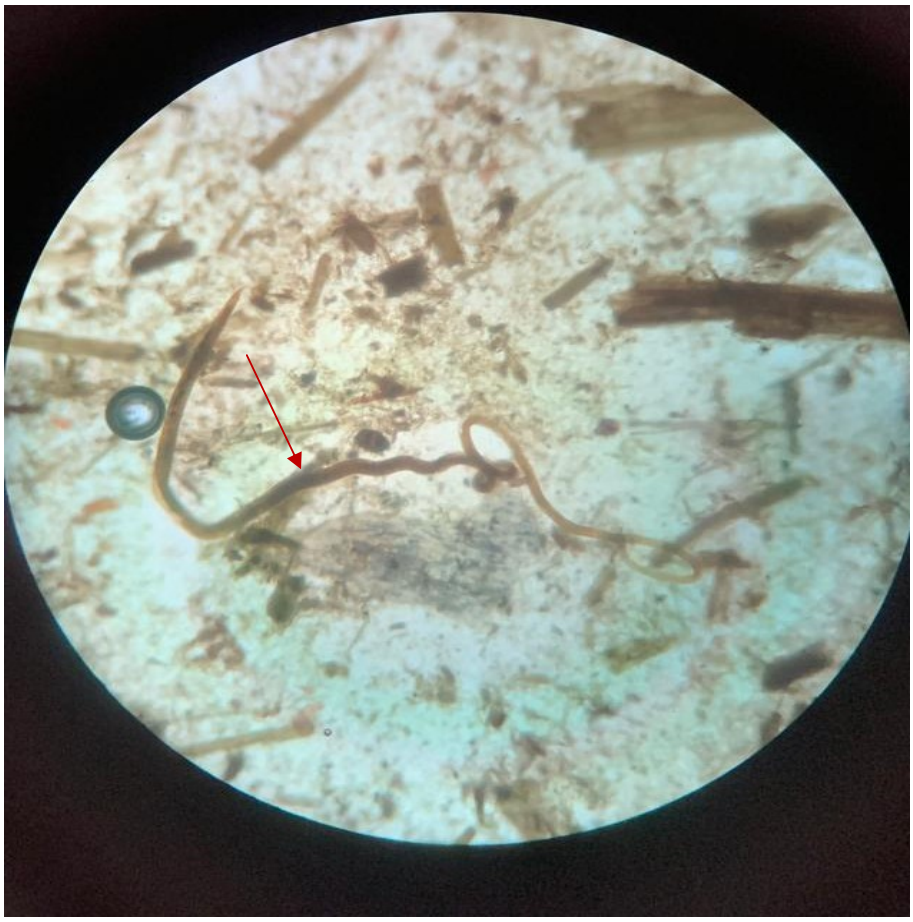

Plate 1: Image of adult *Haemonchus contortus* recovered from goat faeces

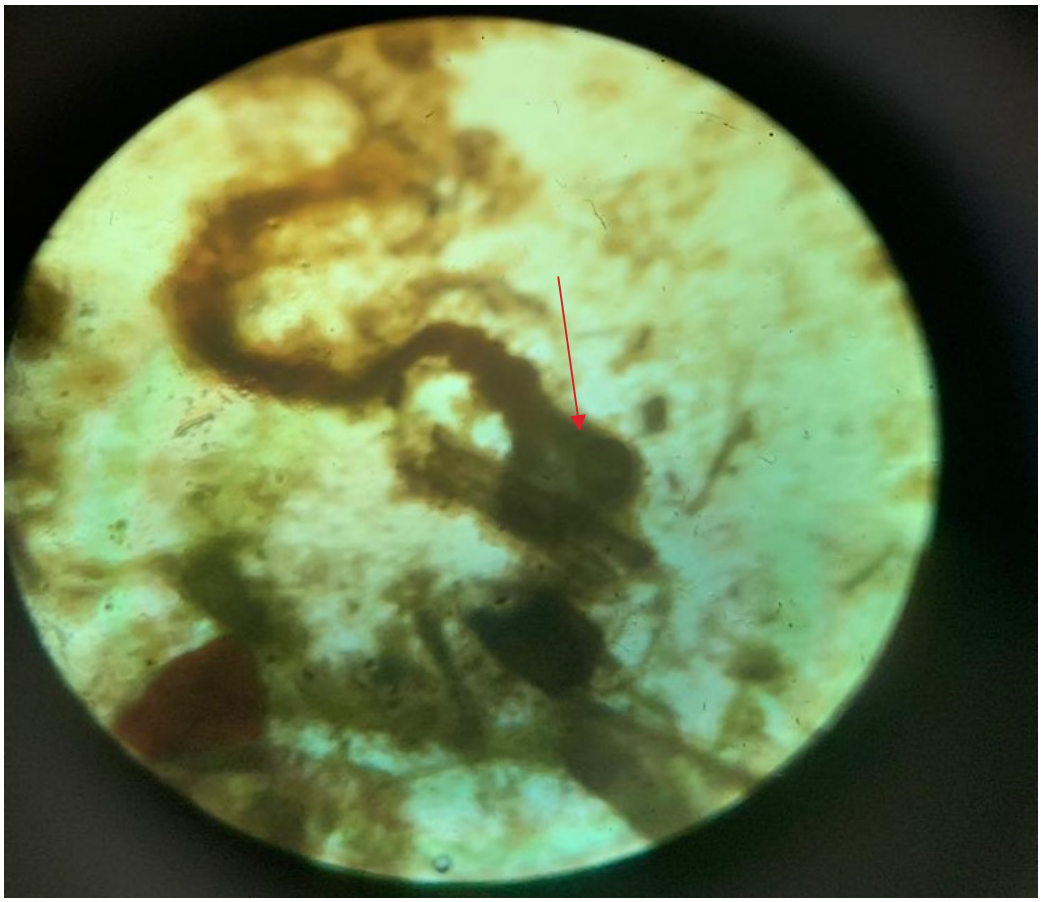

Plate 2: Image of adult Taenia spp recovered from goat faeces

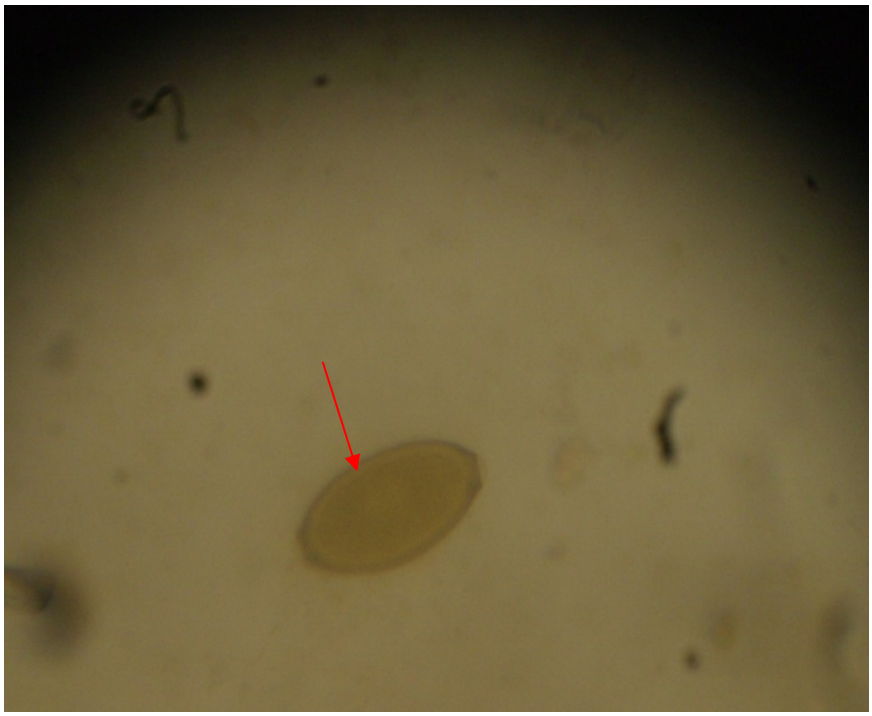

Plate 3: Image of Trichuris trichiura egg recovered from goat faeces

IV. DISCUSSION

This investigation revealed three helminth parasites comprising two nematodes, *Heamonchus contortus* and *Trichuris trichiura* and one cestode, *Taenia* species. An overall prevalence of 77.6% of endoparasite helminthes is reported in this present study. This result is similar to those obtained by [35] 75.5% in Port Hartcourt, [11] 75.75% in Ibadan and [36] 74.00% in Bangladesh. However, this finding is lower compared to 88.1%, 85.22%, and 89.33% reported by [37] in South West China, [38] in India, and [39] in Egypt respectively. The most prevalent parasite encountered was *H. contortus* (49.4%) which contrast the result of [15], who reported S. papilosus as the most prevalent helminth parasite in Nsukka urban, Nigeria. However, this result is not in conformity with the findings of [40] in Rwanda, who reported 71.8% prevalence of *H. contortus* in goats. There was higher endoparasitic infection in Red Sokoto goats (78.35%) than in West Africa Dwarf goats (73.2%). This difference in infection between breeds could be explained through the grazing habit of potential hosts. Some investigators opined that susceptibility to infection could be as a result of some breeds grazing close to the ground where their droppings are, therefore picking up eggs/oocysts or larvae [41]. The highest worm burden and prevalence rate of 43.6% and 51.7% was recorded for *H. contortus* in the two breed of goats. This high worm burden could be explained by the fact that immune compromised animals usually have high fecundity of parasites, due to malnutrition as shown by the investigated goats. Therefore, this makes it impossible for these animals to resist invasion of parasites [42, 43].

