

Occurrence of infection with *Haemonchus* species in sheep in some households at Gwange-I ward and at Maiduguri cattle market, Maiduguri, Borno State, Nigeria

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Abstract

Haemonchus species is one of the economically important parasites of small ruminants, and haemonchosis in sheep is associated with anaemia, poor weight gain and mortality. This study determined the occurrence of infection with *Haemonchus* species in sheep in some households at Gwange-I ward and at Maiduguri cattle market, Maiduguri, Borno State, Nigeria. The design of the study was cross-sectional survey. Faecal samples from a total of 150 sheep were used for the study. The faecal samples were examined by floatation technique. Photographs of eggs were taken and identified based on shape and size. Results showed that out of the 150 faecal samples examined, *Haemonchus* eggs were detected in 111 (74%). The Balami breed of sheep had a relatively higher occurrence of infection (78.08%) than the Yankasa breed (70.13%). Young sheep had a relatively higher occurrence of infection (75.56%) when compared to the adults (71.67%). Also, male sheep had a relatively higher occurrence of infection (75.36%) than females (72.84%). The occurrence of *Haemonchus* infection in sheep sampled at the Maiduguri cattle market (90.48%) was significantly ($p < 0.05$) higher than the occurrence in those sampled at households in Gwange-1 ward (35.56%). There were no significant association ($p > 0.05$) between infection occurrence and breed/age/sex. It was concluded that the occurrence of infection with *Haemonchus* species in the study area was high, and it was recommended that farmers and traders should employ the practice of strategic anthelmintic medication annually using effective broad-spectrum anthelmintics.

Keywords: *Haemonchus* infection; Sheep; Occurrence; Breed, Age and Sex; Maiduguri, Nigeria.

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Introduction

Sheep breeding and husbandry is a widespread and important livestock sector in many countries around the world. Sheep are among the major economically important livestock in Northern Nigeria, and they play an important role in the lives and livelihoods of subsistent farmers. They are a source of meat, milk, skin and manure, and they are also used for religious rituals (Yusuf *et al.*, 2018). In Northern Nigeria, livestock production systems are characterized by low input, mixed crop-livestock, agro-pastoral and pastoral systems (Ajola 2008; Yusuf *et al.*, 2018). Commonly, these livestock are almost entirely managed by the poor small-holder farmers and pastoralists. Due to their hardiness and fecundity, small ruminants (both sheep and goat) play a crucial role in the cultural and socioeconomic lives of rural people in Africa, providing meat, milk, income, and wealth (Ajola 2008; Yusuf *et al.*, 2018)

Helminth infections/diseases are one of the most important diseases limiting livestock production in many parts of the world (Sharma and Ganguly, 2016). Gastrointestinal helminths cause significant economic losses of small ruminant enterprises through increased susceptibility of animals to other infections, morbidities, and mortalities, especially in heavily parasitized animals and in young animals. Furthermore, they lead to forced culling, condemnation of carcass and organs at meat inspection, increased cost of veterinary treatments, decreased weight gain, reduced milk production and reproductive capacity, decreased work capacity, diminished food intake, reduced animal growth rates, and lower weight gains and treatment and management costs (Jaja *et al.*, 2017). Among gastrointestinal helminths, nematodes are the leading cause of ill-health and production losses in sheep and goats worldwide. Reports point to trichostrongylid nematodes, especially *Haemonchus contortus* (also known as the barber's pole worm) as the most

prevalent parasite identified in small ruminants (Jaja *et al.*, 2017).

Climatic conditions in the tropics and almost year-round grazing of sheep make them an easy target of various parasite attacks. Intestinal parasitism is a major constraint to small ruminant production in rural and semi urban communities (Wanzala *et al.*, 2005). In the tropics, the nematode species that affects small ruminants are *Haemonchus contortus*, *Trichostrongylus* species, *Nematodirus* species, *Cooperia* species, *Bunostomum* and *Oesophagostomum* species (Smith, 2009; Paddock and Breed, 2010). The most common nematodes that infect small ruminants are the gastrointestinal strongylids. *Haemonchus contortus* is one of the most pathogenic species belonging to this parasite group, and is an important limiting factor for the health and productivity of small ruminants (Radostits *et al.*, 2000).

