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Haemoparasites and Haematological Parameters of Nigerian Indigenous (local) and Exotic (broiler) Chickens Slaughtered in Makurdi Major Markets, Benue State, Nigeria

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ABSTRACT

Parasitism causes huge production losses in poultry industry particularly in the tropics and Sub-tropics through reduction in growth, drop in egg production, emaciation, anemia, as well as mortality. A study on the prealence of haemoparasites and blood analysis of chickens was conducted during the dry season from October, 2017 to February, 2018. A total of 220 blood samples were collected from both local (95 samples) and broiler (125 samples) chickens at four Makurdi main poultry Markets (North-bank, Wurukwu, Wadata and Modern markets) and transported to the Veterinary Teaching Hospital Annex, University of Agriculture Makurdi for analysis. Giemsa-stained thin blood smear method was used for the screening of haemoparasites and the major haematological parameters (TBC, DLC, PCV, and PP). An overall prevalence rate of 23.2% was recorded. Prevalence rates of 23.15% and 23.2% were recorded for local and broiler chickens respectively. Wurukwu (34.09%) market recorded the highest prevalence rate while Modern market (15.38%) had the least. Three different haemoparasites (*Plasmodium* spp, *Haemoproteus* spp and *Leucocytozoon* spp) were encountered with *plasmodium* spp (23.5% and 21.6% in local and broiler chickens respectively) having the highest prevalence rate. Infection rate was higher in male (27.2%) than female chickens (26.1%), but the difference was not statistically significant ($p > 0.05$). There are significant differences ($p < 0.05$) between the hematological parameters of the infected and uninfected chickens. The study revealed existence of three genera of haemoparasites in Makurdi and its environs at a relatively high prevalence.

1. INTRODUCTION

The poultry industry occupies an important position in the provision of animal protein to human, and also plays a vital role in the national economy as a source of revenue (FAOSTAT, 2005b). Poultry production includes chickens, ducks, guinea fowl, turkey and ostrich, but chicken and turkey production make up the main component of commercial poultry (Opara et al., 2012). Chicken is one of the most intensively reared of the domesticated poultry species and the most developed and profitable animal production enterprise (Page and Daniel, 2000). Poultry production in Africa and parts of Asia is still distinctively divided into two parts; commercialized and village enterprise subsector, each with its peculiarities.

Currently, Nigeria is the leading country in Africa with respect to egg production, but fourth in broiler production (USDA, 2013). The Poultry sector contributes about 25% of the agricultural domestic products of Nigerian economy (FAO, 2010), and only commercial poultry production was reported to generates about USD 800 million (USDA, 2013). Poultry production is on the

increase in most of the developing countries due to its role in bridging the protein malnutrition and economic empowerment of the resource poor segment of the society (Wishart, 2002). The good thing about Poultry production is that it is practice in all levels ranging from subsistence to large scale commercial operations. Poultry meat and eggs are the most consumed animal protein irrespective of religion or culture in Nigeria (USDA, 2013).

Unfortunately, reaching optimum Poultry production in most developing countries has been hampered by several factors among which are parasitic infections (Mapiye et al., 2008). Among the various parasitic diseases, haemoparasitic infections are considered very significant (Soulsby, 1982). Parasitism causes huge production losses through reduction in growth, drop in egg production, emaciation, anaemia, as well as mortality (Kaufman et al., 2007). It has been reported that parasitic infections or their concurrent infections can lead to immunosuppression and poor immune response to vaccines against some poultry diseases (Anna, 2006).

The life cycles of most of the haemoparasites of poultry are closely related using either Mosquitoes, Midges, Simulium, Culicodes or Hippoboscid as their arthropod vectors. Birds are infected with Plasmodium sporozoites, which are injected into the host system by the mosquito from the salivary glands. The parasites undergo schizogony in macrophages and fibroblasts and then liver cells producing merozoites. These merozoites enter erythrocytes, where they multiply by schizogony and finally form gametes, which are picked by mosquitoes (Soulsby, 1982). Both gametocytes and schizonts of P. gallinaceum can be round, oval or irregular in shape (Campbell, 1995). In the case of most Leucocytozoon species, schizogony with the production of small schizonts and megaloschizonts occurs in hepatocytes, although schizogony can also occur in the vascular endothelium of other tissues (Fallis et al., 1973). Gametocytes of the parasites are found in erythroblasts and mononuclear leucocytes as ovoid (10 by 15 microns) or elongated (24 by 4 microns) forms. The bite of the vectors (Culicoides spp and Hippoboscid flies) of a new host, results in the introduction of sporozoites into the blood stream which then invade endothelial cells of blood vessels within various tissues including the lung, liver, and spleen. The sporozoites go through asexual reproduction in the endothelial cells to become schizonts, which then produce numerous merozoites (Weisman et al., 2007).

