Immunological Response of Cattle to Gastro-S Intestinal Helminth Burden and Treatment Choice in A Semi-Intensive Management System

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ABSTRACT
The study was conducted to determine the relationship and effect of sex, on the immunological response of 40 cattle to helminth infection over twelve weeks' period in a longitudinal study. The cattle were managed in a semi intensive system and are made up of 29 cows and 11 bulls. Blood and fecal samples were collected at the beginning of the study and taken to the laboratory of the state Veterinary Hospital, Minna for Haematology immunology and parasitogical examination. The cattle were divided into four groups A, B, C and D. Group A was control while group B, C and D were administered Albendazole, Levamisole, Baminth F dewormers respectively. Thereafter, Blood and fecal samples were collected weekly for twelve weeks and analysed in the laboratory. The Results shows that there is significance ($p<0.05$) difference in weight changes, haemoglobin, packed cell volume(PCV) and white blood cell (WBC) with treatment 4 having highest value compared to other treatments. However, the control treatment (T1) and T3 show similarity. There was also no significant difference ($p>0.05$) in the immunoglobulin G and immunoglobulin D but immunoglobulin A, E, and M differs significantly ($p<0.05$) with the control cattle group having the highest titre. It was concluded that administration of antihelminthic drugs lower immunoglobulin titer in cattle. It is recommended that routine deworming exercise be carried out on cattle to minimize the helminth infection.

Keywords: Albendazole, Antihelminthic, Haemoglobin, Immunoglobulin

INTRODUCTION
Livestock are essential agricultural commodity in developing countries of the world. They are reared under a wide variety of production systems ranging from large-scale intensive commercial enterprises to traditional small-holder and village production systems. (Jorgen, 1998). Livestock production is therefore an invaluable component of pastoral and agro-pastoral farming, with human populations largely depending on it for meat, milk, fat, dung and farm energy (Wilson, 1991). In Nigeria, ruminants comprising cattle, sheep and goats constitute the livestock farm animals and about 13.9 million cattle, 22.1 million sheep, 34.5 million goats are currently been reared by farm families in the country as reported by Lawal-Adebowale (2012). These livestock animals are mostly managed on free range/ extensive system and semi-intensive system, where the animals are allowed to roam the streets and neighborhood to feed for themselves with little or no special provision of supplements for the animals (Lawal-Adebowale, 2012). The growth and development of healthy ruminants have not been maximally exploited due to obstacles such as diseases, malnutrition and mismanagement (Adzitey, 2013). Parasitism diseases contribute to the lower rate of animal production in different countries, specifically in the tropic like Nigeria (Ibrahim *et al.*,2014). Ruminants managed in extensive systems and semi intensive system of management are very susceptible to various parasitic helminths (Ibrahim *et al.*,2014). The gastro-intestinal tracts (GITs) of these livestock frequently shelter a variety of helminths, which cause clinical and subclinical

parasitism (Regassa *et al*., 2006). Gastrointestinal helminth infection is one of the most health problems limiting the productivity of livestock such as cattle (Dimaner *et al*., 2000 and Johannes *et al*., 2009), with infected animals having reduced weight gains, reduced food conversion rates, abortion, infertility and reduced meat and milk production, and sometimes leading to high mortality rates (Ogunrinade, 1984; Tisdell *et al*., 1999). Some important predisposing factors that might promote helminth infections are carelessly handled by the farmers keeping these animals. Such predisposing factors include grazing or feeding habits, pasture management, immunological status, nutritional deficiency, presence of intermediate hosts and vectors, number of infective larvae and eggs released into the environment, and a conducive weather condition for the development of the helminth's eggs to infective stages reported by Odoi *et al* (2007). However, the treatment of gastrointestinal helminthes to improve the productivity of livestock is paramount since animals managed on extensive and semi intensive system are exposed always to helminthic infection. This study therefore investigates the sex, immunological response of cattle on gastrointestinal helminth burden and treatment choice in semi intensive management system in Minna, Niger State, North-Central Nigeria.