Haemonchus species is a helminth parasite of the abomasum of ruminants and, in particular, is the most important gastrointestinal parasite in sheep. It is the most economically important and pathogenic helminth parasite of small ruminants in the warm tropical and subtropical regions of the world (Sharma and Ganguly, 2016; Blackie 2014). *Haemonchus contortus* is a blood sucking nematode parasite that inhabits the abomasum of small ruminants, especially sheep. It has been ranked the most important parasite of small ruminants in all regions across the tropics and sub-tropics, where they cause an insidious drain on production, mortality and morbidity in young animals (Smith, 2009 and Paddock and Breed, 2010). Haemonchosis is prevalent in sheep, and exerts the greatest economic loss in both temperate and tropical regions (Chaudhary *et al.*, 2007). Acutely infected sheep exhibit pale mucous membranes, dark coloured faeces, weakness, and oedema (bottle jaw) and may die suddenly. Chronic disease may manifest as decreased appetite, weight loss, and anaemia (Roeber *et al.*, 2013).

Ambient temperature, environmental humidity, grazing behaviour of the host, and quantity and quality of pasture are some factors responsible for the variations in prevalence of gastrointestinal helminths. Outbreaks had been reported to be more common and severe in warm, humid climates (Gadahi *et al.*, 2009). Other risk factors which include host species, sex, age, body condition, breed and intensity of worm infections affect the development of gastrointestinal parasites (Badaso and Addis, 2015). The occurrence and severity of *Haemonchus* infection has been reported to depend on the rainfall patterns and temperatures of an area (Gebresilassie and Afera-Tadele, 2015). High rainfall and temperatures promote rapid hatching of eggs on pasture and hence increased contamination. There is paucity of information in available literature on the occurrence of *Haemonchus* infection in sheep populations in Maiduguri Nigeria. The present study determined the occurrence of infection with *Haemonchus* species in sheep in some households at Gwange-I Ward and at Maiduguri cattle market, Maiduguri, Borno State, Nigeria.

Materials and Methods

Study area: The research was conducted in Gwange-I Ward and the Maiduguri Cattle market in Maiduguri, the capital city of Borno State, North-eastern Nigeria. The city lies on an altitude of 354m and is located between latitudes 10.2°N and 13.4°N and longitudes 9.8°E and 14.4°E. It occupies an area of 75,540.9 square kilometres (km²). Two dominant seasons are the wet (June to October) and the dry (November to May) seasons (Peter *et al.*, 2015). Temperature ranges from 13 – 41°C. Annual rainfall is at 9 – 198 mm and sunshine of 7 – 9 hours/day. Relative humidity varies between 19 to 78% and remains at 45% during the wet season (Peter *et al.*, 2015).

Gwange-I ward is a densely populated area and in fact the largest ward in terms of size and population in the whole of Maiduguri metropolitan council, and its inhabitants are basically low income earners who commonly rear small ruminants: this was the reason for its choice as study location because of the large numbers of sheep reared in the ward. Maiduguri cattle market is located opposite to the famous Maiduguri central abattoir positioned in the outskirts of Maiduguri town adjacent to one of the tributaries of Lake Chad Basin called Ngadda River to the east of the town. The cattle market is a hotspot for sale and purchase of sheep, goats, cattle and camels transported from the neighboring Chad, Cameroon and Niger Republics. Some of the animals offered for sale/purchase at Maiduguri cattle market are usually slaughtered for meat, after purchase, at the abattoir situated less than 100 metres from the market, but most of them are transported to the southern part of Nigeria for sale or slaughter at abattoirs.