As regard sex, female goats were found to be more infected than their male counterparts, which is consistent with the reports of [3, 15, 44, 45, 46] who gave similar report between sex in goats. It should be noted that when female goats are pregnant or lactating, they experience hormonal changes which lowers their immunity and resistance to parasitic invasion, thus having high worm burden [3].

As regard age, adult goats above 2 years were more susceptible to infection than the young ones < 2 years. This finding is in consonance with the work of [10], who reported age as a risk factor for more susceptibility of infection in older small ruminant > 2years. Similarly, [47] disclosed that small ruminant adult goats have higher worm burden without adverse effect which leads to chronic infection.

In this present study, it was found that months and seasons have effect on endoparasite infection of small adult ruminants, throughout the period of investigation. It was found that *H. contortus* worm burden increased from July to September where it formed a single peak, then declined until December. This finding is consistent with the work of [47] who reported that adult *H. contortus* worm burden was high from May to October in Guinea Savannah zone of Nigeria. However, *T. trichiura* prevalence in goats increased from July to September where it formed a small peak of 22%, then declines in October and then rises to its maximum levels of 37% in December. This finding accedes with [48] in Srinagar District of Kashmir, who reported that *Trichuris* count in Ovines increased in Autumn (42.02%), reached it maximum levels in Winter (59.37) and then tended to decline until Spring (53.22%) and reached minimum levels in Summer (30.6%) before increasing again in mid-Autumn. This study reported the prevalence of 7.9% Taenia spp in the study area, which is lower than 15.81% documented by [49] in