



MICROSCOPIC DETECTION OF HAEMOPARASITES IN MUSCOVY DUCKS (*ANAS PLATYRYNCHOS*) IN GOMBE STATE, NIGERIA

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ABSTRACT

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This present study aimed to detect haemosporidians from the blood of Muscovy ducks in Gombe State Nigeria. Blood samples were collected from 880 apparently healthy ducks of both sexes from the month of April, 2015 to February, 2016. Microscopic examination of Giemsa stained thin blood films revealed 16.14% overall prevalent rate of haemoparasites. The prevalence was found to be highest in Yamaltu/Deba LGA (23.08%) and least in Funakaye LGA (7.83%). Among the four genera of haemoparasites detected, *Aegyptinella* species (7.73%) was most prevalent followed by *Leucocytozoon* species (5.57%) and *Haemoproteus* species (2.16%) while *Plasmodium* specie (0.68%) was the least. Prevalence rate was found to be significantly higher ($p < 0.0001$) in the young (22.68%) compared to the adults (10.43%) ducks. The female (18.54%) were found to be more infected than the male (13.58%) ducks, but the difference was not statistically significant ($p = 0.0565$). The prevalence of haemoparasites was found to be significantly ($p < 0.0001$) higher during the rainy (24.55%) compared to the dry (7.27%) season. This present study represents the first to provide evidence of haemoparasites in Muscovy ducks in Gombe State, Nigeria. There is need for further researches on the epidemiology of haemoparasites in Muscovy ducks reared under extensive management system in Nigeria. Strategic control of arthropods and maintenance of strict biosecurity in and around poultry houses will curb transmission of arthropod borne haemoparasites among village poultry species.

Contribution/Originality: This study is one of very few studies which have investigated the occurrence of avian haemoparasites in free range Muscovy ducks in developing countries including Nigeria. The study has also contributed to the existing literatures concerning haemoparasites infections in domesticated ducks in the world.

1. INTRODUCTION

The domestic ducks which belong to the *Anas platyrhynchos* are among the domesticated poultry species reared in most developing countries of Africa including Nigeria [1]. They play significant role in household nutrition as animal protein in the form of meat and eggs as well as being a reliable source of petty cash source from the sale of live birds and eggs [2]. Therefore, strategic increases in the productivity of ducks will greatly assist in poverty alleviation, improve household food security and protein intake of the rural communities and in the long term curb the massive urban migration of the youth [3]. Although, the rearing of commercial large scale exotic breeds of ducks as in some developed countries of the world is not very popular in Nigeria poultry industry when compared

to the chickens [4, 5]. Several poultry management activities that include poor nutrition, inadequate husbandry, and lack of veterinary healthcare as well as inadequate biosecurity leading to the menace of both infectious and non-infectious diseases have been reported as the major constraints to successful duck production and productivity in developing countries including Nigeria [5-7]. Although, ducks are considered hardy and are more resistant to some diseases that may lead to high morbidity and mortality rate as well as loss in productivity compared to other domesticated poultry species especially the chickens [1]. Yet, they may still succumb to some sub-clinical diseases, serve as pathogen reservoirs and play key role in the transmission of other avian infectious diseases [1, 8].

Parasitism ranks high among factors that threaten local duck production in Africa [9]. Among the various parasitic diseases, haemoparasites infections are also considered prevalent in ducks [10]. Haemosporidian parasites are common blood parasites of reptiles, birds, and mammals with some stages of development in both tissues and circulating blood cells of infected hosts [11]. The most commonly recorded parasites in smears of peripheral blood are unicellular eukaryotic parasites of the genera, *Haemoproteus*, *Leucocytozoon* and *Plasmodium* [12]. These pathogens are widespread and commonly include species from the genera *Plasmodium*, *Haemoproteus*, *Leucocytozoon*, *Fallisia* and *Trypanosoma* [13, 14]. Avian haemoparasites are known to be pathogenic to their hosts causing high mortalities [15] these blood parasites can exert important selection pressure on their hosts through effects on survival [16, 17] on reproductive success [18, 19] on plumage coloration with important ecological and evolutionary consequences, such as changes in community structure [20]. Avian haemoparasites has not been reported in local breed of Muscovy ducks in Gombe State, Nigeria. Therefore, the present study was aimed to determine the avian haemoparasites in Muscovy ducks in Gombe State Nigeria using the microscopy detection and to provide data that can serve as references in future research on Muscovy ducks in the study area.