MATERIALS AND METHODS

Study Site

This study was conducted in Waji Farm, Nigeria Limited. The Farm is located at Kante village along Tagwe Dam road, Tungangoro, Chanchaga, Minna. Niger State, Nigeria. Minna lies within latitude 9°30^{1}, North and longitude 6°33^{1}, East. The annual rainfall ranges between 110mm -1600mm and a mean temperature of 21°C and 36.5°C (Usman, 2011).

Sample Collection

The experiment was carried out to analyse faecal and blood sample of 40 cattle of different sex, various ages and body weight.

Faecal Sample Collection

Faecal samples for the study were collected from the experimental cattle. Samples were collected per rectum to obtain 5g of the sample using hand gloves into sterile bottles. All the specimens were identified clearly, labeled and kept in an ice box and transported for examination at Niger State Veterinary Hospital, Minna Niger State and processed immediately. The study lasted for twelve weeks.

Faecal Sample Processing

Faecal samples were processed and examined for the presence of helminth eggs and larvae using simple faecal centrifugation floatation technique as described by Foryet (2001). 2g of the samples (faeces) were mixed with 60 ml of sugar solution; the samples were then strained through a tea strainer into test tubes and single-step centrifugation was carried out for 10 minutes at 300 rpm (Weber992). A plastic pipette was used to pick few drops of the samples from the top layer for a wet mount smear on a microscope slide using X10 and X40 objectives lens and observed under a microscope for eggs and larvae as reported by Kassai (1999). In each case, the parasite stage was photographed using Celestron LCD digital microscope model 44340. Faecal samples were also examined by direct smear and concentration method using Formol-ether concentration technique and saturated salt floatation for adult parasites as described by Urquahart *et al*. (1996).

Blood Collection and Analysis

Blood samples were collected via the jugular vein puncture from each animal on weekly basis. For each animal, 7mls of blood sample were collected between 7:00 am and 10:00 am for haematology, blood biochemistry and immunogloblin's test. 5ml of the collected blood sample was emptied into labelled ethylene diamine tetraacetate (EDTA) bottle (heparinized test tube) and reserved for haematological studies while the remainder was decanted into labelled plastic test tubes for serum metabolites determination. Packed cell volume (PCV), White Blood Cell (WBC), differential counts of WBC (Neutrophils, Lymphocytes, monocytes, Eosinophils, and Basophilis) and immunoglobulin (IgA, IgG, IgE, IgD and IgM) were determined according to

the methods described by Coles (1986). Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) and platelet were calculated as: MCV (fl) = Haematocrit (PCV) × 10 RBC mm-3 MCH (pg) = Hb in g/100ml blood × 10 RBC mm-3 MCHC % = Hb in g/100ml blood × 10 Haematocrit (PCV) Total protein, albumin and other serum metabolites were determined using commercially available diagnostic kits according to the methods described by Ogunsanmi *et al*., 2002 and Ahamefule *et al*., 2008.

Statistical Analysis

Data generated were subjected to Chi-Square test used for association using the SPSS software version 20. The level of significance was defined as $p < 0.05$.

RESULTS AND DISCUSSION

Elevation in immunoglobulin A in cattle not administered antihelminth drugs could be as a result of the fact that helminth parasite load in cattle lowers immunity of the animals which gives way to other secondary infections (Tisdel *et. al*., 1999). Immunoglobulin A is usually the body first line of defence especially against barterial and viral infections mostly recure in animals that are already stressed or on a low plane of nutrition. Helminth load in animals does not allow the animal's body access to nutrient consumed in the feed because their nutrients are equally fed upon and utilized by these parasitic organisms. Certain helminth parasites are responsible for some allergic reactions in animals, thereby, causing elevation in immunoglobulin E. This may explain the elevation of immunoglobulin E titer observed in cattle not administered any antihelminth drug in this study. Elevated immunoglobulin M in the cattle in the control group is probably due to the its immunoregulatoty role in immunology and also likely because of its function as the first and immediate role in responding to threats to the animal's body.

