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Gastrointestinal Helminths of Sahelian Breed of Goats in House-holds and Maiduguri Cattle Market, Nigeria

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ABSTRACT

Gastrointestinal nematodes are important problems and constraints to the livestock industry in Nigeria. The study assessed the possible prevalence of Ostertagia ostertagi species infection in Sahelian breeds of goats in Maiduguri and environs commonly occurring as mixed infections with other gastrointestinal nematodes. It also investigated the common age and sex groups most susceptible to infection in goats in the study area. Out of the 150 faecal samples examined from Sahelian breed of goats, 64 were from male and 86 from female goats; and 40 were from young while 110 were from adult goats. A total of 99 of the faeces were from the house-holds comprising of 35 from Shettimari and 64 from Mairi ward and 51 from Maiduguri cattle market. Goats from house-holds were mostly asymptomatic but from cattle market was a mixture of apparently healthy and asymptomatic and others showing clinical signs including diarrhoae, nasal discharges and cachectia. Of the one hundred and fifty faeces examined, 102 cases of Ostertagia ostertagi infections were recorded accounting for 68.o% prevalence. The prevalence in the male and female was 70.31% and 66.28% respectively. Similarly the prevalence was 70% and 67.27 % respectively in the young and in the adult goats. Chi-square test using SPSS statistics test16.0 analyzing the data tested for significance at probability levels of P< 0.05, revealed that there was a significant difference in the prevalence of Ostertagia ostertagia species infection between sex and age distribution. It was concluded that the prevalence of infection was more in male than female and it was higher in young than adults. Strategic anthelmintic medication was advocated for use annually. Free-living, pre-parasitic stage of biological control will help in breaking the parasite life cycle.

Key words: Prevalence, gastrointestinal, helminthes, goats, market, households

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INTRODUCTION

Gastrointestinal tract (GIT) nematodes are one of the most important problems and constraints to the livestock industry in Nigeria. An abomasal nematode, *Ostertagia ostertagi* is a clade V nematode of the Phylum: Nematoda, order Strongylida, family Trichostrongylidae and genus *Ostertagia*. *Ostertagia ostertagi* is the parasitic nematodes commonly known as the medium stomach worm or brown stomach worm (round worm) of goat, sheep and cattle. *Ostertagia ostertagi* can also be found to a lesser extent in wild ruminants, and horses. These parasites cause ostertagiosis, which is potentially fatal in goats, sheep and cattle. It is found worldwide and is economically important to goats, sheep and cattle industries, particularly those found in temperate climates [1]. Ransom first described the genus Ostertagia in 1907, which currently contains approximately 15 species. All species of the genus Ostertagia infect domestic or wild ruminants. These species form a large and complex group, the taxonomy of which has not been fully elucidated [2]. Infection with these parasites affects the health of small and large ruminant population and causes significant economic losses to farmers and the country at large. Infected animals normally fail to thrive well and in turn result in reduced meat, milk and wool production and also affect fertility [3].

The livestock share in the agricultural sector is more than 60%. Livestock plays an important role in the national economy. Sheep and goats possessed tremendous potentials of meat, milk, and wool production. Livestock generally are prone to gastrointestinal tract nematode infections, that can lead to significant mortality in small ruminants. These gastrointestinal tract infections with nematodes significantly affect sheep and goats' production and reproductive performance [4]. Gastrointestinal tract nematodes primarily affect livestock feed consumption thereby reducing the efficiency of these ruminants. However, the potential negative impact of the parasitic infection primarily depends on the animals' age, severity of worm burden, the epidemiology pattern of the parasites, management strategies of the flock, and ecoclimatic conditions in the worm environment [5].

Clinical ostertagiosis normally occurs during the first grazing in the rainy season when kids appeared most susceptible, although the disease can also affect mature animal [6]. Subclinical infection results in reduced weight gain and rate of growth thereby reducing reproductive efficiency and milk production [7]. The primary clinical symptom of fulminant caprine ostertagiosis is watery diarrhoea and is usually accompanied by reduced appetite [7]. Infected animals are characterised by dull, rough coats and faeces soiled hindquarters as a result of profuse diarrhoea. Goats are frequently co-infected with many gastrointestinal nematodes including species of the genera: Haemonchus, Bunostomum, Oesophagostomum, Trichuris, Trichostrongylus, Cooperia, and Nematodirus. The clinical signs of infections with these species of nematodes are difficult to distinguish from each other, and are often referred to as a syndrome called parasitic gastroenteritis [8].

