

Study of the haematological and biochemical values and gastrointestinal and haemoparasites in racing pigeons (*Columba livia*) in Owerri, Imo State, Nigeria

Estudio de los valores hematológicos y bioquímicos y parásitos gastrointestinales y sanguíneos en palomas (*Columba livia*) criadas en Owerri, Estado de Imo, Nigeria

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ABSTRACT

The study was conducted to determine the blood chemistry, and naturally occurring haemo and gastrointestinal parasites of rearing pigeons (*Columba livia*) in Owerri, Imo State, Nigeria. The packed cell volume, white blood cell, red blood cell, mean cell volume, mean haemoglobin concentration and total bilirubin values of the female pigeons were significantly ($p < 0.05$) different from their male counterparts. All the other haematological and serum biochemical parameters measured were similar ($p > 0.05$) between the two groups. Out of 150 pigeons examined for prevalence of parasites, 70 (46.7%) of them were infected with gastro-intestinal parasites, of which 30 (42.9%) were males and 40 (57.1%) females. Four gastrointestinal parasites were identified, with *Trichomonas* sp. returning the highest prevalence of 42.8%, followed by *Eimeria* sp. (28.6%), while coccidian oocysts and *Ascaridia* sp. each gave the prevalence rate of 14.3%. Results of haemo-parasitological examination of thin blood smears revealed haematozoa of two genera: *Haemoproteus* sp. and *Plasmodium* sp. The haemo-parasitological examination revealed that *Haemoproteus* sp. was more common, with the prevalence of 30 (75.0%) for males and 70 (87.5%) for females. *Plasmodium* sp. gave prevalences of 10 (25.0%) for both, male and female. Fecal cultures recorded high growth of bacterial organisms, of which the prevalence for *Proteus* sp. was 130 (86.7%), while *Enterococcus* sp. was 20 (13.3%). Overall, 40.0% of the pigeons had bacterial infections. It is concluded that there was high prevalence of gastrointestinal and haemoparasites in rearing pigeons in Owerri, Imo State, Nigeria. However, these parasites did not cause any observable clinical effects in the serum biochemical and haematological parameters of the pigeons.

Key words: Pigeons, haematology, serum biochemistry, haemoparasites, gastrointestinal parasites

RESUMEN

El estudio se realizó para determinar la química sanguínea y los parásitos sanguíneos y gastrointestinales que se encuentran naturalmente en palomas (*Columba livia*) criadas en Owerri, Estado de Imo, Nigeria. Los valores de hematocritos, glóbulos blancos, volumen promedio de células, concentración promedio de hemoglobina y bilirrubina total de las palomas femeninas fueron significativamente ($p < 0,05$) diferentes de sus contrapartes masculinos. Todos los demás parámetros hematológicos y bioquímicos séricos medidos fueron similares ($p > 0,05$) entre los dos grupos. De las 150 palomas examinadas para prevalencia de parásitos, 70 (46,7%) de ellas estaban infectadas con parásitos gastrointestinales, de los cuales 30 (42,9%) fueron masculinos y 40 (57,1%) femeninas. Se identificaron cuatro parásitos gastrointestinales, siendo *Trichomonas* sp. el de mayor prevalencia (42,8%), seguido por *Eimeria* sp. (28,6%), mientras oocistos de coccideos y *Ascaridia* sp. cada uno dio una prevalencia de 14,3%. Los resultados del examen hemo-parasitológico de frotis finos de sangre revelaron los hematozoarios de dos géneros: *Haemoproteus* sp. y *Plasmodium* sp. El examen hemo-parasitológico reveló que *Haemoproteus* sp. fue el más común, con una prevalencia de 30 (75,0% para los machos y 70 (87,5%) para las hembras. *Plasmodium* sp. dio prevalencias de 10 (25,0%) para ambos, machos y hembras. El cultivo de heces registró un alto crecimiento de organismos bacterianos, de los cuales la prevalencia de *Proteus* sp. fue de 130 (86,7%), mientras que *Enterococcus* sp. fue 20 (13,3%). El 40,0% de las palomas tuvo infecciones bacterianas. Hubo una alta prevalencia de parásitos gastrointestinales y sanguíneos en palomas criadas en Owerri, Estado de Imo, Nigeria. Sin embargo, estos parásitos no causan ningún efecto clínico observable en los parámetros séricos bioquímicos y hematológicos de las palomas.