2. MATERIALS AND METHOD

2.1. Study Area

This study was conducted in Gombe State, Northeastern Nigeria Figure 1 which shares boundaries with Bauchi, Taraba, Adamawa, Yobe and Borno states. Gombe State is located between latitude 9° 30' and 12° 3' N and longitude 8° 45' and 11° 45' E [21]. The state has Eleven Local Government Areas viz: Gombe, Akko, Funakaye, Kwami, Dukku, Billiri, Shongom, Nafada, Yamaltu-Deba, Kaltungo and Balanga Local Government Areas. The state has a mean annual rainfall of 818.5mm, with a mean maximum temperature of 37°C and a mean minimum temperature of 12°C. The major economic activities of the people of Gombe State include crop and livestock production as well as trading. Rural areas within Eight (8) out of the Eleven (11) Local Government Areas of the state viz: Gombe, Akko, Funakaye, Kwami, Dukku, Yamaltu-Deba, Kaltungo and Balanga Local Government Areas were visited for blood samples collection. Non-probability convenience sampling method was adopted with emphasis on areas with large populations of local Muscovy ducks. Criteria considered for the selection of duck blood sampling locations include; relatively higher populations of Muscovy ducks in the selected study area, willingness of the village poultry farmers to volunteer their ducks for blood sampling and cooperate with the researchers during the period of study.

2.2. Sampling Period

Blood sampling was carried out during the study period from the month of April, 2015 to February, 2016 within two (2) seasons viz: the rainy season (April – September) and dry season (October – February). All study locations were visited for blood samples collection on alternate periods within these study periods.

2.3. Collection of Blood Samples

Using sterile 5ml syringe and 23gauge needles, 3 – 4ml of blood samples were aseptically collected from the brachial (wing) vein of 880 selected apparently healthy domesticated Muscovy ducks from village poultry farmers'

households. Each blood sample was carefully dispensed immediately following collection into EDTA coated blood sample collection bottles, rocked and rolled gently to allow for uniform mixing of the blood with the anticoagulant then label appropriately and gently arranged in racks. The collected blood samples were stored at 4°C and transported in insulated boxes to the Department of Parasitology and Entomology Research Laboratory, Faculty of Veterinary Medicine, University of Maiduguri, Nigeria for parasitological examination.