Clinical ostertagiosis can be observed under two sets of circumstances referred to as type I and type II disease. Type I disease occurs in young ruminants grazing on pastures for their first time during the period of high pasture contamination [9] [10]. This syndrome usually occurs in the summer and fall months in the Northern hemisphere and during the winter and spring months in the Southern hemisphere [11]. Infective larvae are ingested daily by the young stock on pasture. The pathological and clinical signs are due to the direct development of large numbers of L3 larvae to adult worms over a relatively short period of time (approximately 3 weeks) in young animals with an immune system naïve to Ostertagia infections [9]. The young adult worms then break out of the gastric glands, causing substantial damage to the abomasal wall. Mild cases result in reduced growth or production and severe cases can result in fulminating disease characterized by profuse watery diarrhoea, rapid weight loss,

submandibular oedema ("bottle jaw"), anemia and death [9] [12].

Type II disease can occur in yearlings and older ruminants. It is however, the result of arrested L4s resuming their development to immature adults and leaving the gastric glands [9][13]. This can occur weeks or months after being ingested as L3s and is a consequence of favourable environmental conditions [13]. The larvae will then resume maturation gradually or in bursts. The clinical signs are identical to type I disease and the severity depends on the magnitude of the eruptions [8]. In the Northern hemisphere, type II disease is often seen in the early spring which occurs in the fall in the Southern hemisphere [12]. Worms can readily be seen and identified in the abomasum, and small petechiae (blood spots) may be visible where the worms have been feeding. The most characteristic lesions of Ostertagia infections are multiple small, white, raised umbilicated nodules 1–2 mm in diameter. These may be discrete, but in heavy infections they tend to coalesce and give rise to a "cobblestone" or "morocco leather" appearance. Nodules are most marked in the fundus region but may cover the entire abomasal mucosa. In severe cases, edema may extend over the abomasum and into the small intestine and omentum [14].

When examined histologically, abomasal gastric glands contain larvae in varying stages of development, which results in hyperplasia and distention of the glands, and flattening of the glandular epithelium. Affected glands lack differentiated acid-producing parietal and pepsinogen producing chief cells. Type I and type II diseases are often differentiated by the presence of increased numbers of globule leucocytes, eosinophils and focal aggregates of lymphoplasmocytic cells in animals with type II disease [12].

Gastrointestinal nematodes may elicit a variety of host immune responses depending on the initial immune status of the host, parasite species, and environmental conditions. The body has several physical defense mechanisms against parasites including the continual sloughing of the gut epithelium to prevent parasite attachment. However, once an infection has occurred, the host's immune system attempts to limit the damage caused by the worm. Apart from the importance of the extrinsic factors of weather, climate and grazing management, the immune status of cattle is perhaps the most significant of all host factors influencing infection with *Ostertagia ostertagi*. Unlike other common gastrointestinal nematodes of ruminants, subject to a quick host immune response after relatively short periods of exposure and immune system memory, a protective host immune response against *Ostertagia ostertagi* requires far longer periods of exposure and is not always permanent. The failure to respond quickly to Ostertagia may be a result of the suggested immunosuppression or impairment of antibody and cellular responses [15]. *Ostertagia ostertagi* has been shown to induce cytokines and T-cells in the adaptive immune response in ruminants, and recent advances have been made to produce suitable vaccines targeting adult stage Ostertagia [16] [17] [18]. The major limitations to reducing parasitic load using vaccines is the complex and dynamic host-parasite interaction that is unique to each species of host and parasite, which is often influenced by several environmental factors [19].

One of the objectives of the study was therefore to determine the possible prevalence of *Ostertagia ostertagi* species infection in some Sahelian breeds of goats in Maiduguri and environs through detection of the eggs of the parasite usually parasitize the abomasum, and small intestine of ruminants which commonly occur as mixed infections naturally with several other genera of Gastrointestinal (GI) nematodes belonging to the family Trichostrogylidae. It was part of the objectives of the study that the common age and sex groups most susceptible to *Ostertagia ostertagi* species infection in goats in be established in the study area.

MATERIALS AND METHODS

Study area

A research was conducted in Maiduguri which is the capital city of Borno State situated in North-eastern terrace of Nigeria. The city lies on an altitude of 354m and is located between latitudes 10.2ºN and 13.4ºN and longitudes 9.8ºE and 14.4ºE. It occupies an area of 75,540.9 square kilometers (km^2). According to the 2006 population census, Maiduguri has a population of 4,171,104 people with population density of 60 people per km2 [20]. The two dominant seasons are the wet (June to October) and the dry (November to May) seasons [21]. Temperature ranges from 13-41ºC. Annual rainfall is at 9-198mm and sunshine of 7-9 hours/day. Relative humidity varies between 19 to 78% and remains at 45% during the wet season.

