# HAEMATOLOGICAL PROFILE OF THE DOMESTIC PIGEON (*COLUMBA LIVIA DOMESTICA*) IN NSUKKA AGRO-ECOLOGICAL ZONE, ENUGU STATE, NIGERIA

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**ABSTRACT**

***This study evaluated the haematological profile of the domestic pigeon (Columba livia domestica). Seventy five pigeons were acquired for the study from three locations (Ibagwa, Orba and Enugu-Ezike) where pigeons are raised in Nsukka agro-ecological zone, Enugu State, Nigeria, but after two weeks of acclimatization 64 of the pigeons (34 females and 30 males) that were considered apparently healthy were used for the study. One ml of blood was collected from each pigeon by jugular venipuncture for evaluation of the haematological parameters. The haematological characteristics of the pigeons were determined using standard methods. The overall mean values obtained for the haematological parameters were as follows: packed cell volume (PCV) – 44.54 ± 4.73%; haemoglobin concentration (Hb) – 12.89 ± 1.55 g/dl; red blood cell (RBC) count – 3.34 ± 0.38 ($10^6$/ul); mean corpuscular volume (MCV) – 133.86 ± 19.37 fl; mean corpuscular haemoglobin (MCH) – 38.67 ± 5.34 pg; mean corpuscular hemoglobin concentration (MCHC) – 28.97 ± 2.59 g/dl; leukocyte counts ($10^3$/ul): total leukocyte – 23.36 ± 7.06; lymphocyte – 10.66 ± 3.49, heterophil – 7.80 ± 2.89, monocyte count – 2.32 ± 0.93, eosinophil count – 2.25 ± 0.89, and basophil – 0.24 ± 0.30. There were no significant differences (p>0.05) between the males and females in all the haematological parameters evaluated and the body weights. There were however significant variations (p<0.05) in the PCV, absolute heterophil, monocyte and basophil counts, percentage lymphocyte, eosinophil and basophil counts of the pigeons from the three locations.***

**Keywords:** Domestic pigeons, *Columba livia domestica*, Haematology

## INTRODUCTION

The domestic pigeon (*Columba livia domestica*) was in ancient times raised as a source of meat, manure (fertilizer) and feather products and also was used for navigation and carrying messages during wars, but currently, pigeons are mostly used as pets, for sports, religious, social, ceremonial and ritual purposes and as laboratory animal models (Levi, 1974; Aggrey and Cheng, 1992; Vogel *et al*., 1994). Pigeons also stand as a symbol of peace, love, purity, innocence, the Holy Spirit and the soul of the deceased (Fakhri *et al*., 2013). The use of pigeons during various national ceremonies as a symbol of peace is conspicuous, and the shift of attention from keeping pet dogs and/or cats to pet pigeons that are low cost to acquire, easy to maintain and are well appreciated by children (because they can fly) has brought the domestic pigeon to focus in recent times. There is also the increasing use of pigeons as laboratory models for experimental studies.

The evaluation of the haematological profile is of importance in animals and humans because the blood is the major transporter of substances in the body, and any deviations from normal caused by derangement of metabolic processes, invasion of the body by pathogens, deprivation, stress and other forms of injury/insult commonly translate to changes in the haematological parameters (Schalm *et al*., 1975; Ihedioha, 2004; Ihedioha *et al*., 2012). Specifically in birds, assessment of the haematology had been used for the evaluation of the state of health and nutrition, diagnosis of diseases, prognosis and the evaluation of the efficacy of therapeutic interventions (Campbell, 1994; 1998; Clark *et al*., 2009; Ihedioha *et al*., 2011).

