Prevalence of Haemonchosis and its relationship with faecal egg count, FAMACHA score and haematological parameters in goats slaughtered at D/Shuni Abattoir Sokoto State

Bala A. Y., Argungu S. Y. and Ladan M. U.

Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto

Correspondence: aminubala2001@yahoo.com

(Received: 05/03/15) (Accepted: 21/03/15)

ABSTRACT

The study was conducted to determine the prevalence of Haemonchosis and its relationship with faecal egg count, FAMACHA© score and haematological parameters in goats brought for slaughter at Dange Shuni abattoir in Sokoto State, Nigeria between September 2012 and March 2013. Faecal samples collected from 160 goats of different age groups were analyzed following modified McMaster technique using saturated solution of sodium chloride. Blood samples were also collected from the goats and analyzed for packed cell volume (PCV %) and haemoglobin concentration (g/dl). Results revealed a prevalence of 16.87% (27/160). It was observed that animals of either sex are equally affected (p > 0.05). A higher infection rate was recorded among the younger animals than the older ones with significance (p < 0.05). The mean values of PCV and Hb were non-significantly (p > 0.05) lower in the infected goats. No significant difference (p > 0.05) was observed in the degree of faecal egg counts (FECs) between the two sexes and the age groups, but an inverse relationship between egg output level and PCV of the infected animals (p < 0.01) existed; PCV (%) decreases with increase in egg output. Results also showed that FAMACHA© scoring had significantly positive correlation with level of H. contortus infection (FECs) and a strong inverse correlation with PCV (%) in the infected animals (p<0.01). It is concluded that epidemiological knowledge of the parasites present in an area is a prerequisite for the development and implementation of sustainable parasite management programs in that area.

Keywords: H. contortus, Haematological parameters, Goats, Dange, Abattoir

INTRODUCTION

Gastrointestinal (GIN) parasite infections are a world-wide problem for both small- and large-scale farmers, but their impact is greater in sub-Saharan Africa in general and Nigeria in particular due to the availability of a wide range of agro-ecological factors suitable for diversified hosts and parasite species [1].

Among GIN parasites, Haemonchus contortus is considered main culprit causing anaemia and hypoproteinaemia in ruminants [2]. Several epidemiological studies on the GIN infections were carried out to depict the seasonal pattern of haemonchosis in different agro-ecological areas of the world including Nigeria [3 – 12].

Goats are born without Haemonchus contortus, however, they become infected with the worm when they start grazing. The infective (L_{3}) larvae are eaten by the goats during grazing. In the humid tropical climate as in West Africa, the regions surrounding Lake Victoria and parts of coastal eastern Africa, the climatic conditions permit development of eggs and larval stages more-or-less continuously throughout the year where the optimal humidity requirement for free living stage development of the parasite is 85% [13 – 17]. Although desiccation is lethal for the free-living stages of the worms, the parasite can survive such conditions either as infective larvae within the hosts.
and because of the extremely high fecundity and short generations intervals, severe outbreaks of the disease may occur after only a short period of suitable weather [15, 16].

The symptoms of haemonchosis include lack of appetite [18, 19], lethargy, loss of weight, reduction in milk and wool production, presence of pale mucosa, oedemas, diminution of PCV, haemoglobin, plasma proteins and increase in the number of circulating eosinophils in peripheral blood and serum pepsinogen and gastrin. The final stages of the disease may be accompanied by emaciation, and death may result [20].

Considering the importance of livestock in Nigeria, livestock production constitutes a great source of revenue generation in Nigeria with goats being an important source of animal protein for vast majority of Nigerians [21]. Livestock has a vital economic and ecological niche in agricultural system throughout developing countries, goats and sheep make a very valuable contribution especially to the poor in the rural areas. These contributions range from precious animal proteins (meat and milk) to fibre and skin, food security and household stability [22].

In Sokoto State, goats serve as assets and are sold especially in situations of impecuniosities. Again, when planting season approaches some of the goats are sold in order that money is made available for the purchase of fertilizer. One other advantage is that the mature animals are slaughtered by the farmers for consumption especially during festivals. This provides a good source of proteins for the families. However, because of the constraint of haemonchosis in goats, the farmers continue to incur significant losses due to insufficient availability of information on the epidemiology of the parasite. Furthermore, the prevalence and the severity of the infection also vary considerably depending on local environmental conditions, such as humidity, temperature, rainfall, vegetation, and management practices. Nigeria and Sokoto State, in particular, offers a wide range of these agro-ecological factors that have been reported [23] to facilitate the spread of the infection.