Nigeria. The presence of zoonotic helminths (Taenia spp) in food animals slaughtered for human consumption in this study is of Public health concern. This finding is in consonance with the report of [29] who reported that these parasites are associated with different conditions in humans, ranging from diarrhea, intellectual and cognitive retardation, and retarded growth. In the present study, the seasonal effects on gastrointestinal parasites of small ruminant goats, was significant in early rainy season (July to August), late rainy season (September to October) and early dry season (November to December). Seasonal prevalence was highest (42.2%) in late rainy season, followed by 36.3% in early rainy season and finally 22.4% in dry season. This finding is in agreement with the result of [46] who reported highest seasonal prevalence in the rainy season.

V. CONCLUSION

In conclusion, this study was conducted to determine the prevalence of endoparasites in two breed of goats, WAD and RS goats. Three helminth parasites *H.contortus, T. trichiura* and *Taenia* species were recovered from 532 faecal samples of slaughtered goats at three abattoirs in Calabar, through corproscopy. An overall endoparasite prevalence rate of 77.6% was found in goats in this study. Red Sokoto were more infected than West Africa Dwarf goats. It was therefore recommended that small ruminant goat farmers in the study area should concentrate in the breeding of WAD goats, which are more resistant to endoparasite helminth infection than the RS goats. To ensure food safety for consumers of small ruminants in the study area and beyond, quality veterinary meat inspection is suggested to curtail the transmission of these helminthes to humans.

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CONFLICT OF INTEREST

The author declared no conflict of interest, as there was no financial support either by company or individual.

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