Sample collection: A total of 150 faecal samples were collected based on convenient sampling strategy from different ages, breeds and sexes of sheep in Gwange-I ward and Maiduguri cattle Market in Maiduguri, Borno State, Nigeria. Relevant permissions were obtained from the sheep owners and traders before faecal samples were collected from the sheep, and the surveyed sheep were handled humanely all through the study.

Forty five faecal samples were obtained from sheep in households in Gwange-I ward area, while 105 samples were obtained from sheep at Maiduguri cattle market. The faecal samples were collected per rectum from sheep using protective disposable gloves into clean and dry universal bottles and taken to Diagnostic Parasitology Laboratory section of the Department of Veterinary Medicine, University of Maiduguri for processing. The faecal samples collected were appropriately labeled with information about sex, age and

breed of each sheep on the universal bottle containing the faecal sample. Sample collection and laboratory examination was done from August to November 2023.

Laboratory examination (Floatation technique): The faecal samples were examined at the Laboratory of Department of Veterinary Medicine, University of Maiduguri, Borno State, Nigeria by the use of floatation technique. The floatation technique is based on the fact that eggs of the parasite were lighter and small and can therefore float in the floatation liquid. One (1) gramme of the faecal sample was each taken in a mortar 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 $\times 10$ and $\times 40$. Photographs of eggs were taken and identified based on shape and size.

Data Analysis and Presentation: Data generated were subjected to descriptive statistics and results were presented as percentages in tables. Chi square was used to determine the association between the occurrence of infection and variables such as breed, sex and age. The analysis was done

using SPSS software, version 20.0. Significance was accepted at probability less than 0.05.

Results

The 150 sheep sampled were made up of 73 Balami and 77 Yankasa breeds, 81 males and 69 females, and 90 young and 60 adults.

Out of the 150 faecal samples collected and examined, 111 (74%) had *Haemonchus* eggs. The occurrence of infection in the Balami sheep breed (78.08%) was relatively higher than the occurrence recorded for the Yankasa breed (70.13%), though there was no significant association ($p > 0.05$) between breed and occurrence of the infection (Table 1). The occurrence of infection in females (75.36%) was also relatively higher than the occurrence in males (72.84%), though there was also no significant association ($p > 0.05$) between sex and occurrence of infection (Table 2). In the same vein, the occurrence of infection in young sheep (75.56%) was also relatively higher than the occurrence in adults (71.67%), and there was also no significant association ($p > 0.05$) between age and occurrence of infection (Table 3). Significantly ($p < 0.05$) higher number of sheep sampled at the Maiduguri cattle market (90.48%) had *Haemonchus* infection when compared to those sampled at households in Gwange-1 ward (35.56%) [Table 4].

Table 1: Breed-based distribution of the occurrence of *Haemonchus* infection in sheep sampled in some households at Gwange-I Ward and Maiduguri cattle market, Maiduguri Borno State, Nigeria.

Breed of sheep surveyed.	Number of sheep surveyed	Number in which <i>Haemonchus</i> species was detected	Occurrence of the <i>Haemonchus</i> infection (%)
Balami	73	57	78.08 %
Yankasa	77	54	70.13 %
Total	150	111	74 %

Table 2: Sex-based distribution of the occurrence of *Haemonchus* infection in sheep sampled in some households at Gwange-I Ward and Maiduguri cattle market, Maiduguri, Borno State, Nigeria.

Sex of sheep surveyed	Number of sheep surveyed	Number in which <i>Haemonchus</i> species was detected	Occurrence of the <i>Haemonchus</i> infection (%)
Male	81	59	72.84 %
Female	69	52	75.36 %
Total	150	111	74 %

Table 3: Age-based distribution of the occurrence of *Haemonchus* infection in sheep sampled in some households at Gwange-I Ward and Maiduguri cattle market, Maiduguri, Borno State, Nigeria.