Globally, there had been a focus of attention on zoonotic diseases and parasites that may be transmitted from street/feral pigeons to humans (Haag-Wackernagel and Moch, 2004; Haag-Wackernagel, 2005; Magnino *et al*., 2008; Vasquez *et al*., 2010; Geingenfeind *et al*., 2012), to the detriment of appreciating the domestic pigeon as a preferred pet for some, laboratory animal model, and a commonly used ceremonial bird. Thus, apart from the numerous reports on diseases and parasites of street/feral pigeons cited above, there is a paucity of reports of studies on the domestic pigeon. In the area of haematology, there are some reports on the haematology of street/feral and racing pigeons (Pavlak *et al*., 2005; Khan *et al*., 2011; Opara *et al*., 2012), and only few preliminary reports on the haematology of the domestic pigeon (Ritchie *et al*., 1994; Lashev *et al*., 2009), which are not comprehensive. The objective of this present study was to comprehensively evaluate the haematological profile of the domestic pigeon.

## MATERIALS AND METHODS

A total of 75 domestic pigeons were acquired for the study from three major local breeders from whom pigeons are usually sourced in Nsukka agro-ecological zone, Enugu State, Nigeria. The breeders were located in Ibagwa (longitude 6°55.12′ north, latitude 7°23.19′ east), Orba (longitude 6°51.25′ north, latitude 7°27.49′ east) and Enugu-Ezike (longitude 6°58.69′ north, latitude 7°24.74′ east), Enugu State, Nigeria. Twenty five pigeons were sourced from each of the breeders/locations. Only adult pigeons were used for the study because the local breeders did not consider it humane and right to sell young ones and therefore refused to sell them out for the study. The pigeons were housed and acclimatized for two weeks in the Faculty of Veterinary Medicine Experimental Animal House, University of Nigeria, Nsukka. The university town of Nsukka is in Enugu State, Nigeria, and is situated within the derived savannah belt between latitudes 5° 50′ and 7°00′ north and longitudes 6°52′ and 7°54′ east, at an average elevation of approximately 500 m above sea level. It is an area of high temperature with yearly minimum and maximum temperature of 24.28° C and 32.19° C, with a mean of 28.24° C, and a relative humidity of about 70% during the rainy season that falls to about 20 % during the dry season.

During the period of acclimatization, the pigeons were examined individually and tagged. Those that showed any signs of abnormality of disorder were excluded from the study. The pigeons were fed *ad libitum* on pelletized growers mash (Vital Feed®, Grand Cereals and Oil Mills, PLC, Nigeria). Clean drinking water was also provided freely. At the end of acclimatization period, 11 of the pigeons were excluded from the study, and only 64 pigeons made up of 23 from Ibagwa, 21 from Orba and 20 from Enugu-Ezike were used for the study.

All through the study, the pigeons were humanely handled and all experimental procedures followed the University of Nigeria guidelines for handling of experimental animals. One millilitre of blood was collected from each pigeon by venipuncture of the jugular vein into a labeled sample bottle containing 1 mg of ethylene diamine tetra acetic acid (EDTA) anticoagulant. All haematological determinations followed standard procedures, and were done immediately upon collection of blood samples. Packed cell volume (PCV) was determined by the microhaematocrit method (Thrall and Weiser, 2002), while haemoglobin concentration (HbC) was determined by the cyanomethaemoglobin method (Higgins *et al*.,

2008). Red blood cell (RBC) and total white blood cell (WBC) counts were done by the haemocytometer method using Natt and Herrick's solution as the diluting fluid (Campbell, 1994). The smears for differential leukocyte count were prepared and stained by the Leishman technique and enumerated by the battlement counting method (Thrall and Weiser, 2002). The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated using the standard formulae (Campbell, 1994). The body weights of the individual pigeons were measured and their sexes determined.

**Statistical Analysis:** Data generated from the study were subjected to descriptive statistics and presented as means ± standard deviation (SD) with the minimum and maximum values. Differences between the sexes in all the parameters were analyzed for using students' t-test. Variations in the haematological parameters between the sources of pigeons were analyzed using one way analysis of variance, and the variant means were further separated using the least significant difference method post hoc. Significant differences were accepted at the probability level $p<0.05$.