Most studies on poultry have focused on viral diseases such as Newcastle disease, Infectious bursal disease, Fowl pox, Avian influenza and Marek's disease among others (Njunga, 2003).The extension messages that are developed on parasites are mainly for endoparasites while ecto- and haemoparasites have received less attention in most reports (Njunga, 2003).The presence of avian haemoparasites has been reported in different areas of the world such as Italy, Bolivia, Malaysia, Czechoslovakia, India, Tanzania, Pakistan, Ghana, Zimbabwe, Malawi, South Africa and various parts of Nigeria (Poulsen et al., 2000; Permin et al., 2002; Njunga, 2003; Sadiq et al., 2003; George et al., 2004; Schultz and Whittington, 2005; Nnadi and George, 2010; Karamba et al., 2012; Opara et al., 2012; Usman et al., 2012; Gimba et al., 2014), with little or no documented evidence in Benue state especially the state capital (Makurdi). For the above reasons the authors designed and carried out this work to investigate the occurrence, prevalence and some possible risk factors in the study area to sensitize and provide some guidance to the experts in designing effective control programme against those parasitic infections for poultry farmers in the area. The study also compared the haematological parameters of the haemoparasites infected with the uninfected chickens to establish whether the haemoparasites have effects on those parameters of the infected birds or not.

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted in Makurdi, Benue State, Nigeria. Makurdi lies on latitude 7º30'N and longitude 8º35'E. It is located within the flood plain of lower River Benue valley (Tyubee, 2009). It is situated between 73-167m above sea level. The town is divided into two parts (North and South banks) by the River Benue and connected by two bridges: the railway bridge and the dual carriage bridge (Tyubee, 2009). Makurdi lies in the tropical Guinea Savanna Zone of Central Nigeria and experiences a typical climate with two distinct seasons, namely, dry and rainy seasons. The dry season lasts from late October to March and the rainy season between April to October which is the period of intensive agricultural activities (Tyubee, 2009).The study was conducted in four major

markets, namely; North bank, Wadata, Wurukwu, and Modern markets.

2.2. Sample Collection

A total of two hundred and twenty (220) blood samples were collected based on a previous prevalence reported by Lawal et al. (2016), from both sexes of indigenous/ local (95) and exotic/ broiler (125) chickens slaughtered at the four markets within Makurdi metropolis between October, 2017 to February, 2018. Approximately, 3ml of blood samples were collected randomly at point of slaughter in properly labeled Ethylene Diamine Tetra Acetic Acid (EDTA) sample bottles, and were immediately transported to the Parasitology and Pathology laboratory of the Veterinary Teaching Hospital Annex, University of Agriculture, Makurdi for analysis.

2.3. Sample Analysis

The samples collected were analyzed using the wet mount technique for motile parasite detection, and thin blood smear method as described by Cheesbrough, (2000). Haemoparasites identification was conducted according to Soubsly, (1982) and Campbell, (1997). Packed Cell Volume (PCV) was determined by haematocrit centrifuge technique as described by Cole, (1986), total and differential white blood cell counts were conducted by standard methods according to Schalm et al. (1975), and Serum plasma protein concentration was estimated using Goldberg Refractometer as described by Kerr, (1989).

2.4. Data Analysis

Data generated were analyzed using descriptive statistics; percentage was used to express prevalence while analysis of variance (ANOVA) was used by the authors to compare the haemoparasites, risk factors like sex and breed and haematological parameters.

3. RESULTS

The study identified three genera (Plasmodium spp, Haemoproteus spp and Leucocytozoon spp) of haemoparasites in the study area as presented in table 1 and Fig 1 and 2. Overall haemoparasites prevalence of 53.3% was recorded (Table 2). Prevalence according to the breed of chickens was 23.16% for local and 21.60% for broiler chickens respectively (table 1). The Wurukwu market had the highest prevalence rate (34.09%) while modern market recorded the lowest prevalence rate (15.38%) (Table 3). The prevalence is slightly higher in local chickens (23.16%) than broiler chickens (21.60%) but the difference was not statistically significant (P> 0.05) as shown in table 1.