REFERENCES

Admtey, F. (2013). Animal and meat production in Ghana: an overview. *Journal World's Poultry Resources*, 3(1): 1-4.

Ahamefule, F. O., Obua, B. E., Ukweni, I. A., Oguike, M. A., Amaka, R. A. (2008). Haematological and biochemical profile of weaner rabbits fed raw or processed pigeon pea seed meal based diets. *African Journal of Agricultural Resources* 3: 315-319.

Coles, E. H. (1986). Veterinary Clinical Pathology. 4th Edition, Pa: Saunders, Philadelphia, USA.

Dimander, S. O., Höglund, J., Spörndly, E., & Waller P. J. (2000). The impact of internal parasites on the productivity of young cattle organically reared on semi-natural pastures in Sweden. *Veterinary Parasitology*. 90(4):271-284.

Foryet, J. W. (2001). *Veterinary Parasitology*: Reference Manual (5th Ed). Blackwell Inc. India. pp 38-39.

Ibrahim, N., Tefera, M., Bekele, M. & Alemu, S. (2014). Prevalence of gastrointestinal parasites of small ruminants in and around Jimma Town Western Ethiopia. *Acta Parasitology Globe* 5(1): 12-18.

Johannes, C., Johan, H., Georg, V. S., Pierre, D. & Jozef, V. (2009). Gastrointestinal nematode infections in adult dairy cattle: Impact on production, diagnosis and control. *Veterinary Parasitology*; 164(1):70-79.

Jorgen, W. H. (1998). Biological control of gastro-intestinal nematodes of ruminants using predacious fungi: *Parasite epidemiology, resistance and the prospects for implementation of alternative control programs*. Italy M-27. ISBN 92-5-104109-1 pg 1

Kassai T. (1999). Veterinary Helminthology: Butterworth-Hireman, Reed Education and professional publishing Limited: Oxford, USA. p.260.

Lawal-Adebowale, O. A. (2012) Dynamics of ruminant livestock management in the context of the Nigerian Agricultural System. Livestock Production (Chapter 4):1-20

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REFERENCES

Adzitey, F. (2013). Animal and meat production in Ghana. an overview. *Journal World's Poultry Resources*, 3(1): 1-4.

Ahamefule, F. O., Obua, B. E., Ukweni, I. A., Oguike, M. A., Amaka, R. A. (2008). Haematological and biochemical profile of weaner rabbits fed raw or processed pigeon pea seed meal based diets. *African Journal of Agricultural Resources* 3: 315-319.

Coles, E. H. (1986). Veterinary Clinical Pathology. 4th Edition, Pa: Saunders, Philadelphia, USA.

Dimaner, S. O., Höglund, J., Spörndly, E., & Waller P. J. (2000). The impact of internal parasites on the productivity of young cattle organically reared on semi-natural pastures in Sweden. *Veterinary Parasitology*. 90(4):271-284.

Foryet, J. W. (2001). *Veterinary Parasitology*: Reference Manual (5th Ed). Blackwell Inc. India. pp 38-39.

Ibrahim, N., Tefera, M., Bekele, M. & Alemu, S. (2014). Prevalence of gastrointestinal parasites of small ruminants in and around Jimma Town Western Ethiopia. *Acta Parasitology Globe* 5(1): 12-18.

Johannes, C., Johan, H., Georg, V. S., Pierre, D. & Jozef, V. (2009). Gastrointestinal nematode infections in adult dairy cattle: Impact on production, diagnosis and control. *Veterinary Parasitology*; 164(1):70-79.

Jorgen, W. H. (1998). Biological control of gastro-intestinal nematodes of ruminants using predacious fungi: *Parasite epidemiology, resistance and the prospects for implementation of alternative control programs*. Italy M-27. ISBN 92-5-104109-1 pg 1

Kassai T. (1999). Veterinary Helminthology: Butterworth-Hireman, Reed Education and professional publishing Limited: Oxford, USA. p.260.

