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Experimental Studies on Gastro-Intestinal Nematode Infection; Clinical Observations and Haematological Changes Following *Haemonchus contortus* Infection in West African Dwarf (WAD) Kids

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Abstract: Clinical observations and haematological changes following gastro-intestinal worm *Haemonchus contortus* was investigated experimentally in West African Dwarf (WAD) kids. 10 apparently healthy kids were experimentally infected orally with 750 infective larvae of *Haemonchus contortus* for a period of 5 weeks. The kids were weighed, the blood and faecal samples were collected before and after infection. Student's t-test statistical analysis was used. The clinical observations on the infected WAD kids were normal rectal temperature, normal respiratory rate, normal heart rate and normal prepatent period with muscular weakness, anorexia, intestinal distension by worms, weight loss, reduced carcass quality, reduced feed intake, diarrhea and anaemia. The infestation was characterized by responsive normocytic-nomochromic anaemia. The weight and erythrocytic values were significantly different at $p<0.05$ and $p<0.01$ compared with the control. The erythrocytic indices, the total WBC and differential leucocyte counts were not significantly different at $p>0.05$ and $p>0.01$. The weight and erythrocytic values are directly proportional to the level of presence of helminthes eggs in the faeces.

Key words: West African Dwarf (WAD), kids *Haemonchus contortus,* clinical observations, haematological changes

INTRODUCTION

Africa is believed to posses a variety of parasites due to their presence in large number, favourable climatic condition and availability of suitable hosts. The existence of these parasites has caused a lot of damage to our livestock industry in term of attaining market weight and the cost of treating them. Animal production in Nigeria is beset by a number of problems amongst which pasturage, diseases and other parasitic problems form a bulk; of all these parasitic problems, helminthosis and ticks infestation ranked high and lead to anaemia. Haemonchosis is an important disease of sheep, goats and cattle in Africa leading to high mortality or high morbidity in lambs and kids[1]. Considerable damage is caused by fourth-stage larvae (L_4) of abomasal parasites leading to reduced appetite, haematological changes and reduced digestive capability of the abomasun as reported by[2].

There are various types and classification of anaemia due to pathophysiology, morphology and bone marrow response that affect livestock[3] leading to clinical signs. These changes may result in mediated haemolytic anaemia, metabolic disease, depression or hypoproliferative, anaemia associated with organ or tissue disorders, Aplastic or hypoplstic anaemia, myeloproliferative disorder and anaemia associated with parasitic disease[4] and but the most common ones which affect (WAD) goats in this environment, leading to high mortality and high morbidity is haemorrhagic and haemolytic anaemia.

Anosa[5] and Ottesile[6] reported that most important endoparasites (helminthes) include *Haemonchus contortus*, *Ostertagia ostergi*, *Trichostrongylus* sp., *Galgeria Pachycelis*, *Fasciola gigantica* and *Monienza expansa*, however, *Haemonchus contortus* and *Monienzia expansa* appear to be the most common in this environment.

Anosa[5] and Otesile[6] reported highly significant correlation between parasite egg per gram faeces (egg) and haemoglobin levels in *Haemonchus contortus* infection in sheep. Hematological changes include

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eosinophilia and terminal death is usually preceded by weakness especially of the hindquarter. While the comprehensives aid the relevance of this symptomatology are never in doubt. The chronological sequence of the same would be more useful to the clinician in following the progress, prognosticating and counseling on gastro-intestinal nematode infection. This study aimed at determine the clinical observations and haematological changes following *Haemonchus contortus* infection in West African Dwarf (WAD) kids.

MATERIALS AND METHODS

Experimental animals: 10 kids from 5 dams were bought from Samanda Area of Ibadan. The kids were acclimatized and treated with Thiabendazole at 66 mg kg^{-1} body weight and 20% L. A oxytetracycline at dosage rate of 1 mL/10 kg body weight before the commencement of the experiment at ward 1, Veterinary Teaching Hospital, University of Ibadan, Nigeria. The blood and faecal samples were taken and analyzed. The faecal samples were negative for faecal egg counts and haematological values recorded to serve as control. The kids were experimentally infected with *Haemonchus contortus* for a period of 5 week (5-wek post infection). 1st reading served as control while 2nd and 3rd and 4th readings at 3rd, 4th and 5th week served as experimental period. The age of kids ranged between 1½-6 months as determined by dentition.