Palabras clave: Palomas, hematología, bioquímica sérica, hemoparásitos, parásitos gastrointestinales

INTRODUCTION

Parasites are endemic in Africa, Central and South America, certain Caribbean islands and parts of

Asia, where vectors of all types transmit them. Over 65 species of parasites have been isolated from birds and only few species are the most pathogenic (Springer, 1991). The parasites infect domestic

chickens, penguins, ducks, canaries, falcons, pigeons and several marine avifauna (Brossy, 1992; William, 2005). In the infected birds, the clinical disease is associated with fever, depression, anorexia, loss of body weight, dyspnea, hepatomegaly, splenomegaly, ocular haemorrhage, haemolytic anaemia, haemoglobinuria, leukocytosis, lymphocytosis, hypoalbuminaemia, nephritis, fatty liver, oedema of the lungs, hydropericardium and occlusion of capillaries of the brain (Jordan and Pattison, 1998; Aiello, and Mays, 1998; William, 2005). Bui *et al.* (2005) recently reported 3.0 % prevalence of pigeons with *Plasmodium* sp. in Maiduguri, Nigeria.

This paper reports the prevalence of gastrointestinal and haemoparasite infections in domesticated pigeons in southeastern Nigeria and the effects of infection on the haematology and serum biochemical characteristics of the birds. Blood acts as pathological reflector of the status of exposed animals to pathogenic organisms (Joshi *et al.*, 2002). Examining blood for their constituents can provide important information for the diagnosis and prognosis of diseases in animals.

Therefore, for many reasons, there is a need to ascertain the parasite spectrum of pigeons in Imo State, Nigeria. This study was therefore designed to determine the haematological and serum biochemical characteristics and the prevalence of gastrointestinal and haemoparasites of pigeons.

MATERIALS AND METHODS

Animals

This research was carried out in the Poultry Unit of the Teaching and Research Farm, Department of Animal Science and Technology, Federal University of Technology, Owerri, Imo State. Imo state (4°4' – 6°3' N, 6°15' – 8°15' E) is situated in south-eastern agro-ecological zone of Nigeria. The mean annual rainfall, temperature range and humidity range of the area were 2500 mm, 26.5 - 27.5 °C and 70 - 80 %, respectively.

One hundred fifteen mature pigeons (100 females and 50 males) used for the study were procured from Relief Market in Owerri, Imo State, Nigeria. They were kept in metallic cages within the Poultry Unit of the Department of Animal Science and Technology, Federal University of Technology, Owerri. The experimental pigeons were fed with

commercial poultry feed (Vital Feed) and were allowed unrestricted access to clean water and feed throughout the study in order stabilize for a period of 14 days.

Blood collection

Blood samples were collected via brachial vein into heparinized and non-heparinized bottles for haematology and serum biochemistry, respectively. Serum was separated from the clotted blood in the non - heparinized bottles and centrifuged into clean bottles for biochemical analysis. Determination of haemoglobin (Hb) concentration was done as described by Schalm *et al.* (1975) using the cyanomethhaemoglobin method. Packed cell volume (PCV) was done by conventional method of filling the capillary tubes with venous blood as described by Schalm *et al.* (1975). Red blood cell (RBC) and white blood cell (WBC) counts were determined by the haemocytometer method as described by Coles (1986). Total leukocytes and leukocyte differential counts were similarly evaluated. The serum total protein was measured using Biuret method while serum albumin was measured by Colorimeter using the Sigma diagnostics albumin reagent (Sigma Diagnostic, United Kingdom) containing Bromocresol green. Aspartate aminotransferase (AST), Alkaline phosphatase (ALP) and Alanine aminotransferase (ALT) were determined using a photoelectric colorimeter (Gallenkamp and Sons Ltd; England) as described by Duncan *et al.*, (1994). Serum urea and serum creatinine were evaluated similarly using photoelectric colorimeter as described by Toro and Ackermann (1975).