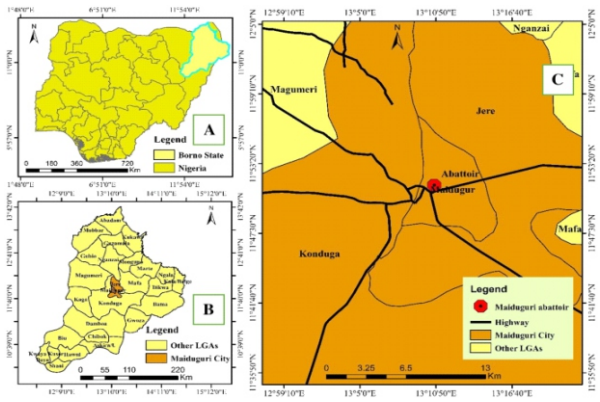

Figure 1: Map of Borno State, Nigeria Showing the Study Area (Maiduguri Abattoir)

Sample Collection

A total of 150 faecal samples were collected from Sahelian breed of goats from Shettimari (New GRA) ward, Mairi ward and Maiduguri cattle market (Abattoir area) all in Maiduguri Metropolitan Council and Jere Local Government Areas located in Borno State, Nigeria. Faecal samples were appropriately collected per rectum of goats using disposable hand gloves into clean and dry universal bottles and taken to diagnostic parasitology laboratory section of the Veterinary Medicine Department, University of Maiduguri for processing. The faecal samples collected were from 64 male and 86 female goats. Similarly, 40 of the faecal samples collected were from young goats while up to 110 of these samples were collected from adult goats. A total of 99 of these faecal samples were collected from the house-holds comprising of 35 from Shettimari area and 64 from Mairi ward. Similarly, a total of 51 of the faecal samples were collected from Maiduguri cattle market. The status of these goats in the house-holds were mostly asymptomatic but for those in the cattle market a mixture of both apparently healthy and asymptomatic and also those with clear clinical manifestations of signs of ailments including diarrhoae, nasal discharges and cachectic were sampled. Age categorization of goats sampled was only young or adult and the criteria were those of less than 6 months of age with milk teeth and very small in size were considered young whereas those that were larger in size and whose milk teeth were broken, were considered adults. The faecal samples collected were appropriately labeled with information about sex, age and breed of each goat on the universal bottle.

Laboratory Examination (FloatationTechniques)

The faecal samples were examined at the laboratory of Veterinary Medicine Department, University of Maiduguri, Borno State by the use of floatation technique [22]. This technique was used widely for detecting eggs of nematodes and cestodes. The eggs of the parasite were lighter and small and can therefore float in the floatation liquid. One (1) gram of faecal sample was each taken in a motar and saturated sodium chloride solution was added, then the sample was grounded lightly with the help of pestle and then the solution was filtered using tea strainer. The filtered solution was poured into a bijour bottle up to the brim and a cover slip was applied to cover it for 5 minutes. Then the cover slip was removed and placed on a slide and examined at X10 and X40. Photographs of eggs were taken using a Samsung Galaxy camera with specifications of SMA-A245F/DSN-R58W40W5N2K and were identified based on egg's shape and size.

RESULTS

Differentiation of *Ostergia ostertagi* species eggs with other related nematodes belonging to Trichostrongylidae was necessary because these parasites usually leave in co-habitation with each other and therefore achieved through Faecal worm Egg Counts (FEC) of up to 500+ was considered clinically significant in heavy infection. However, significant disease can occur with lower FECs with eggs typically strongyle. Worm counts in heavy infections usually records up to 5,000- to10, 000+ worms whereas egg output of 100 to 200 per female per day is usually recorded in light infections with burden of 1000-2000 worms. The later was the case related to probable detection of *Ostertagia ostertagi* species eggs signifying a lighter infection rate.

Although constraint couldn't allow subjecting samples collected for screening in the present studies but it is however relevant to clearly state that the presence of "*Ostertagia ostertagi"* within a host may be inferred by several others in addition to faecal egg count to include faecal worm egg counts (FECs) in particular (preferably with speciation by way of larval culture and differentiation), and total worm counts, the tests most commonly employed in the diagnosis of helminth infections in ruminants.

Other biochemical methods have been developed to help more accurately diagnose *Ostertagia ostertagi'* parasitism. These include the determination of specific anti-parasite antibodies in milk. Evaluation of anti-*Ostertagia ostertagi* antibodies in individual milk samples as decision parameter for selective anthelmintic treatment in dairy animals. Enzyme-linked immunosorbent assays (ELISA) have been used as a diagnostic tool to quantify the impact of gastrointestinal nematodes in dairy cattle by measuring antibodies in milk. Higher levels of antibodies measured by ELISA methods, referred to as optical density ratios (ODRs) were associated with decreased milk production in dairy cattle. The association between *Ostertagia ostertagi* antibodies in bulk tank milk samples and parameters linked to cattle reproduction and mortality.