## RESULTS

The overall means of the erythrocytic parameters of the domestic pigeons, with their minimum and maximum values were PCV (%) - 44.54 ± 4.73 [32.0 – 55.0], HbC (g/dl) - 12.89 ± 1.55 [7.76 - 16.00], and RBC counts ($10^6$/µl) - 3.34 ± 0.38 [2.12 - 3.95] (Table 1). There were no significant differences ($p>0.05$) between the mean PCV, HbC and RBC counts of the males and females (Table 2). The mean PCV of pigeons sourced from Orba was significantly higher ($p<0.05$) than that of pigeons obtained from Ibagwa, but the mean PCV of those obtained from Enugu-Ezike did not vary significantly from that of others (Table 3). There were however no significant variations ($p>0.05$) in the HbC and RBC counts of pigeons sourced from Orba, Ibagwa and Enugu-Ezike (Tables 3).

For the mean red cell corpuscular values, the overalls, with their minimum and maximum values were MCV (fl) - 133.86 ± 19.37 [109.82 - 169.09], MCH (pg) - 38.67 ± 5.34 [26.86 - 50.41], and MCHC (g/dl) - 28.97 ± 2.59 [23.57 - 33.75] (Table 1). There were no significant differences ($p>0.05$) in the MCV, MCH and MCHC between the male and female pigeons (Table 2), and no significant variations in these parameters between the pigeons sourced from the three different locations (Table 3).

The mean total WBC counts ($10^3$/µl) of the pigeons with the recorded minimum and maximum values were 23.36 ± 7.06 [12.50 - 35.50] (Table 4). There were no significant differences ($p<0.05$) between the total WBC count of the male and female pigeons (Table 5), and no significant variations ($p>0.05$) between that of pigeons obtained from the different locations (Table 6). For the percentage lymphocyte counts (%), the overall mean, and minimum and maximum values recorded for the pigeons were 45.76 ± 4.77% [32.00 - 58.00], while for the absolute lymphocyte counts ($10^3$/µl), the mean, and minimum and maximum values were 10.66 ± 3.49 [5.74 - 18.20] (Table 4). There were no significant differences ($p>0.05$) between the percentage and absolute lymphocyte counts of the male and female pigeons (Table 5), but the percentage lymphocyte count of the pigeons obtained from Orba was significantly higher ($p<0.05$) than that of pigeons obtained from other locations. There was however no significant variation ($p>0.05$) in the means of the absolute lymphocyte counts of the domestic pigeons sourced from the three different locations (Table 6).

For the heterophil counts, the means of the percentage heterophil counts (%) of the pigeons with their minimum and maximum values were 33.37 ± 5.86 [18.00 - 50.00], while that of the absolute heterophil counts ($10^3$/µl) were 7.80 ± 2.89 [2.43 - 13.80] (Table 4). There was no significant difference ($p>0.05$) in the percentage and absolute heterophil counts of the males and females (Table 5), and no significant variations ($p>0.05$) in the percentage heterophil counts of the pigeons sourced from the three different locations (Table 6).

**Table 1: The erythrocytic profile of domestic pigeons in Nsukka agro-ecological zone, Enugu State, Nigeria**

| Parameters | Mean | Minimum and maximum values |
|---|---|---|
| **Packed cell volume (%)** | 44.54 ± 4.73 | 32.0 – 55.0 |
| **Haemoglobin concentration (g/dl)** | 12.89 ± 1.55 | 7.76 – 16.00 |
| **Red blood cell count ($10^6$/µl)** | 3.34 ± 0.38 | 2.12 – 3.95 |
| **Mean corpuscular volume (fl)** | 133.86 ± 19.37 | 109.82 – 169.09 |
| **Mean corpuscular haemoglobin (pg)** | 38.67 ± 5.34 | 26.86 – 50.41 |
| **Mean corpuscular haemoglobin conc. (g/dl)** | 28.97 ± 2.59 | 23.57 – 33.75 |