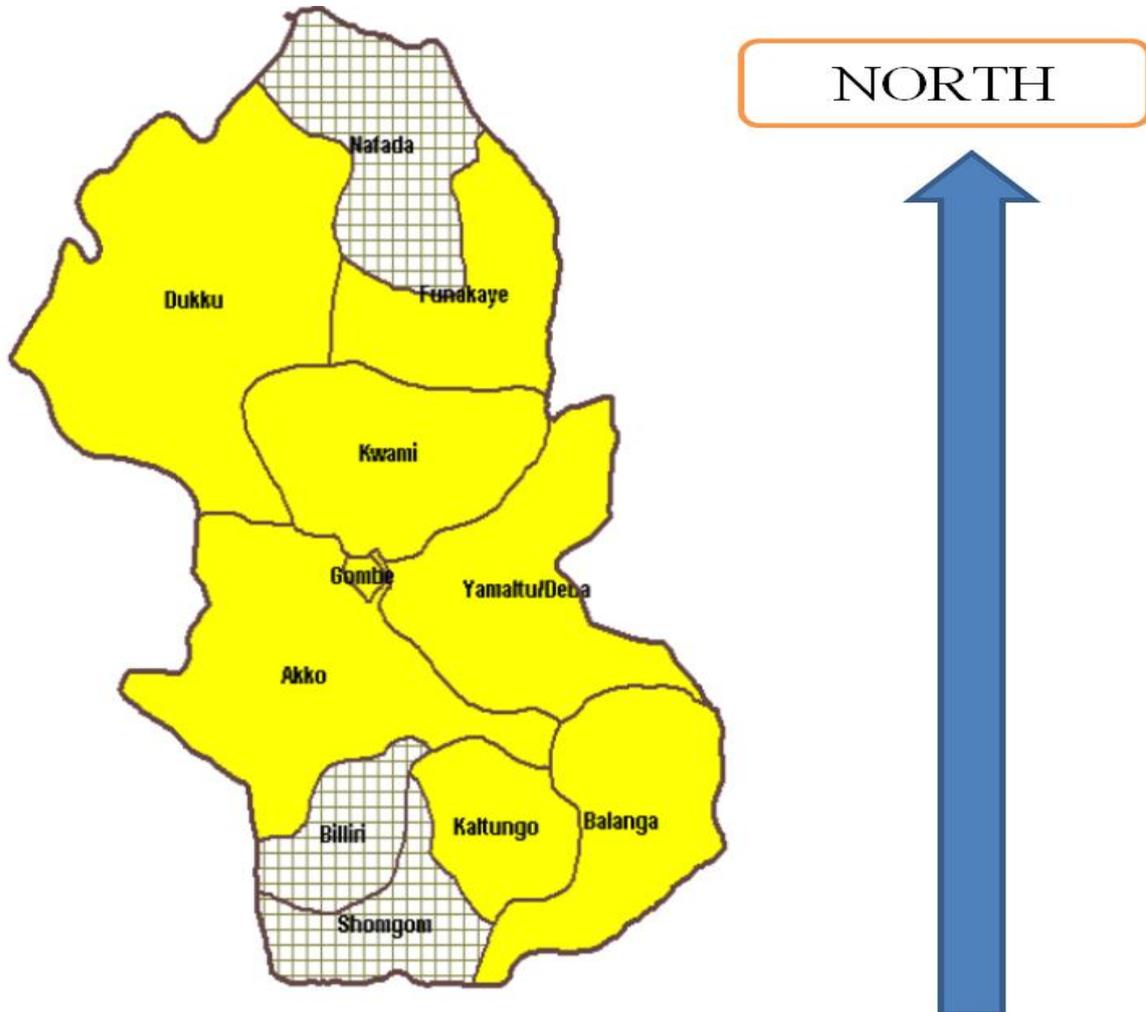


Figure-1. Map of Gombe State showing the study areas in yellow colour.

Source: Gombe State Ministry of land and survey from Jesse, et al. [22].

2.4. Parasitological Examination

Thin blood smear was made on clean dry slides, allowed to air dry for about 5 minutes then fixed with methanol and allowed to air dry again. The slides were then stained with diluted 10% Giemsa stain according to standard procedures, the stained slides were rinsed with distilled water to remove extra stain and air dried. The stained slides were examined under microscope in higher magnification (40×, 100×) and parasites were identified based on morphology using keys described by Valkiūnas [13] and Valkiūnas, et al. [23].

To detect extracellular haemoparasites, each blood sample was collected into heparinized micro-hematocrit capillary tube and centrifuge to concentrate the organisms in the buffy coat. The buffy coat was discharged on a clean dry glass slide to make a thin smear, then allowed to air dry, fixed with methanol, labeled accordingly and stained. Stained buffy coat smears on slides were later viewed at low magnification (40×) and at high magnification (100×) using microscope under oil immersion for 10–15 min for the presence of extracellular blood parasites as previously described by Valkiūnas [13] and Valkiūnas, et al. [23]. Sample was considered negative when no parasite is detected after examining 100 microscopic fields.

2.5. Data Analysis

The raw data obtained in the present study were cross-tabulated initially using Microsoft Office Excel version 2011 to obtain proportions and prevalence of haemoparasites infection. This was later imported into SPSS statistical software version 22 for chi square analysis and Fisher's exact test in order to determine the strength of association between the dependent and independent variables. The association is considered significant at $p < 0.05$.

3. RESULTS

Of the 880 blood samples microscopically examined for the presence of intracellular and extracellular haemoparasites, 142 were found to be positive, with an overall prevalence rate of 16.14%. Prevalence rate was higher in Muscovy ducks sampled from Yamaltu/Deba Local Government area (23.08%) followed by Kwami LGA (22.12%), Kaltungo LGA (17.27%), Balanga LGA (19.81%), Gombe LGA (15.38%), Dukku LGA (13.59%), Akko LGA (10.19%) and Funakaye Yamaltu/Deba LGA (7.83%) in a descending order of prevalence Table 1. Among the haemoparasites microscopically detected in the infected Muscovy ducks, *Aegyptinella* species (7.73%) was more prevalent followed by *Leucocytozoon* species (5.57%), *Haemoproteus* species (2.16%) while *Plasmodium* species (0.68%) was the least prevalent Table 2. Considering the risk factors associated with the prevalence of haemoparasites in Muscovy ducks, age-specific prevalence rate revealed a statistically significant difference (<0.0001) among the age groups studied. The high prevalence rate of 22.68% (70.90 – 81.28 at 95% confidence interval) was observed among growers ducks (2 – 5 months old) as compared to adult ducks (>5 months old) 10.43% (86.48 – 92.12 at 95% confidence interval). Female ducks had the high prevalence of haemoparasites of 18.54% (77.59 – 84.91 at 95% confidence interval) as compared with male ducks 13.58% (82.78 – 89.53 at 95% confidence interval). However, this was not statistically significant at $p > 0.05$ (p -value = 0.0565). According to the season of sampling, the high prevalence rate of haemoparasites 24.55% (71.10 – 79.49) was observed during the rainy season as compared to the dry season 7.27% (89.86 – 94.98). Season-specific prevalence rate revealed a statistically significant difference (<0.0001) among the two season Table 3.