Haemoparasitological examination

About 2 ml of blood samples was collected via brachial vein puncture. Thin film and thick films of each blood samples were made with Leishman stain (thin film) and Giemsa stain (Thick stain) and allowed to dry for about 12 minutes and 16 minutes, respectively. Two growth media used for the study were blood agar and MacConkey agar. They were prepared according to the manufacturer's instruction and thereafter sterilize by autoclaving at 121 °C for 15 minutes in 15 pounds per square inch using autoclave. They were allowed to cool to 45 °C on the workbench before plating out into the various Petri dishes at 15-20 ml following standard laboratory procedure. The dishes were inoculated with blood samples and incubated at room temperature for 5 days at the end of which they were examined for parasite growth using low and high power microscope.

Fecal collection

For each of the birds, after clinical examination, fecal samples were collected via the cloaca where possible or with a spatula for freshly voided faeces. The fecal sample were put into sterile sample bottles and identified appropriately. The samples were later taken to the laboratory within 3 hours of collection.

Fecal examination

A drop of normal saline and an applicator stick was used to collect 2 grams of faeces. This was emulsified and covered with a cover slip. The identification of fecal bacteria was done using a standard microscope under $\times 10$ magnification. A drop of lugols iodine was added to the cover slip and allowed to diffuse into the sample. The essence of using lugols iodine stain was to make the cysts of protozoa to be seen more clearly and also to differentiate them from the ova of helminthes.

Data analysis

Data obtained on haematology and serum biochemistry were subjected to the Student's test and results were considered significant at $p < 0.05$ (Elston and Johnson, 2008). The data obtained on gastrointestinal and blood parasites were analyzed using simple descriptive statistics to obtain their prevalence.

RESULTS AND DISCUSSION

Differences in the mean values for haematological parameters between the male and female pigeons during the study are shown in Table 1. The differences between male and female pigeons for Hb, mean cell haemoglobin concentration, differential white blood cell (heterophils, lymphocytes, monocytes, eosinophils and basophils) and RBC were not significantly ($p > 0.05$) different. The higher percentage of heterophils as observed in the male pigeons when compared with the females agreed with findings of Oyawale (1994) who reported a similar value in laughing doves. The male sex hormone, testosterone was reported to be responsible for this higher heterophil counts in males (Short, 1980). The difference between the values for male (43.80 ± 4.64) and female (51.40 ± 2.21) for PCV was significantly ($p < 0.05$) different. The mean WBC value of male pigeons (0.64 ± 0.12) was significantly ($p < 0.05$) higher than that of the female pigeons (0.35 ± 0.07), whereas the mean cell volume and mean haemoglobin concentration values of the female pigeons was

significantly ($p < 0.05$) lower when compared with that of the male pigeons.

Table 2 shows the differences in mean values for serum biochemical parameters during the study. The differences between male and female values for serum urea, serum creatinine, serum total protein, serum albumin and serum total bilirubin, serum conjugated bilirubin, serum globulin respectively were not significant ($p > 0.05$) whereas for serum total bilirubin was significant ($p < 0.05$). The serum sodium, serum potassium and serum chlorides values total were similar ($p > 0.05$) between the two treatment groups. Similarly, the differences between male and female values for serum ALP (276.80 ± 4.51 and 275.60 ± 2.93), serum AST (3.60 ± 0.81 and 3.20 ± 0.42) and serum ALT (14.40 ± 2.66 and 15.70 ± 0.84) were not significantly ($p > 0.05$) different.