All the positive cases found in this study were single infections of Plasmodium spp (21.6%), Haemoproteus spp (0.8%) and Leucocytozoon spp (0.8%) in broiler chickens and only plasmodium spp (23.16%) in local chickens (table 1).

Table 1: Genera of haemoparasites found in the blood of screened local and broiler chickens in Makurdi major markets.

Breed	Total No Sampled	Plasmod-ium Infected	Infected %	Haemoprote-us Infected	Infected %	Leucocy-tozoon Infected	infected %	P-Value
Local chicken	95	22	23.16	0	0	0	0	0.32
Broiler chicken	125	27	21.60	1	0.8	1	0.8	

Table 2: Sex- Specific Prevalence of Haemoparasites in Screened blood of broiler and local chickens in Makurdi major markets

Sex	No of samples Examined	Positive sample	(%) Prevalence rate	P-Value	Odd Ratio
Male	132	28	27.2		
Female	88	23	26.1	0.56	0.84
Total	220	51	53.3		

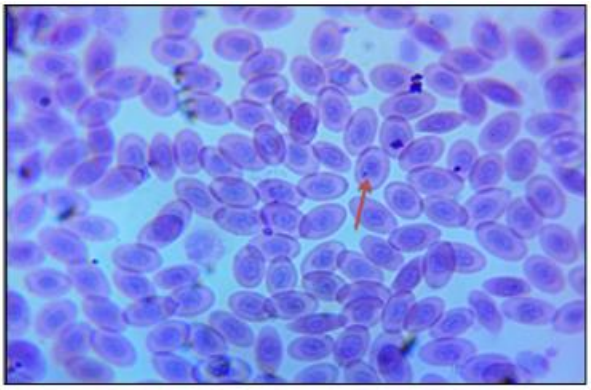

Fig 1: plasmodium ssp.

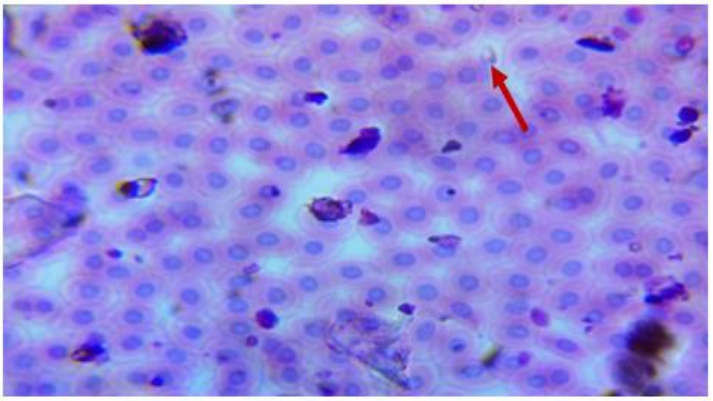

Fig 2: Infected cell with *Haemoproteus* spp in chicken thin blood smear

Table 3: Market-Specific Prevalence of Haemoparasites in Local and Broiler Chickens in Makurdi.

Market/Chicken Breed	Number Sampled	Number infected	Prevalence (%)	P-Value
North bank				
Local	45	12	26.67	
Broiler	42	9	21.43	
Total	**87**	**21**	**24.14**	
Modern market				
Broiler	29	3	10.34	
Local	10	3	30.00	
Total	**39**	**6**	**15.38**	
				0.54
Wadata				
Broiler	25	5	20.00	
Local	25	4	16.00	
Total	**50**	**9**	**18.00**	
Wurukum				
Broiler	29	12	41.38	
Local	15	3	20.00	
Total	**44**	**15**	**34.09**	

Out of the 51 positive cases, 28(27.2%) were male and 23(26.1%) female. There was slight different in the infection rate among sex but the difference is not significant (P>0.05) as shown in table 2.

The results show that there were no statistical significance differences in the haematology of the infected and non-infected chickens (table 4). These show that the presence of the parasites may not lead to significant alteration of the haematology of the chickens but the haematological parameters can only be significantly affected by the severity and pathogenicity of the parasites involved.