Therefore, there is the need to acquire a comprehensive knowledge of the epidemiological knowledge of haemonchosis in order to device appropriate and cost effective strategies to control the infection with timely anthelmintic treatments in the study area. The purpose of this investigation was to study the prevalence of *H. contortus* in goats slaughtered at Dange Shuni LGA, Sokoto State, Nigeria. Emphasis was also placed on determining the severity of *H. contortus* infection by evaluating the level of worm infection (FECs), some haematocrit values and pallor scoring of ocular mucous membrane by FAMACHA® application for identifying the anaemic state of the infected animals.

**MATERIALS AND METHODS**

**Study area**

The study area was Dange abattoir situated at Dange-Shuni (12.8500° N, 5.3500° E) local government area of Sokoto State, Nigeria. The climate of the area is tropical continental and is dominated by two opposing air masses, the tropical maritime and tropical continental. Rainy season in the area starts late around April-May and ends around September/October, with a mean annual fall of about 1300mm. the temperature of the area is characterized by hot and cold seasons. The extreme temperature is experienced during the hot season in the months of March/April with about 36°C as average annually. The cold season is prevalent between November and February and is characterized by cold temperatures and dust winds often by thick fogs of alarming intensity [24].

The abattoir is particularly sited beside Dange Modern Central Market, a place called “Buide” where animals are sold. The Local Government Authority established this abattoir in order to provide a proper conversion of animals’ by-product into useful product. The abattoir consists of a lairage, where animals are kept before slaughter, the slaughter and dressing unit, where the animals are slaughtered, de-haired and split to carcass.

**Sample collection**

**Parasitology**

One hundred and sixty (160) faecal samples were collected directly from the rectum of goats with strict sanitation using a gloved finger and placed in air and water tight sample bottle containing 10% formalin. Each sample bottle was labeled with the following information, sex, age, and date of collection. Parasitological examination of samples was done by direct smear and flotation techniques to identify eggs. Positive faecal samples were subjected to faecal egg counts (FECs) following the modified McMaster method with saturated sodium chloride solution as the floating medium, at a sensitivity of 50 eggs per gram (EPG) of faeces [8]. *H. contortus* (L3) larvae were examined at 10 X

http://www.journalzbr.com/issues.html
magnification and were identified according to the keys and morphological characteristics described by [25]. The
degree of infestation was categorized based on literature [26, 27]. In each case, 3g of faeces were mixed in 42 ml of
saturated salt solution, and the number of eggs per gram of faeces (EPG) was obtained by multiplying the number of
nematode eggs counted in two squares of the McMaster slide by a dilution factor of 50 [14, 28, 29].

**Haematology**

Blood samples of the same goats as stated above were also collected. The blood samples were collected from the
goats at the point of slaughter, in EDTA coated vacutainer tubes, for the determination of packed cell volume (PCV %)
and haemoglobin concentration (Hb g/dl). The PCV was determined using the micro-haematocrit method while the
Hb content of the blood samples was determined by the spectrophotometric as described by [30].

**FAMACHA© chart scoring**

FAMACHA© eye color chart clearly depicts various categories from healthy to severely anaemic condition. The
ocular mucous membrane of the eye of each goat was examined by comparing them with the laminated color chart
bearing the picture of goat conjunctiva [42]. This chart was calibrated into five categories i.e. 1 = red (non-anaemic);
2 = red-pink (non-anaemic); 3 = pink (mildly-anaemic); 4 = pink-white (anaemic) and 5 = white (severely anaemic).
All scorings were done on the same day along with faecal and blood samplings.

The samples were collected between September 2012 and March 2013 from both sexes and different age groups.
Samples collected from the abattoir were transported to the Zoology Laboratory in the Department of Biological
Sciences, Usmanu Danfodiyo University Sokoto, for analysis. Out of the 160 goats sampled 95 were males and 65
females, 89 were between 1-2 yrs, 63 between 3-4 yrs old and 8 were 5 yrs and above.

**Data Analysis**

The prevalence was calculated by dividing the number of animals harbouring parasite eggs or larvae by the total
number of animals examined. Percentage (%) to measure prevalence, chi-square ($\chi^2$) and Pearson partial correlation
(rho, r) analysis to measure association between prevalence of the parasite and age, sex, FECs, haematological
parameters and FAMACHA scoring were the statistical tools applied. In all the analyses, confidence level was held
at 95% and $P < 0.05$ was set for significance. In all cases data was put into computer and analyzed using SPSS
version 21.0 (SPSS, Inc. Chicago, Ill) software package.

**RESULTS AND DISCUSSION**

Out of the 160 goats examined, 27 were found to be positive. This represents a prevalence of 16.87%. The sex
specific distribution of the infection shows that male goats were infected 16 (59.25%) more than females with 11
(40.74%), although statistical analysis revealed no significant difference ($p>0.05$). No significant difference
($p>0.05$) was observed in prevalence of the parasite and degree of FECs between male and female animals (Table
1).