**Table 2: Comparison of the erythrocytic profile of male and female domestic pigeons in Nsukka agro-ecological zone, Enugu State, Nigeria**

| Parameters | Sexes | |
|---|---|---|
| | **Males (n = 30)** | **Females (n= 34)** |
| **Packed cell volume (%)** | 44.33 ± 4.85<br>[36.0 – 52.0] | 44.66 ± 4.75<br>[32.0 – 55.0] |
| **Haemoglobin concentration (g/dl)** | 13.15 ± 1.67<br>[9.43 – 15.84] | 12.73 ± 1.47<br>[7.76 – 16.00] |
| **Red blood cell count ($10^6$/µl)** | 3.43 ± 0.40<br>[2.31 – 3.95] | 3.24 ± 0.74<br>[2.12 – 3.72] |
| **Mean corpuscular volume (fl)** | 130.01 ± 19.99<br>[109.82 – 167.50] | 138.02 ± 18.28<br>[113.43 – 169.09] |
| **Mean corpuscular haemoglobin (pg)** | 38.35 ± 6.38<br>[26.86 – 50.04] | 39.27 ± 4.69<br>[32.87 – 50.41] |
| **Mean corpuscular haemoglobin concentration (g/dl)** | 29.72 ± 2.70<br>[23.57 – 33.75] | 28.50 ± 2.46<br>[23.71 – 33.11] |

*Mean ± SD with minimum and maximum values in square brackets, No significant differences between the means of the males and females, p>0.05*

**Table 3: Comparison of the erythrocytic profile of domestic pigeons sourced from different locations in Nsukka agro-ecological zone, Enugu State, Nigeria**

| Parameters | Locations | | |
|---|---|---|---|
| | **Ibagwa (n = 23)** | **Orba (n= 21)** | **Enugu-Ezike (n= 20)** |
| **Packed cell volume (%)** | 42.91 ± 4.32 [a]<br>[32.0 – 49.0] | 46.14 ± 5.81 [b]<br>[35.0 – 55.0] | 45.00 ± 3.12 [ab]<br>[38.0 – 50.0] |
| **Haemoglobin concentration (g/dl)** | 12.49 ± 2.06<br>[7.76 – 16.00] | 13.35 ± 1.10<br>[10.88 – 15.56] | 12.93 ± 0.97<br>[11.52 – 14.53] |
| **Red blood cell count ($10^6$/µl)** | 3.24 ± 0.37<br>[2.12 – 3.75] | 3.39 ± 0.39<br>[2.31 – 3.95] | 3.36 ± 0.34<br>[2.46 – 3.85] |
| **Mean corpuscular volume (fl)** | 133.18 ± 12.19<br>[113.43 – 158.62] | 135.99 ± 19.53<br>[116.45 – 169.09] | 134.02 ± 20.02<br>[109.82 – 166.23] |
| **Mean corpuscular haemoglobin (pg)** | 38.58 ± 4.89<br>[26.86 – 47.27] | 39.16 ± 4.52<br>[28.30 – 50.04] | 38.48 ± 4.60<br>[34.71 – 50.41] |
| **Mean corpuscular haemoglobin concentration (g/dl)** | 28.99 ± 0.62<br>[23.57 – 32.65] | 28.93 ± 2.80<br>[23.71 – 33.75] | 28.68 ± 1.94<br>[25.60 – 31.60] |

*Mean ± SD with minimum and maximum values in square brackets; [a] [b] Different superscripts in a row indicate significant differences between the means, p<0.05*