Table-1. Prevalence of Avian haemoparasites in Muscovy ducks in Gombe State, Nigeria.

LGAs	Number of blood samples collected	Number of ducks infected	Prevalence (%)	Confidence interval (95%)	
				Low limit	Upper limit
Dukku	103	14	13.59	0.0827	0.2153
Balanga	106	21	19.81	0.1334	0.2839
Funakaye	115	9	7.83	0.0417	0.1421
Kwami	104	23	22.12	0.1522	0.3101
Kaltungo	110	19	17.27	0.1134	0.2541
Yalmatu/Deba	117	27	23.08	0.1637	0.315
Gombe	117	18	15.38	0.0995	0.2301
Akko	108	11	10.19	0.0579	0.1733
Total	880	142	16.14	0.1386	0.1872

Table-2. Microscopically detected Avian haemoparasites genera in Muscovy duck in Gombe State, Nigeria.

Haemoparasites encountered	Number of infected animals (N= 880)	Prevalence rate (%)
<i>Aegyptinella</i> spp	68	7.73
<i>Leucocytozoon</i> spp	49	5.57
<i>Plasmodium</i> spp	6	0.68
<i>Haemoproteus</i> spp	19	2.16
Total	142	16.14

N = Total number of Muscovy ducks examined.

Table-3. Risk factors associated with haemoparasites infection in Muscovy ducks in Gombe State, Nigeria.

Risk factors	Parameters	No. of ducks examined	No. of ducks infected	Prevalence (%)	Confidence interval 95%		P-value
					Lower limit	Upper limit	
Age (months)	Growers (2 – 5 months)	410	93	22.68 ^a	0.7290	0.8128	<0.0001
	Adult (>5 months)	470	49	10.43 ^b	0.8648	0.9219	
Sex	Male	427	58	13.58 ^a	0.8278	0.8953	0.0565
	Female	453	84	18.54 ^a	0.7759	0.8491	
Season	Rainy	440	108	24.55 ^a	0.7110	0.7945	<0.0001
	Dry	440	32	7.27 ^b	0.8986	0.9498	

^{ab} Different superscripts indicate significant ($p < 0.05$) difference in the risk factors.

4. DISCUSSION

To the best of our knowledge the present study represent the first detection of haemoparasites in naturally infected and apparently healthy local breed of Muscovy ducks in Gombe State and the Northeastern part of Nigeria with an overall prevalence of 16.14%. This finding is lower than 40.0% prevalence reported in Southeastern Nigeria by Opara, et al. [24] and 48.3% prevalence rate as reported by Waruiru, et al. [9] in Kenya. The variation in the reported prevalence might be attributed to different factors such as abundance of arthropod vectors, sample size, method used for diagnosis, sampling periods, geographical area, and climatic conditions. However, higher prevalence of avian haemoparasites have previously been reported in chickens in many developing countries including Nigeria [25-27] this report provided evidence that indicated the chickens being more susceptible to haemoparasitosis compared to other domesticated avian species including the ducks, probably due to the abundance of comb and wattle in the chickens. The mixed poultry species production system is usually a common practice among village poultry farmer especially in the rural areas within the present study, whereby the ducks are reared together with other species of domestic birds. This practice may enhance the strategic transmission of the haemoparasites from more susceptible infected birds to less susceptible naïve birds, especially in the abundance of the arthropod vectors and close proximities [28].

The result of the present study revealed that the ducks examined in Yamaltu/Deba LGA have the highest prevalence of haemoparasites during the study period while Funakaye LGA has the least prevalence. The variation in the prevalence rates among the different study areas found in the present study might be attributed to difference in the level of vegetation durations, increased topography or ecological activities, availability of stagnant pools of water, swampy or marshy environments which is usually favours the breeding and the life cycles vectors such as the mosquitoes and some flies in addition to availability and abundance of arthropod vectors. Yamaltu Deba LGA is the station of the Dandin Kowa dam which makes the LGA the swampiest LGA in the state especially during the rainy season when the banks of the dam breaks.