Lawal-Adebowale, O. A. (2012) Dynamics of ruminant livestock management in the context of the Nigerian Agricultural System. Livestock Production (Chapter 4):1-20

Mondal, M. M., Islam, M., Hur, J., Lee, J. & Baek, B. (2000). Examination of gastrointestinal helminth in livestock grazing in grassland of Bangladesh. *Korean Journal of Parasitology*, 38 (3), 187-190.

Odoi, A., Gathuma, J. M., Gachuiri, C. K. & Omore, A. (2007). Risk factors of gastrointestinal nematode parasite infections in small ruminants kept in smallholder mixed farms in Kenya. *BMC Veterinary Research*, 3:6.

Ogunrinade, A. F. (1984). A response in natural and experimental infections of cattle with Fasciola giganticain. West Africa dwarf sheep and goats. *Tropical Animal Health and Production*, 16(3):161-166.

Ogunsanmi, O. A., Ozegbe, P. C., Ogunjobi, D., Taiwo, V. O., Adu, J. O. (2002). Haematology, plasma biochemistry and whole blood minerals of the captive adult african grasscutter (thryonomys swinderianus, temminck). *Tropical Veterinary*, 20: 27-35.

Regassa, F., Sori, T., Dhuguma, R. & Kiros, Y. (2006). Epidemiology of Gastro-intestinal Parasites of Ruminants in Western Oromia, Ethiopia. *International Journal of Applied Research in Veterinary Medicine*, 4 (1): 51-57.

Tisdell, C. A., Harrison, S. R., & Ramsay, G. C. (1999). The economic impacts of endemic diseases and disease control programmes. *Revised Science and Technology, Official International* Epiz, 18(2):380- 398.

Urquhart, G. M., Aremour, J., Dunchan, J. L., Dunn, A. M. & Jeninis, F. W. (1996). *Veterinary Parasitology* (2nd Edition). The University of Glasgow, Blackwell sciences, Scotland; pp.3-137

Usman, H. I. (2011). Effect of time of intercropping soyabean on weed suppression and performance of upland rice in southern guinea savanna of Nigeria. PhD thesis, Department of Crop Production, Federal University of Technology, Minna.

Wilson, R. T. (1991). Small ruminant production and the small ruminant genetic resource in Tropical Africa. Domestic Animals Genetic Resources Information System. FAO animal health and production paper. 88:14-28.

Table 1: Haematology Parameters on Sex, Immunological Response of Cattle in A Semi-Intensive Management System

Parameter[Units]	Control	T2	T3	T4	Standard Error
Weight	281.4286^{ab}	313.5714^{b}	270.7143^{ab}	260.0000^{a}	7.976
Heamoglobin	11.5238^{a}	13.0673^{b}	13.3796^{b}	13.2653^{b}	0.1149
PVC	34.5238^{a}	39.4122^{b}	39.5388^{b}	39.9531^{b}	0.3087
RBC	10.4952	6.5082	9.2	7.751	0.746
WBC	3.7048^{a}	4.5286^{b}	4.6592^{b}	4.5694^{b}	0.0364

a,b,c means denote by different superscripts are significantly difference ($p<0.05$)
PVC = Packed cell volume, RBC = Red blood cell, WBC = White blood cell

Table 2: Immunoglobulin Parameters On Sex, Immunologibulin Response of Cattle in Semi-Intensive System

Parameters(Unit)	Control	T2	T3	T4	Standard Error
IgA	11.8571^{a}	12.4898^{ab}	12.2857^{ab}	12.5918^{b}	0.1057
IgG	71.7619	72.6735	71.7347	73.0408	0.5396
IgE	0.0571^{a}	0.1429^{b}	0.1408^{b}	0.1490^{b}	0.007
IgD	0.1286	0.1184	0.1245	0.1286	0.006
IgM	2.0952^{a}	3.6531^{b}	3.7755^{b}	3.7551^{b}	0.0869

a,b,c means denote by different superscripts are significantly difference ($p<0.05$)