Age of sheep surveyed	Number of sheep surveyed	Number in which <i>Haemonchus</i> species was detected	Occurrence of the <i>Haemonchus</i> infection (%)
Young	90	68	75.56 %
Adult	60	43	71.67 %
Total	150	111	74 %

Table 4: Sampling location based-distribution of the occurrence of *Haemonchus* infection in sheep sampled in some households at Gwange-I Ward and Maiduguri cattle market, Maiduguri, Borno State, Nigeria.

Location of sheep surveyed	Number of sheep surveyed	Number of sheep in which <i>Haemonchus</i> spp. was detected	Occurrence of the <i>Haemonchus</i> infection (%)
Households in Gwange-1 ward	45	16	35.56 %
Maiduguri Cattle market	105	95	90.48%
Total	150	111	74%

Discussion

The findings in the present study of an overall 74.0% occurrence of *Haemonchus* infections in the sheep sampled is considered high, but it compares favourably and concurs with the reports of Mbap and Chiroma (1998) and Ibukun and Oludunsi (2015) who reported overall prevalence rates of 81.4% and 82.7% in Bauchi and Minna, Nigeria, respectively. Also, the high overall occurrence recorded in the present study concurred with the reports by Sangma *et al.* (2012) of the prevalence of 81.1% in Bangladesh. This high overall occurrence of *Haemonchus* infections agrees with reports of Vatta *et al.* (2002) who pointed out that *Haemonchus* species was one of the most important helminth parasites in small ruminants and mostly found from economically poor areas. However, the overall occurrence recorded in the present study is far higher than the 43.1% reported by Nwosu *et al.* (2007) for nematode infections in sheep. It is thought that the difference in the prevalence recorded in the two studies might be attributed to the period of the year (season) of the study, which differed; the present study spanned from August to September 2023, while the period of study reported by Nwosu *et al.*, 2007 was from January to December, 2002. The reports of Pandit *et al.* (2003) and Tramboos *et al.* (2015) with the prevalence rates of 65.4% and 62.9% respectively from sheep in Kashmir valley, India are also lower compared to the findings in the present studies. Similarly, there was a relative concurrence with the findings of the present studies with that of Yadav *et al.* (2006), and Tramboos *et al.* (2015) who differently reported prevalence rates of 83.24% and 77.00%, respectively in sheep of Jammu, India. In separate investigations, Moti (2008), Dagnachew *et al.* (2011), Zerihun (2012) and Diriba and Birhanu (2013) reported overall prevalence rates of 76.3%, 79.09%, 59.89% and 68.1% respectively from different parts of Ethiopia. Similarly, Raza *et al.*

(2012) reported an overall prevalence of 78.0% in Pakistan.

In the present study, a relatively lower occurrence of infections was recorded in Yankasa breed (70.13%), when compared to the Balami breed (78.08%); this is comparably higher than the overall prevalence rate of 53.97% reported for Yankasa breed in Abuja, Nigeria by Solomon-Wisdom *et al.* (2014) and 65.5% of the prevalence for the Yankasa breed of sheep reported in Lafia by Hassan *et al.* (2013a). The differences between the occurrence recorded in this present study and that reported is thought to be as a result of ecological and management differences in handling sheep in the study area, because the sheep sampled at the Maiduguri cattle market (in the present study) were rarely subjected to any form of deworming. The findings in the present study differed from that of Ibukun and Oludunsi (2015) in Minna, Nigeria who reported that the overall helminth prevalence in Yankasa was higher than that of Balami, and that of Thlama *et al.* (2016) in Maiduguri, Nigeria that showed that prevalence was higher in Yankasa (77.1%) than Balami (66.7%). Dafur (2008) also similarly reported that Yankasa breed had higher prevalence than Balami under communal management system on the Jos Plateau, Nigeria.