EXPERIMENTAL DESIGN

Assessment of live weight changes: The kids were weighed before and after experimental period with Salter (Butcher) scale machine, model 253 of sensitivity 0.05 kg.

Blood samples: Blood samples were collected from jugular with 10 mL calibrated syringe and hypodermic needle. 5 mL of the blood was dispense inside the bijou bottle with etylenediamine tetra acetate (EDTA) to prevent blood clotting and samples were taken to the laboratory inside the ice pack.

Faecal samples: Fresh rectal fecal samples were collected with bijou bottle from kids for faeceal egg counts as described by[7,2].

Larvae culture: The faeces obtained from goats confirmed to have hemonchosis was cultured to produce third stage (L_3) Larvae of *Haemonchus contortus* using Baermann apparatus as described by[2].

Larvae dose and oral infection: 5 mL of suspension containing infective larvae (L_3) which were suspended in distilled water equivalent to 750 larvae of *Haemonchus contortus* were administered orally into 10 kids (each) at moderate infection described by[2]. The oral infection was infected by expulsion of the desired dose from a disposable syringe in a small amount of water into the anterior pharynx, followed by a few mililitres of water in order to stimulate swallowing reflex[7].

Monitoring of the clinical signs: The Routine clinical examination of the kids were done, all clinical observations were made daily in the morning and these included respiratory rate, pulse rate, rectal temperature, alertness, general demeanor nature of hair coat and changes in live weight and physical examination was carried out on all the animals for other clinical signs and lesions.

Haematology: The blood was analyzed for Packed Cell Volumes (PCV) Red Blood Cell (RBC), Haemoglobin concentration (Hb) total and differential leucocytes counts erythrocytic indices: Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) and Mean Corpuscular Haemoglobin (MCH) as described by[8,4].

Blood staining technique: was done to determine the presence of haemoprotozoan parasites as described by[4].

Determination of helminthes eggs: using modified Mc-master floatation method as described by[7].

Statistical analysis: Data were analysed using student's t-test.

RESULTS AND DISCUSSION

Preclinical assessement: Generally, the kids were clinically healthy with no abnormalities, mucous membrane were pink, they were eating well with smooth hair coat, therefore the erythrocytic values, erythrocytic indices, total WBC values and differential leucocyte counts were normal. Both Giemsa stained thin film microscopy and haematocrit techniques did not reveal the presence of any haemoparasites. Examination by floatation method of faecal samples from the kids did not reveal any appreciable number of eggs.

Clinical assessment: After infecting kids with *Haemonchus contortus* for 5 weeks, the kids were emanciated and lean with starring hair coat, watery faeces, inappetence with slight pallour of mucous membrane of the eyes, mouth or vulva, the weight of the kids were seriously affected with presence of helminthes eggs in the faeces. No significant differences were observed in the

Table 1: Clinical parameters of kids following experimental infection with *Haemonchus contortus*

Clinical parameter	Control normal values	Experimental period		
		3rd week post infection	4th week post infection	5th week postinfection
Mean rectal temperature	38.15±1.24	38.15±0.24	38.20±0.76	38.25±0.24
Mean respiratory rate	15.40±0.52	15.60±0.52	15.40±0.52	15.01±0.32
Mean heart rate (minutes)	92.50±2.64	91.40±0.974	91.00±1.05	90.70±0.82

Mean prepatent period observed: 14.60±0.07 Mean and standard deviation ± shown

Table 2: Showing weight and haematological changes following *Haemonchus contortus* infection in WAD kids