The occurrence of the infection decreases with age ($p<0.05$), 14 animals (51.85%) were found infected within 1-2
yrs age group, 11 (40.74%) in the 3-4 yrs old and 2 (7.41%) in the 5+ yrs old age group (Table 2). Higher prevalence
rates were found in younger animals while no association was recognized between degree of FECs and age in all the
study animals, although higher egg counts were found in the 5+ yrs old animals (Table 2).

Results of haematological studies revealed that the infected animals had a PCV range of 7.20 to 34.90 and Hb 2.40 –
11.63 (g/dl) while in the non-infected goats the PCV ranges between 35.0 to 38.0% and Hb range of 11.50 – 13.60
(g/dl) Table 3). The mean values of PCV and Hb were relatively lower in the infected goats, although statistical
analysis showed no significant difference ($P>0.05$) (Table 3). Conversely, there is a relationship between EPG level
and PCV of the infected animals ($p<0.01$), as the PCV (%) decreases, there is an increase in FEC level (Table 6).
The results also showed that the PCV and Hb showed positive significant correlation in the infected animals
($p<0.05$).

Results of the FAMACHA© scoring revealed that in the infected goats with an eggs per gram (EPG) level of 1050 -
2500, most of the animals fell in category 4 with pink-white eye colour (Table 5). Similarly, with EPG level above
2500, animals fell in category 5, having white eye colour showing severe anaemic condition. Animals showed
anaemic and severe anaemic conditions with the constant increase in the level of FECs. The results elucidated a

http://www.journalzbr.com/issues.html
relationship between FECs level and FAMACHA© categories (Table 6). Moreover, FAMACHA© scoring had significantly positive correlation with level of \textit{H. contortus} infection (FECs) in the infected animals (p<0.01). There is also a strong inverse correlation (p < 0.01) between the PCV (%) and FAMACHA© scoring. Results indicated that as the FAMACHA© scoring increase there is a decrease in the PCV (%) of the infected animals (Table 6).

Table 1: Prevalence and Degree of FECs of the Sex Groups

<table>
<thead>
<tr>
<th>Sex</th>
<th>Faecal egg counts (FECs) ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50-500</td>
</tr>
<tr>
<td>Males</td>
<td>5</td>
</tr>
<tr>
<td>Females</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2: Prevalence and Degree of EPG Across Age Groups

<table>
<thead>
<tr>
<th>Age group (yrs)</th>
<th>Faecal egg counts (FECs) ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50-500</td>
</tr>
<tr>
<td>1-2</td>
<td>5</td>
</tr>
<tr>
<td>3-4</td>
<td>3</td>
</tr>
<tr>
<td>5+</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 3: Mean Haematological parameters of \textit{Haemonchus contortus} of infected and non-infected goats

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Infected</th>
<th>Non-infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCV (%)</td>
<td>22.78</td>
<td>39.40</td>
</tr>
<tr>
<td>HB (g/dl)</td>
<td>7.59</td>
<td>11.63</td>
</tr>
</tbody>
</table>

Table 4: Haematological profile of the infected goats in the study area

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Statistic</th>
<th>Statistic</th>
<th>Statistic</th>
<th>Statistic</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCV (%)</td>
<td>27</td>
<td>27.70</td>
<td>7.20</td>
<td>34.90</td>
<td>22.78</td>
<td>27.70</td>
<td>27.70</td>
<td>27.70</td>
<td>27.70</td>
<td>2.01073</td>
</tr>
<tr>
<td>Hb (g/dl)</td>
<td>27</td>
<td>9.23</td>
<td>2.40</td>
<td>11.63</td>
<td>7.59</td>
<td>9.23</td>
<td>9.23</td>
<td>9.23</td>
<td>9.23</td>
<td>.67024</td>
</tr>
</tbody>
</table>

Table 5: Various sets of FECs ranges in the infected goats for evaluation of FAMACHA© system

<table>
<thead>
<tr>
<th>FAMACHA© categories</th>
<th>Faecal egg counts (FECs) ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50-500</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
</tr>
</tbody>
</table>