**Table 4: The leukocytic profile of domestic pigeons in Nsukka agro-ecological zone, Enugu State, Nigeria**

| Parameters | Mean | Minimum and maximum values |
|---|---|---|
| **Total leukocyte count ($10^3$/µl)** | 23.36 ± 7.06 | 12.50 – 35.50 |
| **Percentage lymphocyte count (%)** | 45.76 ± 4.77 | 32.00 – 58.00 |
| **Absolute lymphocyte count ($10^3$/µl)** | 10.66 ± 3.49 | 5.74 – 18.20 |
| **Percentage heterophil count (%)** | 33.37 ± 5.86 | 18.00 – 50.00 |
| **Absolute heterophil count ($10^3$/µl)** | 7.80 ± 2.89 | 2.43 – 13.80 |
| **Percentage monocyte count (%)** | 10.04 ± 3.02 | 5.00 – 19.00 |
| **Absolute monocyte count ($10^3$/µl)** | 2.32 ± 0.93 | 0.63 – 4.09 |
| **Percentage eosinophil count (%)** | 9.83 ± 2.77 | 4.00 – 17.00 |
| **Absolute eosinophil count ($10^3$/µl)** | 2.25 ± 0.89 | 0.90 – 4.76 |
| **Percentage basophil count (%)** | 1.02 ± 1.12 | 0.00 – 5.00 |
| **Absolute basophil count ($10^3$/µl)** | 0.24 ± 0.30 | 0.00 – 1.70 |

**Table 5: Comparison of the leukocytic profile of male and female domestic pigeons in Nsukka agro-ecological zone, Enugu State, Nigeria**

| Parameters | Sexes | |
|---|---|---|
| | **Males (n = 30)** | **Females (n= 34)** |
| **Total leukocyte count ($10^3$/µl)** | 22.47 ± 7.61 [12.50 – 35.50] | 23.91 ± 6.75 [13.50 – 34.00] |
| **Percentage lymphocyte count (%)** | 45.52 ± 4.82 [32.00 – 53.00] | 45.91 ± 4.80 [38.00 – 58.00] |
| **Absolute lymphocyte count ($10^3$/µl)** | 10.17 ± 3.42 [5.75 – 16.33] | 10.97 ± 3.57 [5.74 – 18.20] |
| **Percentage heterophil count (%)** | 34.76 ± 6.28 [20.00 – 50.00] | 32.48 ± 5.49 [18.00 – 41.00] |
| **Absolute heterophil count ($10^3$/µl)** | 7.93 ± 3.29 [3.20 – 13.80] | 7.72 ± 2.65 [2.43 – 13.26] |
| **Percentage monocyte count (%)** | 9.42 ± 2.69 [5.00 – 15.00] | 10.42 ± 3.19 [6.00 – 19.00] |
| **Absolute monocyte count ($10^3$/µl)** | 2.10 ± 0.85 [0.63 – 4.06] | 2.46 ± 0.96 [1.20 – 4.09] |
| **Percentage eosinophil count (%)** | 9.38 ± 2.82 [4.00 – 17.00] | 10.12 ± 2.74 [5.00 – 16.00] |
| **Absolute eosinophil count ($10^3$/µl)** | 2.09 ± 0.94 [0.90 – 4.49] | 2.36 ± 0.87 [1.08 – 4.76] |
| **Percentage basophil count (%)** | 0.90 ± 0.89 [0.00 – 3.00] | 1.09 ± 1.26 [0.00 – 5.00] |
| **Absolute basophil count ($10^3$/µl)** | 0.19 ± 0.21 [0.00 – 0.69] | 0.27 ± 0.35 [0.00 – 1.70] |

*Mean ± SD, with minimum and maximum values in square brackets; No significant differences between the means of the males and females, p>0.05*

The absolute heterophil counts of pigeons obtained from Enugu-Ezike was however significantly higher (p<0.05) than those of the pigeons obtained from the other locations (Table 6).

The mean of the percentage monocyte count (%) of the pigeons with their minimum and maximum values were 10.04 ± 3.02 [5.00 - 19.00], while the mean absolute monocyte count ($10^3$/µl) with minimum and maximum values were 2.32 ± 0.93 [0.63 - 4.09] (Table 4). There were no significant differences (p>0.05) in the percentage and absolute monocyte counts between the male and female pigeons (Table 5), and no significant variation (p>0.05) in the percentage monocyte counts of pigeons obtained from the different locations (Table 6).