Table 3 showed the prevalence of parasites from the gastrointestinal tract of pigeons reared Imo State. Out of 150 pigeons examined for gastrointestinal parasites, 30 (42%) were seen in males while 40 (57%) were found in females. Four gastrointestinal parasites were found during this study. These were: *Trichomonas* sp. (42%), *Eimeria* sp. (28%), coccidian oocysts (14%) and *Ascaridia* sp. (14%) (Table 3). These results were in agreement with those reported by Keymer (1982) and Zwart

Table 1. The mean values of haematological indices of racing pigeons (*Columba livia*) in Owerri, Imo State, Nigeria.

Parameters	Male (n = 50)	Female (n = 100)
PCV (%)	43.80 ± 4.64^a	51.40 ± 2.21^b
RBC ($\times 10^6 / \mu\text{l}$)	2.16 ± 0.14	2.16 ± 0.11
WBC ($\times 10^6 / \mu\text{l}$)	0.64 ± 0.12^a	0.35 ± 0.07^b
Hb (g / dl)	14.60 ± 1.49	17.12 ± 0.73
MCV (fl)	205.40 ± 23.38^b	239.80 ± 9.11^a
MHC (pg)	68.40 ± 7.53^b	80.00 ± 2.94^a
MCHC (g)	333.60 ± 1.66	333.50 ± 1.54
Heterophils (%)	42.20 ± 4.79	37.00 ± 2.11
Lymphocytes (%)	56.40 ± 4.61	59.40 ± 2.70
Monocytes (%)	1.20 ± 0.74	1.30 ± 0.30
Eosinophils (%)	0.00 ± 0.00	0.20 ± 0.13
Basophils (%)	0.00 ± 0.00	0.00 ± 0.00

^{ab}Means within a row with different superscript are significantly different at $p < 0.05$, according to Student's t-test. PCV - Packed cell volume, RBC - Red blood cell, WBC - White blood cell, Hb - Haemoglobin concentration, MHC - Mean haemoglobin concentration, MCV - Mean cell volume, MCHC - Mean cell haemoglobin concentration.

(1993) in Uganda. Generally more species were isolated in females than the males, with ascaridia and coccidian sp. being the only species not isolated in males.

Results from haemoparasitological examination of thin blood smears from racing pigeons revealed haematozoa of mainly two genera: *Haemoproteus* sp. and *Plasmodium* sp. (Table 3).

Out of the 150 pigeons examined for haemoparasites, 120 (80.0%) were infected. Of those infected, 80 (66.7%) were females, while 40 (33.3%) males. Two haemoparasite species were found during this study: *Haemoproteus* sp. 90 (75.0%) and *Plasmodium* sp. 30 (25.0%). These results on type of haemoparasites species were in agreement with the studies done in Uganda by Dranzoo *et al.* (1999) who reported *Haemoproteus* sp. and *Plasmodium* sp. as the most common haemoparasites found in pigeons. Dranzoo *et al.* (1999) found *Haemoproteus* sp. as the most prevalent (76.5%) of the two, the results that are comparable to our findings. Prevalence of *Plasmodium* sp. infection reported in this study was comparable to previous studies in other countries. In Ghana, Poulsen *et al.* (2000) reported a prevalence of 37%; in Zimbabwe, Permin *et al.* (2002) found a

prevalence of 35%; while in Malawi, Njunga (2003) reported a prevalence of 39.5%. Schultz and Whittington (2005) reported a prevalence of 87.5% in seabirds of South Africa. The slightly higher prevalence of haemoparasites in pigeons could be attributed in part to the unhygienic nature of the environment where these birds are kept. Cooper (1997) reported that pigeons often harbour zoonotic parasites some of which may be transmissible to humans in the African environment. Jacobs (1974) also observed that strains of *Toxoplasma* found in pigeons were morphologically and serologically identical with the virulent RH-human strain.

Following incubation of blood sample plated on blood and MacConkey agar for 24 hours, this study found a heavy growth of 2 bacteria: *Proteus* sp 130 (86.7%) and *Enterococcus* sp 20 (13.3%). Of those infected, 80 (66.7%) were females, while 50 (38.5%) males (Table 3). Prevalence of *Enterococcus* sp was same between sexes. High bacteria infection frequently accompanies manifestations of poor health such as infectious diseases, malnutrition as well as poor sanitation.