Table 4: Comparative Hematological Parameters of haemoparasites infected and uninfected Screened broiler and Indigenous chickens in Makurdi major markets. (P> 0.05)

Hematological parameters	Mean±SEM Infected broilers &Indigenous chickens	Mean ± SEM Un-infected broilers &Indigenous chickens	P-value
Packed cell volume	28.4±1.25	27.0±0.55	0.28
Plasma protein	7.53±0.31	7.68±0.17	0.68
Neutrophils	30.4±1.83	29.29±0.84	0.75
Lymphocyte	66.75±1.76	73.95±5.35	0.74
Monocyte	0.0±0.0	0.20±0.05	0.20
Eosinophils	0.0±0.0	3.88±0.79	0.44
Basophils	0.0±0.0	0.0±0.0	0.00

4. DISCUSSION

The three different genera (*Plasmodium*, *Haemoproteus* and *Leucocytozoon*) of parasites encountered in this study is in agreement with karamba *et al*. (2012) and Lawal *et al*. (2016), who also reported the same three genera of haemoparasites in chickens, but differ with reports of some authors in Nigeria and other parts of the world; Nigeria (Sadiq *et al*., 2003; Usman *et al*.,2012; Opara *et al*,. 2016), Malaysia (Siong *et al*,.2010),Iraq (Gimba *et al*,. 2014),and Zimbabwe (Permin *et al*, .2002),Who reported more than three genera of haemoparasites in chickens in their areas. In addition to the three genera, they reported *Trypanosoma and Filarial* species.This may be due to variations in climatic condition and season of the research which are some of the determinants on the activities of the vectors. The high prevalence rate of *Plasmodium* spp observed in this study is in agreement with Sadiq *et al*. (2003), Usman *et al*.(2012) and Shadan, (2013), but disagrees with Permin *et al*. (2002), Gimba *et al*. (2014), Hasson, (2015), Opara *et al*. (2016) and Hassan *et al*. (2018), who reported *Haemoproteus* spp as the most prevalent in their own studies .

The overall prevalence of 53.3% observed in this study is significantly higher than 19.56% that was reported by karamba *et al*. (2012), 17% by Lawal *et al*. (2016) and 17% by Opara *et a*l. (2016). However, it is lower than 88.1%, 79.2% and 76% documented by Hassan *et al*. (2018), Sabuni *et a*l. (2011) and Hasson, (2015) respectively. This may be due to the climatic differences and/ or differences in the period of research. Work conducted during rainy season may probably encounter higher incidence of haemoparasites than the one conducted during the dry season because of the increase activities of the vectors. In relation to breed, prevalence rates of 23.16% and 21.60% were recorded for indigenous (local breed) and broilers respectively. The difference was not statistically significant and the finding is in disagreement with Opara *et al*. (2016), who reported higher prevalence rate in the local chickens than the broiler chickens. It is not surprising for this observation because most of the local chickens scavenge which make them to be more exposing to the vectors than the broiler chickens.

The low prevalence rate recorded in modern market is due to the good drainage system and sanitary condition of the place. The market is considered to be the most organized and neatest of all the markets in Makurdi. So, sanitation/ or hygiene is also a predisposing factor to the infection. This study recorded higher prevalence in male than female chickens. However, there was no statistical significant difference in the infections rate between the sexes. This implies that sex is not a risk factor of contacting the infection by the chickens (P-value: 0.56 and OR: 0.84).This finding is in agreement with previous reports by Lawal *et al*. (2016), Opara *et al*. (2016), Al-barwari and Saed (2012) who also reported that sex is not a risk factor of acquiring the infections; but in variance with the findings of Hasson, (2015) who reported higher prevalence in female than in male. There were no statistical significant differences (P> 0.05) between infected and uninfected chickens in Packed Cell Volume (PCV), Serum Plasma Proteins (SPP) and differential Leucocytes Count (DLC). However, there was a slight deviation from Motta *et al*. (2013) who reported higher monocytes in chickens infected with haemoparasites than the non-infected ones. The stage and severity of the infections also determine the types

and population of blood cells in the peripheral circulation and the level of anaemia (Cannell *et al*., 2013). Although, even when the occurrence of the parasites does not manifest clinically, it still has some effect on the performance of the host (Chickens). Good management system will greatly assist in overcoming these challenges and improve productivity.

5. CONCLUSION

This study confirms the presence of *Plasmodium, Haemoprotues and Leucocytozoon* in local and broiler chickens slaughter at poultry markets in Makurdi, Nigeria. The high prevalence recorded in this study was not expected at this period since dry season is considered to be off season of high activities for most of the arthropod vectors especially mosquitoes. The infections are more among the male chickens than the female chickens which show that the male have higher chances of contacting the infection than female but this was not statistically proof.

Authors recommend that similar study should be conducted during the wet season when the activities of the insect vectors are considered to be high. This is to confirm effect of season in the occurrence of the parasites**.** Also similar work should be replicated in different geographical zones of the country to establish the current status of haemoparasites of chickens in the entire country.

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