**Table 6: Comparison of the leukocytic profile of domestic pigeons sourced from different locations in Nsukka agro-ecological zone, Enugu State, Nigeria**

| Parameters | Locations | | |
|---|---|---|---|
| | Ibagwa (n = 23) | Orba (n= 21) | Enugu-Ezike (n= 20) |
| **Total leukocyte count ($10^3$/µl)** | 22.64 ± 7.31 [12.50 – 34.50] | 21.78 ± 7.68 [12.50 – 35.50] | 26.33 ± 5.20 [16.00 – 34.00] |
| **Percentage lymphocyte count (%)** | 44.91 ± 5.52 [a] [32.00 – 56.00] | 48.17 ± 3.73 [b] [43.00 – 58.00] | 44.27 ± 3.73 [a] [38.00 – 51.00] |
| **Absolute lymphocyte count ($10^3$/µl)** | 10.22 ± 3.80 [5.74 – 18.20] | 10.31 ± 3.76 [5.75 – 16.70] | 11.67 ± 2.62 [7.20 – 17.34] |
| **Percentage heterophil count (%)** | 32.23 ± 7.46 [20.00 – 50.00] | 33.29 ± 5.50 [18.00 – 39.00] | 35.13 ± 2.56 [32.00 – 41.00] |
| **Absolute heterophil count ($10^3$/µl)** | 7.29 ± 2.99 [a] [3.20 – 13.80] | 7.13 ± 2.95 [a] [2.43 – 13.49] | 9.29 ± 2.18 [b] [5.28 – 12.71] |
| **Percentage monocyte count (%)** | 10.41 ± 3.46 [5.00 – 19.00] | 9.41 ± 2.72 [6.00 – 15.00] | 10.20 ± 2.73 [6.00 – 15.00] |
| **Absolute monocyte count ($10^3$/µl)** | 2.36 ± 1.04 [a b] [0.63 – 4.09] | 1.97 ± 0.78 [a] [1.05 – 4.08] | 2.67 ± 0.81 [b] [1.28 – 3.92] |
| **Percentage eosinophil count (%)** | 10.77 ± 3.38 [a] [4.00 – 17.00] | 8.82 ± 1.74 [b] [6.00 – 12.00] | 9.60 ± 2.38 [a b] [5.00 – 13.00] |
| **Absolute eosinophil count ($10^3$/µl)** | 2.37 ± 1.01 [1.26 – 4.76] | 1.89 ± 0.89 [0.90 – 3.74] | 2.48 ± 0.62 [1.05 – 3.36] |
| **Percentage basophil count (%)** | 1.68 ± 1.32 [a] [0.00 – 5.00] | 0.35 ± 0.12 [b] [0.00 – 1.00] | 0.80 ± 0.77 [b] [0.00 – 2.00] |
| **Absolute basophil count ($10^3$/µl)** | 0.39 ± 0.39 [a] [0.00 – 1.70] | 0.08 ± 0.11 [b] [0.00 – 0.36] | 0.21 ± 0.20 [a b] [0.00 – 0.65] |

*Mean ± SD, with minimum and maximum values in square brackets; [a b] Different superscripts in a row indicate significant differences between the means, $p<0.05$*

The absolute monocyte count of pigeons obtained from Enugu-Ezike was significantly higher ($p<0.05$) than that of pigeons obtained from Orba (Table 6).

The overall mean percentage eosinophil count (%) for the pigeons with their minimum and maximum values was 9.83 ± 2.77 [4.00 - 17.00], while the mean absolute eosinophil count ($10^3$/µl) with minimum and maximum values was 2.25 ± 0.89 [0.90 - 4.76] (Table 4). There was no significant difference ($p>0.05$) in the percentage and absolute eosinophil counts between the males and females (Table 5).