Haematological values	Control normal values	Experimental period		
		3rd week post infection	4th week post infection	5th week post infection
Weight	7.45±1.21	5.10±1.30**	4.63±1.09**	3.79±0.97**
PCV%	26.30±1.12	22.85±3.64*	19.40±3.54**	17.45±4.40**
RBC$10^6/\mu l$	12.02±0.76	10.50±4.26*	8.42±1.98**	8.10±2.08**
Hb g dl^{-1}	9.48±0.97	8.31±1.30*	6.88±1.37*	6.65±1.31*
Total WBC/mm^3	1860±2993	10830±3069	14540±4968	17345±8899
MCHC (%)	35.83±3.39	36.43±1.54*	35.40±3.46*	38.72±3.06*
MCV (fl)	21.97±1.72	25.98±13.07*	23.83±5.26*	22.18±5.87*
MCH pg	7.87±0.98	9.48±5.12	8.40±1.96	8.38±1.90
Reticulocyte (%)	-	0.07±0.48	0.30±0.31	0.04±0.46
Lymphocyte (%)	42.6±17.9	30.6±7.04	38.10±19.15	41.10±11.90
Monocyte (%)	0.40±0.70	1.2±0.4	2.4±1.2	3.1±1.4
Eosinophil (%)	-	1.2±1.3	2.1±1.1	3.8±3.2
Basophil (%)	-	-	-	-
Neutrophil(%)	36.8±10.9	28.9±11.90	42.1±14.8	48.1±16.3
Epg	-	810±36.4	5570±436.4	14010±3624**

differ significantly at $p<0.05$ and $p<0.01$* none significant at $p>0.05$ and $p>0.01$ mean and standard deviation ± shown

mean rectal temperature, mean respiratory rate and the mean heart rate of the experimental kids as shown in Table 1. This means *Haemonchus contortus* did not elaborate any certain chemicals that can cause pyrexia or interfere with respiration and pulse rate of the kids. These clinical observation observed in WAD kids agreed with those of previous workers[10,11]. In the parastological content,[2] defined the preparent period in the heliminthes infection as the time lapses between infection and the first appearance of eggs in faeces. It varies much with the route of infection, sex, age and degree of acquired resistance of the host. In practical terms, it is a measure of time taken by the infective larvae (L_3) to migrate from the point of infection to the lower intestine and reach sexual maturity and lay eggs. The mean prepatent period in this experiment is The haematological values revealed reduction in erythrocytic values, total WBC values, erythrocytic indices and differential leucocyte values were normal with the presence of reticulocytes as shown in Table 2.

The erythrocytic values, erythrocytic indices, total WBC and differential leucocyte counts obtained from preclinical assessment agreed with[9] in kids between 0-6 months of age.

The mean values of PCV during 3rd week post infection did not differ significantly at $p>0.05$ and $p>0.01$ with normal, while PCV in the 4th and 5th week post infection were significantly different at $p<0.05$ and $p<0.01$ with normal. This conforms with[1].

The mean value of RBC during 3rd week post infection did not differ significantly at $p>0.05$ and $p>0.01$ with normal RBC while in the 4th and 5th week post infection RBC value was significantly different at $p<0.05$ and $p<0.01$ compared with normal. The 3rd, 4th and 5th week post infection RBC values were not significantly different from one another a $p>0.05$ and $p>0.01$. This conforms with[1].

The mean value of Hb concentration during 3rd , 4th and 5th week post infection did not significantly different at $p>0.05$ and $p>0.01$ compared with normal. The fall in erythrocytic values in an indicative of anaemia consequent to the sucking of the blood by *Haemonchus contortus*.

The MCHC values during 3rd 4th and 5th week post infection did not differ significantly at $p>0.05$ and $p>0.01$. These values were normal as described by[12-14,9]. This is anaemia with normal MCHC value (Normocytic).

The MCV values during 3rd, 4th and 5th week post infection and 5th week post infection treatment did not differ significantly at $p>0.05$ and $p>0.01$. These values were normal as described by[9,5] as normochromic anaemia.

The weight in kg values during 3rd 4th and 5th post infection differ significantly at $p<0.05$ and $p<0.01$ with normal weight. This conforms with report by[15,16].

The helminthes eggs per gram faeces in 3rd week post infection indicated mild infection while in the 4th and 5th week post infection indicated moderate infection as reported by[5,2].

Four persent (0-6%) and (1-10%). The normal values reported by[17] ranged between (1-8%) but in the 5th week post infection eosinophil values ranged between (1-10%) was due to higher proportion of eosinophils in Nigeria goat due to parastitism as reported by[9]. This experiment showed that helminthes and particularly haemonchosis infection affect the weight gain of an animal as well as erythrocytic values leading to responsive normocytic normochromic anaemia.

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