Out of one hundred and fifty (150) faecal samples collected and examined from both male and female sahelian breed of goats, from the young and the adult and from male and female goats in different locations in Maiduguri and environs, 102 cases accounting for 68% prevalence was detected as positive *Ostertagia ostertagi* species infections. The prevalence of *Ostertagia ostertagi* species infection in the male and female sahelian breed of goats examined were 70.31% (45) and 66.28% (57) cases respectively. Similarly the prevalence of *Ostertagia ostertagi* species infection was 70% (28) and 67.27 % (74) respectively in young and adult Sahelian breed of goats. Data collated were analyzed statistically using the Chi-square test (SPSS statistics 16.0). Differences between the parameters were tested for significance at probability levels of $P< 0.05$.

There were significant differences in the prevalence ($P < 0.05$) of *Ostertagia ostertagia* species infection based on sex and age distribution of the Sahelian breed of goats which accounted for the prevalence of 68% of positive detection. The significant ($P < 0.05$) difference in the prevalence of the infection based on sex susceptibility of these animals was presented in Table 1. Similarly, the statistically significant difference ($P<0.05$) in the prevalence rate among the age groups of the Sahelian breed of goats was presented in Table 2.

Table 1: Prevalence of *Ostertagia ostertagi* Species I nfection in Sahe lian Breed of G oats According to Sex of the Animals Examined

S/N	Sex Sampled	Number of Goats Examined	Number of *Ostertagia ostergi* Eggs Detected	Prevalence (%)	Chi-Square	P-Value
1.	Male	64	45	70.31		
2.	Female	86	57	66.28	0.274	0.043
	Total	150	102	68		

Tab le 2: Prevalence of *Ostertagia ostertagi* Species infection in Sahelian B reed of Goats Based on Age Group of Animals Examined

S/N	Age Group	Number of Goats Examined	Number of *Ostertagia ostertagi* Species Detected	Prevalence (%)	Chi-Square	P-Value
2.	Young	40	28	70		
	Adult	110	74	67.27	0.100	0.026
	Total	150	102	68		

Key: Young – Below 6 Months Old; adult – Above 6 Months Old

DISCUSSIONS

A study for establishment of the prevalence of *Ostertagia ostertagi* species infection in Sahelian breed of goats in Maiduguri and environs revealed a positive detection of as high as 102 cases of the worm burden after examining 150 faecal samples of goats. This accounted for 68% of the prevalence rate. The finding was higher compared to that of Rajpoot *et al*. [23] who conducted similar investigations for detection of *Ostertagia ostertagi* species infection in Madhya Pradesh, India where up to 200 cases were recorded in Mulwa region and accounted for 3.34% prevalence. This clearly appeared lower compared to the findings in the present studies despite having larger number of

records of positive detection of parasite eggs. But it was attributed to larger sample size screened. The high prevalence rate recorded in the present study might be attributed to the study period was carried out which was at the middle of the raining season that suitably favoured development of eggs, larvae and therefore abundance of the parasite.

However, a contrary opinion was shared by Tefera *et al*. [24] who conducted a similar research for detection of *Ostertegia ostertagi* species infection and reported the prevalence of 25.0% of positive cases. Similarly, the prevalence of 24.1% (42) cases of *Ostertagia ostertagi* species infection recorded by Nuraddis *et al.* [25] after examining 170 faecal samples from Sahelian breed of goats in a related investigation were clearly lower when compared with the findings of the present studies where up to 68.0% of the prevalence of *Ostertagia ostertagi* species infection was detected as 102 positive cases of the parasite after examining 150 faecal samples of sahelian breed of goats in Maiduguri and environs. A similar report by Muhammad *et al.* [26] from Southern Punjab, Pakistan revealed the prevalence of 3.0% (3) cases of *Ostertagia ostertagi* species infection from 100 faecal samples examined from goats in the area. This was considerably lower when compared with the findings in the present study which recorded 68.0% of the prevalence rate amounting to 102 numbers of cases after examining 150 faecal samples from the Sahelian breed of goats in Maiduguri and environs. Assoku, [27], however reported the detection of 103 cases of *Ostertagia ostertagi* species infections accounting for 28.7% prevalence after examining 360 faecal samples from goats in Ghana. Although, the prevalence rate detected was lower compared to the findings of the present studies but the number of faecal samples examined from goats was higher than the number examined in the present study, where only 150 faecal samples specifically from Sahelian breed of goats were explored and up to 102 cases were recorded.