The finding of the present study revealed that affected ducks were infected with *Aegyptinella*, *Leucocytozoon*, *Plasmodium* and *Haemoproteus* species at variable prevalent rates. This findings is comparable to the reports of Waruiru, et al. [9] who have detected *Aegyptinella*, *Leucocytozoon*, *Eperythrozoön* and *Haemoproteus* species in ducks even though the present study did not detect *Eperythrozoön* in the infected ducks while, Opara, et al. [24] reported *Leucocytozoon* and *Trypanosoma* as the only species encountered among the infected ducks. The varying prevalence of these genera of avian haemoparasites has been previously reported in village chickens in developing countries including some parts of Nigeria [29-34]. These reports establish the occurrence of these avian haemoparasites in the poultry industries in Africa [35].

This present study revealed that the prevalence of haemoparasites is higher in young ducks as compared to the adults. This finding may be associated with the fact that young ducks are usually more susceptible to parasitic infections, probably due to their tender immune system. This finding is consistent with previous report by Waruiru, et al. [9] who have also reported high prevalence of haemoparasites in growing ducks compared to adults. The result of the present study also considered the sex-specific prevalence of avian haemoparasites in the infected ducks in Gombe State. The prevalence of haemoparasites was found to be higher in female (18.54%) than in male (13.58%) ducks; although the difference in the prevalent rates is statistically not significant ($P > 0.05$) at 95% confidence interval. This finding signifies both sexes of duck share equal chance of getting infection in the presence and abundance of the arthropod vectors. However, the high prevalence of haemoparasites in female Muscovy ducks may be associated with the stationary state of the females during incubation of eggs which allows the female duck to be more exposed to arthropod vectors. Previous reports have indicated more likelihood of female domesticated poultry species being more exposed to arthropods during incubation compared to the males in Nigeria [36-38] and in Ethiopia [39]. This finding contradicts the sex-specific prevalence of avian haemoparasites reported in chickens where prevalence is reported significantly higher in cocks than in hens [33, 34, 40]. The reasons were attributed to the abundance of predilection sites and larger surface areas (larger comb and wattles in male compared to female) for blood meal by blood sucking arthropods that plays vital roles as vectors in the transmission of the disease. There are conflicting reports on the impact of host sex on prevalence rate of avian parasitic infections in several species of birds [41].

The result of the present study revealed higher prevalence of haemoparasites in ducks sampled during the rainy season compared to those sampled during the dry. This finding concurs with previous report by Igbokwe, et al. [35] who have also reported high prevalence of avian haemoparasites in domesticated poultry species during the rainy season compared to the dry season. This finding might be attributed to the rainy season usually being the favorable breeding season for arthropod vectors such as mosquitoes and other flies due to the abundance of stagnant pool of water bodies and thick vegetation from crop farming activities. This is evidenced by the high prevalence of many arthropod vector (mosquitoes, ticks and flies) borne blood parasitic infections such as malaria, trypanosomosis in human and animal populations during the rainy season in Nigeria [42-45]. The rainy season is considered the most favorable weather for the proliferation of parasitic infections including the ectoparasites. Moderated to high ambient temperature and humidity which are one of the characteristics of the rainy season are very essential for the hatching of eggs and larval developmental stages [10]. In contrast, the dry season is usually considered neither favorable nor conducive for arthropod breeding. This serves as a strategy for effective arthropod control to curb the proliferation and transmission of arthropods borne haemoparasitic diseases.

5. CONCLUSION

This study provides baseline data on prevalence and species distribution of avian haemoparasites of Muscovy ducks in Gombe State, Nigeria. The different species of haemoparasites identified in this present study provide evidence of the existence of diverse haemoparasites fauna in the present study locations. Among the haemoparasites genera identified, *Aegyptinella* species are the most predominant while *Plasmodium* species is the least. Among the potential risk factors assessed in the present study, avian haemoparasites was significantly ($P < 0.0001$) higher among the young ducks and during the rainy season compared to the adult ducks and dry season. Prevalence of haemoparasites is also higher among the female compared to the male ducks, even though the difference was not statistically significant. It was therefore assumed that the male and female ducks shares equal chances of getting infected in the abundance of vectors. From the result of the present study, there is need for further studies on epidemiology and economic significance of avian haemoparasites of Muscovy ducks under the scavenging free range management system. Strategic control of arthropods should be carried out to curb the transmission of arthropod borne haemoparasites among village poultry species and village poultry farmers should be encouraged to improve

on the provision of adequate husbandry and management system as well as maintenance of strict biosecurity in and around their poultry houses.

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