CONCLUSION

This study demonstrated high prevalence of both haemoparasites and gastro-intestinal parasites in rearing pigeons in Imo State, Nigeria. Based on the known pathologic effects of these parasites, the result of this study highlights the eminent dangers of these parasites of pigeons to human health.

Table 2. The mean values of serum biochemical and enzyme parameters of racing pigeons (*Columba livia*) in Owerri Imo State, Nigeria.

Parameters	Male (n = 50)	Female (n = 100)
Creatinine (mg/dl)	0.66 ± 0.09	0.56 ± 0.10
Urea (mg/dl)	6.50 ± 0.31	5.69 ± 0.38
Total protein (g/dl)	5.47 ± 0.17	5.31 ± 0.23
Albumin (g/dl)	4.62 ± 0.26	3.84 ± 0.15
Globulin (g/dl)	1.36 ± 0.31	1.47 ± 0.20
Albumin/globulin	3.26 ± 0.06	2.37 ± 0.05
TC (mg/dl)	68.80 ± 4.71	62.00 ± 2.96
TB (mg/dl)	1.64 ± 0.33 ^b	1.53 ± 0.19 ^a
CB (mg/dl)	0.70 ± 0.12	0.63 ± 0.12
Sodium (mmol/l)	80.00 ± 4.06	83.00 ± 3.92
Potassium (mmol/l)	4.14 ± 0.22	4.71 ± 0.37
Chloride (mmol/l)	91.00 ± 5.05	87.80 ± 4.23
ALT (μl)	14.40 ± 2.66	15.70 ± 0.84
AST (μl)	3.60 ± 0.81	3.20 ± 0.42
ALP (μl)	276.80 ± 4.51	275.60 ± 2.93

^{ab}Means within a row with different superscript are significantly different at $p < 0.05$, according to Student's t-test. TC - Total cholesterol, TB - Total bilirubin, CB - Conjugated bilirubin, ALT - Alanine aminotransferase, AST - Aspartate aminotransferase, ALP - Alkaline phosphatase.

Table 3. Prevalence of gastrointestinal and blood parasites and bacterial species in pigeons (*Columba livia*) in Owerri, Imo State, Nigeria. n = 150; male = 50 (33.3%), female = 100 (66.7%).

Gastrointestinal parasites	No. observed (%)	No. of male (%)	No. of female (%)
<i>Trichomonas</i> sp.	30 (42.8)	20 (66.7)	10 (25.0)
<i>Eimeria</i> sp.	20 (28.6)	10 (33.1)	10 (25.0)
Coccidian oocysts	10 (14.3)	-	10 (25.0)
<i>Ascaridia</i> spp.	10 (14.3)	-	10 (25.0)
Total	70 (100.0)	30 (100.0)	40 (100.0)
Blood parasites			
<i>Haemoproteus</i> spp.	90 (75.0)	30 (75.0)	70 (87.5)
<i>Plasmodium</i> spp.	30 (25.0)	10 (25.0)	10 (12.5)
Total	120 (100.0)	40 (100.0)	80 (100.0)
Bacteria			
<i>Proteus</i> spp.	130 (86.7)	50 (83.3)	80 (88.9)
<i>Enterococcus</i> spp.	20 (13.3)	10 (16.7)	10 (11.1)
Total	150 (100.0)	60 (100.0)	90 (100.0)