The results revealed that 16.87% of the animals harbour \textit{H. spp}. This seems to be in conformity with the 12.01% percent reported in goats in Northern Nigeria [30] (Idris, 2003). However, the result was higher than the 1.9% reported by Ghanem et al., [31] in Somalia. The result also contradicted the work of Nwosu et al. [7] who reported a higher prevalence rate of haemonchus in goats in Nigeria. In addition, Fabiyi et al., [10] also found a higher prevalence of haemonchus species in sheep in the study area. The relatively higher prevalence of haemonchosis in sheep in the study area is in conformity with previous workers [5, 32, 33] (Jacquiet \textit{et al.}, 1992; Fritsche \textit{et al.}, 1993; Ndao \textit{et al.}, 1995), who have also reported that sheep generally harbour more GIT nematodes than goats. The plausible explanation might be the fact that sheep are generally grazer in their feeding habit and usually graze very close to the soil which might be helpful in the acquisition of more infective larvae (L3) of \textit{H. Contortus} from the contaminated herbage. On the other hand, goats browse on shrubs and small trees where translation of infective larvae to such a height seems to be relatively minimal.
Table 6: Correlations analysis showing association between FECs, PCV (%) and FAMACHA© categories of the infected animals

<table>
<thead>
<tr>
<th></th>
<th>Egg per gramme</th>
<th>PCV (%)</th>
<th>Hb (g/dl)</th>
<th>Fams</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Correlations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg per gramme</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>-957*</td>
<td>-957*</td>
<td>.926*</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>PCV (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>-957*</td>
<td>1</td>
<td>.877*</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Hb (g/dl)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>-957*</td>
<td>1.000*</td>
<td>1</td>
<td>.877</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Fams</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.926</td>
<td>.877*</td>
<td>.877*</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

The high, but not significant prevalence of the infection in males could be due to variation in sample size, where more males were found to be sampled than females. This may not be unconnected with the habit of the goat rearers in the study area. They tend to sale more males than females because of their reproductive capacity; hence more male goats find themselves in the slaughter houses than females.

The study further revealed that sex of the animal did not show significant association with the prevalence of the parasite and degree of EPG. This means that both sexes can equally excrete equal number of eggs in the study area. This is in conformity to the findings of Keyyu, et al., [34] and Ghanem et al., [31] who made similar observations in cattle from Tanzania and Somalia respectively.

There was a significantly higher prevalence rate recorded in younger animals. This finding is in agreement with most literatures [7, 11, 34-37] from different corners of the world. This could be due to the fact that younger animals are more susceptible than the adult counter parts. Adult animals may acquire immunity to the parasites through frequent challenge and expel the ingested parasite before they establish infection [25, 39]. But the findings of this study are inconsistent with the report of Fritsche et al., [5] who found adults and older animals to bear high worm burden.

There was no association between age of animals and faecal egg count though higher proportions of severe cases were recorded in the older study animals. This observation is in consent with the work of [31, 36] Githigia, et al., (2005) and Ghanem et al., 2009 that stated no association of degree of EPG and age of the animals. But it is to the contrary with the findings of Waruiru, et al., [40] that reported higher prevalence and intensity of EPG in older sheep and goats.

Values of haematological parameters obtained from haemonchus infected animals is in accord with low values earlier reported [42]. The relatively lower, although non-significant mean PCV and Hb in the infected animals is a sign of low grade anaemia which is a main feature of haemonchosis. The fall in PCV, a common finding in haemonchosis [43-47], is due to the combined effect of young and adult parasites’ increased blood demand, the efficiency of now well-developed lancet in the worms’ oral cavity, and blood loss to the gastrointestinal tract caused by infection-related hemorrhagic gastritis [47-49]. The observed fall in PCV values coincides with a fall in haemoglobin concentration as seen in this study is in agreement with [50]. This is related to the haematophagy of the worms, as well as to blood loss through the intestine [49] and erythrocyte lysis caused by haemolytic factors excreted by the parasite [51, 52]. The strong inverse correlation between the PCV and FECs is a confirmation that the severity of infection is responsible for the observed low PCV and Hb in this study. This is in agreement with Wallace et al., [53] and Chaudhury et al. [54] who found high FEC to coincide with reduced PCV and Hb in *Haemonchus contortus* infected animals.

This study reveals a highly significant correlation between FEC and FAMACHA© eye scoring. The FAMACHA® system is used to correctly mark those animals that are possibly anaemic and which may require anthelmintic treatment, probably due to high worm burden, depicted by higher FECs as observed in this study. This agrees with the work of Chaudary et al., [54] who also reported a correlation between FEC and FAMACHA® scoring in infected goats. This observation, further confirmed by low PCV and Hb, in the infected animals, supports the
assertion that the FAMACHA® system may be used to accurately estimate PCV by assessing the colour of the mucous membranes of (especially) the eyes. This is seen in the mucous membranes of the eyes as a visible paleness generally known as anaemia. By monitoring anaemia, resilient and susceptible animals can be identified [42].

It is concluded that
1. Haemonchosis is present in the study area
2. Both sexes are equally infected
3. Younger animals are more affected
4. It is known that a prerequisite for the development and implementation of sustainable parasite management programs is to have an epidemiological knowledge of the parasites present in a specific area.

REFERENCES