Some reasons for the differences in the prevalence of *Ostertagia ostertagi* infection was given by array of researchers from different geographical entities that *Ostertagia ostertagi* species infections in goats as for example might be due to differential management practices reported by Lindquist *et al.* [28], natural resistance based on genetic background and drug treatment regimens as reported by Soulsby [29], local geo-climatic factors and nutritional status. The high prevalence of 68.0% of *Ostertagia ostertagi* species infections recorded in the present studies affirmed these claims as in most cases the management system goats were subjected to in Nigeria was the scavenging type where these animals were in most cases left to wander about scouting indiscriminately for any available feed they come in contact with and later return to poorly kept sheds available as housing. These findings also corroborated with the work of Forse *et al.* [30] who stated that animals are exposed to massive helminth infection when they were maintained in an unhygienic and poorly kept ranches and also when fed with contaminated feeds and water.

Claerebout and Vercruysse [31] asserted that there were different methods for detection of the prevalence of *Ostertagia ostertagi* infection in the caprine species and specifically cited faecal worm egg counts (FECs) by way of larval culture and differentiation and total worm counts as the most commonly employed tests in the diagnosis of helminthes infections generally in ruminants. Although, the present studies does not employ other methods useful as criteria for identification of *Ostertagia ostertagi* parasites to species level, but was only limited to floatation techniques grossly inadequate for establishing a confirmatory prevalence of the parasite as attested to by Claerebout and Vercruysse [31]. However, the findings affirmed the claim of the authors as floatation technique was approved validated means of parasite identification.

Although the present studies only restricted the investigations to faecal egg counts for detection of the prevalence of *Ostertagia ostertagi* species

infections in goats in Maiduguri and environs [32] and Sanchez *et al*. [33] were both with the opinion that biochemical methods have been developed to help more accurately in the diagnosis of *Ostertagia ostertagi* species infection. These included the determination of specific anti-parasite antibodies in milk in addition the evaluation of anti- *Ostertagia ostertagi* antibodies in individual milk samples as decision parameter for selective anthelmintic treatment in dairy animals.. Charlier *et al.* [32] and Sanchez *et al*. [33] further emphasized that Enzyme-linked immunosorbent assays (ELISAs) have also been used as a diagnostic tool to quantify the impact of gastrointestinal nematodes in ruminants by measuring antibodies in milk. Delafosse [34] also supported these claims and was with the opinion that higher levels of antibodies measured by ELISA methods, referred to as optical density ratios (ODRs) were associated with decreased milk production in a study conducted in ruminants. The present studies restricted the investigations for the diagnosis of *Ostertagia ostertagi* species to only analysis of faecal samples but not milk and therefore floatation techniques was employed alone.

In related studies by Entrocasso *et al.* [35] and Simpson [36] who reported similar results using different approaches from earlier ones reported by other researchers in the diagnosis of Ostertagia species infections in ruminants where each employed the assessment of the relationship between increased optical density ratio (ODR) and negative effects on health of these ruminants and body weight and reproductive measures in the dairy industries.

Furthermore, the work of Entrocasso *et al.* [35] and Simpson [36] also emphasized the role of blood pepsinogen concentration which increases with abomasal mucosa injury as another method that have been used for diagnosis of ostertagiosis. Analysis of sera for increased plasma pepsinogen levels was established as useful diagnostic aid for detection of *Ostertagia ostertagi* species infection in ruminants. In this respect Vercruysse *et al.* [37] generally observed that increased levels of pepsinogen activity (tyrosine levels >3 IU) were associated with clinical abomasal parasitism. The emphasis here was that the present studies only limited the diagnosis to faecal floatation techniques in establishing the prevalence of *Ostertagia ostertagia* species infections in goats in Maiduguri and environs and therefore seek to explores these other methods in future studies.

Conclusions

It is concluded that the prevalence of *Ostertagia ostertagi* species infection was more in male as compared to female Sahelian breed of goats in Maiduguri and environs. The prevalence of the parasite in this breed of goats was also higher in young compared to adults.

Recommendations

It was therefore recommended that management system in rearing goats should be improved to also include the observance of strategic anthelmintic medication annually by deworming goats with effective broad-spectrum anthelmintic. Free-living, pre-parasitic stage of biological control of the parasites will also help in breaking the parasite life cycle including that of the intermediate hosts. Other methods of diagnosis should be employed in other researches that involved the detection of *Ostertagia ostertagi* species infections in goats in order to augment the findings of the conventional floatation techniques.

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CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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