LITERATURE CITED

- Aiello, S. E. and A. Mays. 1998. The Merck veterinary manual, 8th edition, Merck and Company Inc., White House Station, New Jersey, United States of America.
- Brossy, J. J. 1992. Malaria in wild and captive Jackass penguins, *Spheniscus demersus*, along the southern African coast. Ostrich 63: 10-12.
- Bui, A. A.; M. S. Jidda and K. Yahaya. 2005. Prevalence of blood parasites of domestic pigeons in Maiduguri, Nigeria. International Journal of Biomedical and Health Sciences 1: 21-24.
- Coles, E. H. 1986. Veterinary clinical pathology. 4th Ed. W. B. Saunders Company, Philadelphia. USA.
- Cooper, J. E. 1997. Possible hazards from birds in the rural environment. Transactions of the Royal Society of Tropical Medicine and Hygiene 91: 366-367.
- Dranzoa, C.; M. Ocaido and P. Katete. 1999 'The ecto, gastro-intestinal and haemoparasites of live pigeons (*Columba livia*) in Kampala, Uganda. Avian Pathology 28 (2): 119-124.
- Duncan, J. R.; K. W. Prasse and E. A. Mahaffey. 1994. Veterinary laboratory medicine. Clinical Pathology. Iowa State University Press. USA.
- Elston, R. C. and W. D. Johnson. 2008. Basic biostatistics for geneticists and epidemiologists. A practical approach. John Willey and Sons Ltd. United Kingdom, 1st edn. p. 233-246.
- Jacobs, L. 1974. *Toxoplasma gondii*: Parasitology and transmission. Bulletin of New York Academy Medical Journal 50: 128-145.
- Jordan, F. T. W. and M. Pattison. 1996. Poultry diseases, W. B Saunders Company Ltd, London, United Kingdom. 546 p.
- Joshi, P. K.; M. Bose and D. Haris. 2002. Changes in certain haematological parameters in asiluroid catfish *Clarias batrachus* (Linn) exposed to a cadmium chloride. Pollution Resources 21 (2): 129-131.
- Keymer, I. F. 1982. Parasitic diseases. In: Diseases of cage and aviary birds. M. L. Petrak (Ed.). 2nd Ed. Lea and Febiger, Philadelphia. p. 535-598.
- Njunga, G. R. 2003. Haemoparasites of chickens in Malawi. [www.poultry.life.ku.dk/upload/poultry/master thesis/njunga.pdf](http://www.poultry.life.ku.dk/upload/poultry/master%20thesis/njunga.pdf)
- Oyawale, J. O. 1994. Further studies on osmotic resistance of nucleated erythrocytes: Observations with pigeon, peafowl, lizard and toad erythrocytes during changes in temperature and pH. J. Vet. Med. A. 41: 62-71.
- Permin, A.; J. B. Esmann, C. H. Hoj. T. Hove and S. Mukaratirwa. 2002. Ecto-, endo- and haemoparasites in free-range chickens in Goromonzi District in Zimbabwe. Preventive Veterinary Medicine 54: 213-224.
- Poulsen, J.; A. Permin, O. Hindsho, L. Yelifari, P. Nansen and P. Bloch. 2000. Prevalence and distribution of gastro-intestinal helminths and haemoparasites in young scavenging chickens in upper eastern region of Ghana, West Africa. Preventive Veterinary Medicine 45: 237-245.
- Schalm, O. W.; N. C. Jain and E. J. Carroll. 1975. Veterinary haematology, Lea and Febiger, Philadelphia, USA.
- Schultz, A. and P. Whittington. 2005. High prevalence of avian malaria infection to avifauna at Cape Recife, Eastern Cape, South Africa. Ostrich 76: 56-60.
- Short, R. V. 1980. The hormonal control of growth at puberty. In: Growth in farm animals. T. L. J. Lawrence (Ed.). Butterworths, London, United Kingdom. p. 25-46.
- Springer, W. T. 1991. Other blood and tissue protozoa. In: Diseases of poultry. B. W. Calnek (Ed.). 9th Edition, Iowa State University Press, Iowa, USA. p. 814-826.
- Toro, G. and P. Ackermann. 1975. Practical Clinical Chemistry, 1st ed. Little Brown and Company, Boston, USA.
- William, R. B. 2005. Avian malaria: clinical and chemical pathology of *Plasmodium gallinaceum* in the domestic fowl, *Gallus gallus*. Avian Pathology, 34: 29-47.
- Zwart, P. 1993. Columbiform medicine. In: Zoo and wild animal medicine: Current Therapy 3. M. E. Fowler (Ed.). 2nd Ed, Saunders Company Philadelphia, USA. p. 240-244.