Relatively higher occurrence of infection was recorded for females (75.36%) in the present study when compared to males (72.84%); this concurs with earlier reports by Asanji and Williams (1987) in livestock in Sierra Leone. The reason could be due to the fact that females stay longer in flocks because of reproduction compared to males which are most frequently slaughtered for meat purpose and sacrifices and therefore the female harbour most of the worm burdens compared to males. This finding of higher occurrence in females relative to males agrees with the earlier reports by Getachew *et al.* (2017) and Borden *et al.* (2018) in which higher prevalences were reported in females relative

to males. The higher occurrence of infection in females relative to males is also thought to be as a result of the concept of sexual dimorphism as female animals have been reported to be more susceptible to helminth infections because of the circulation in their blood of female sex hormones that decrease in immune status, especially during gestation and the lactation period, while males seem to be more resistant to infection due to circulation of testosterone in their blood (Urquhart *et al.*, 1996).

The difference in occurrence between the sexes was not significantly different, though the findings in the present study show a relatively higher infection occurrence in females. Adua and Hassan (2016) also reported that sex does not really have a significant influence on the epidemiology and distribution of gastrointestinal parasites among sheep. Also, Attah and Galamaji (2019) reported no significant sex difference in infection occurrence. However, the work of other researchers presented clear sex differences as reported by Keyyu *et al.* (2003), Regassa *et al.* (2006), Ghanem *et al.* (2009), Hassan *et al.* (2013a) and Dagnachew *et al.* (2011). In contrast to the present findings, Attah and Galamaji (2019) reported a high prevalence of gastrointestinal parasites in males (50.71%) than females (32.86%).

The 75.6% occurrence recorded for young sheep and 71.7% for adults in the present study is relatively higher than the 67.1% for young sheep and 40.4% for adults recorded by Lateef *et al.* (2005). Other researchers (Gamble and Zajac, 1992; Watson *et al.*, 1994; Colditz *et al.*, 1996) also recorded high prevalence in young sheep, though their age categorizations varied. The relatively lower occurrence recorded in adults relative to the young has been attributed to stronger resistance to infection in adults. Thlama *et al.* (2016) reported higher prevalence of all parasites species (cestodes and strongyles) in adult than young sheep in Maiduguri, Nigeria.

Similarly, Hassan *et al.* (2013b) found significantly lower prevalence (2.1%) in lamb (< 6 months old) when compared to 6 – 12 months (28.7%) and sheep above 12 months of age (34.7%) sheep in Lafia, Nigeria. Tramboos *et al.* (2015) recorded significantly higher prevalence of all gastrointestinal helminths in adults (> 1 year) [83.00%] than lambs and hoggets (\leq 1 year), [53.11%] in sheep of Kashmir valley, India. The authors further reported higher prevalence rates of trematodes and nemathelminths in adults than young sheep. Other workers, Swarnkar *et al.* (1996) and Yadav *et al.* (2006) similarly reported higher helminth prevalence in adults than young sheep. Getachew *et al.* (2017) reported of higher prevalence of *Haemonchus* species infection in young than adult sheep, while Mbap and Chiroma (1996) on the other hand did not find any significant difference between age groups in helminth prevalence.

The significantly lower occurrence of *Haemonchus* infections in sheep sampled in households when compared to the ones sampled at the Maiduguri cattle market in the present study is thought to be due to the fact that veterinary care and deworming is more commonly done in households while traders at the markets rarely deworm their animals, and the stocking density at the markets is usually very high; such overcrowding promotes infection transmission and sustenance.

Conclusions: Based on the results of the study, it was concluded that there was a high occurrence (74%) of *Haemonchus* infection in the sheep sampled, and that there were relatively higher occurrence of infection in Balami breed of sheep (when compared to Yankasa breed), females (when compared to males) and young (when compared to adults). Significantly higher number of sheep sampled at Maiduguri market had infection when compared to those sampled in households. Strategic deworming using broad spectrum anthelmintics is recommended.

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Conflict of interest

The authors have declared that there is no conflict of interest.

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