Furthermore, there was no significant variations ($p>0.05$) in the absolute eosinophil counts of pigeons from the different locations (Table 6). The percentage eosinophil counts of the pigeons obtained from Ibagwa was significantly higher ($p<0.05$) than that of pigeons obtained from Orba (Table 6). For the basophil counts, the overall mean percentage basophil count (%) with their minimum and maximum values was 1.02 ± 1.12 [0.00 - 5.00], while the mean absolute basophil count ($10^3$/µl) with minimum and maximum values was 0.24 ± 0.30 [0.00 – 1.70] (Table 4). There was no significant difference ($p>0.05$) in the percentage and absolute basophil counts between the male and female pigeons (Table 5). The percentage basophil count of the pigeons obtained from Ibagwa was significantly higher ($p<0.05$) than those of pigeons obtained from Orba and Enugu-Ezike, and the absolute basophil count of the pigeons from Ibagwa was significantly higher ($p<0.05$) than that of pigeons from Orba (Table 6).

The mean body weight (g) of the pigeons was 211.46 ± 20.74, with minimum and maximum values of 153.20 and 229.02 (Figure 1). There was no significant difference ($p>0.05$) between the body weights of the males and females (Figure 1), and no significant variations between the body weights of the pigeons obtained from the different locations (Figure 2).


**Figure 1: Sexual dimorphism in the body weights of the domestic pigeons in Nsukka agro-ecological zone, Enugu State, Nigeria**

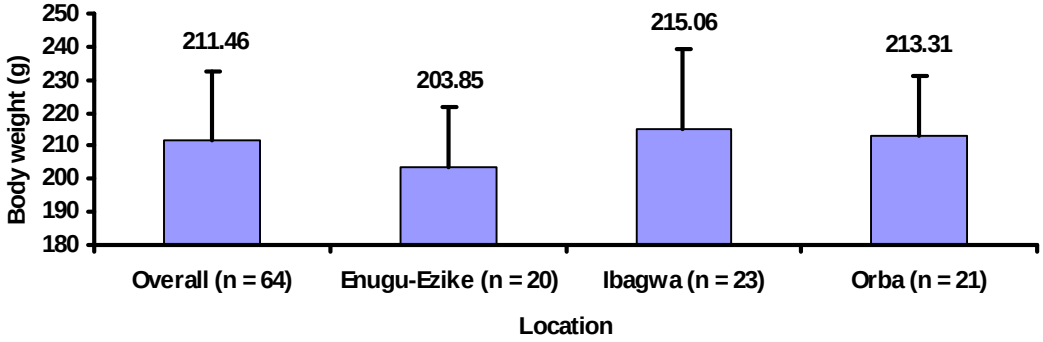


**Figure 2: Spatial variations in the body weights of the domestic pigeons sourced from different locations in Nsukka agro-ecological zone, Enugu State, Nigeria**

## DISCUSSION

The overall mean PCV recorded for the pigeons in this present study (44.54 ± 4.73 %) was comparable to and slightly higher than that reported by Ritchie *et al*. (1994) for domestic pigeons (42.5 %). It was however relatively lower than the 49.36 ± 6.40 % reported for street rock pigeons by Khan *et al*. (2011). The relatively higher PCV reported for street pigeons may be part of adjustment for greater demands for constant flight of street pigeons (Viscor *et al*., 1985). The HbC recorded for the pigeons in this study (12.89 ± 1.55 g/dl) were comparable to, but relatively lower than the mean value (14.46 ± 0.19 g/dl) reported by Lashev *et al*. (2009) for domestic pigeons. The minimum and maximum values for HbC reported by Ritchie *et al*. (1994) (8.1 – 9.9 g/dl) lied within the minimum and maximum recorded in this study (7.76 – 16.00), though the range in this study was wider. The mean RBC counts of the pigeons in this study (3.34 ± 0.38) were comparable to, but slightly lower than RBC counts (3.96 ± 0.05) reported by Lashev *et al*. (2009) for domestic pigeons and the minimum and maximum values recorded in this study (2.12 – 3.95) were relatively lower than values reported by Ritchie *et al*. (1994) for domestic pigeons (3.1 – 4.5). The relatively lower HbC and RBC counts recorded in this study when compared to that reported by Ritchie *et al*. (1994) and Lashev *et al*. (2009) may be due to difference between the temperate environment (with its relatively lower environmental temperatures) in which the earlier reported studies were conducted compared to the tropical environment (higher environmental temperature) under which the present study was done. Olsen (1973) had earlier reported higher values of erythrocyte parameters in cattle exposed to controlled cold environmental temperatures. This difference between the erythrocytic profile of the same species at temperate and tropical environments also concurred with the earlier reports of such differences in albino rats (Ihedioha *et al*., 2004).

There were no reported values for the erythrocyte MCV, MCH and MCHC of domestic pigeons in available literature to compare with the values obtained in this study. However, the MCV, MCH and MCHC recorded in this study were relatively lower than that reported for street pigeons by Khan *et al*. (2011) and Opara *et al*. (2012). These higher values reported for the erythrocyte corpuscular values of street pigeons relative to domestic pigeons may be due to physiological adjustments for the greater demand for constant flight by street pigeons (Viscor *et al*., 1985).

The mean total WBC count recorded in this study (23.36 ± 7.06) was comparable to, and in agreement with the mean of 23.80 ± 1.27 reported by Lashev *et al*. (2009), and the minimum and maximum values reported by Ritchie *et al*. (1994) for domestic pigeons (13.0 – 22.3) lied within the minimum and maximum values recorded in this study (12.5 – 35.50), though the upper limit of the values obtained in this study were higher. The minimum and maximum values of the absolute lymphocyte, heterophil, monocyte and basophil counts recorded in this study were comparable to that recorded by Ritchie *et al*. (1994) but were of a wider range. The wider range of the absolute values recorded in this study in comparison with that reported by Ritchie *et al*. (1994) may be because domestic pigeons used in this present study were sourced from three different breeders/locations within the same geographical zone. The minimum and maximum values for the absolute eosinophil counts obtained in this study (0.90 – 4.76) were however higher than the 0.1 – 0.3 reported by Ritchie *et al*. (1994). It was also of a wider range when compared to that reported by Ritchie *et al*. (1994). Lashev *et al*. (2009) reported the differential WBC counts in mean percentages; and the mean percentage lymphocyte and heterophil counts recorded in this study were slightly lower than that reported by Lashev *et al*. (2009), while the mean percentage monocyte, eosinophil and basophil counts recorded in this study were higher than that recorded by Lashev *et al*. (2009). These differences in the differential WBC counts may be attributed to differences in environmental and geographical factors.

The absence of sex (male and female) related differences in all the haematological parameters recorded in this study may not be unrelated to the documented lack of obvious gender related differences in the outward secondary sexual characteristics, body size, morphology and specific behavior between male and female pigeons (Vogel *et al*., 1994; Kigir *et al*., 2010). The findings of no significant sex related differences in the haematological parameters of pigeons in this study were in agreement with the reports of Lashev *et al*. (2009) who also reported no differences in the haematology of male and female domestic pigeons. Our findings however is slightly at variance with the reports of Pavlak *et al*. (2005) who reported sex related differences only in the MCV values and in the percentages of lymphocytes and neutrophils.

The significantly higher mean PCV and slightly higher RBC count and HbC recorded for the pigeons sourced from Orba relative to those sourced from Ibagwa and Enugu-Ezike may be attributable to the differences in the altitudes of the locations; Orba is located at 452 metres above sea level, while Ibagwa and Enugu-Ezike are located 334 m and 391 m above sea level respectively. Higher altitudes with their relatively lower oxygen tension had been reported to be associated with higher hematocrit, haemoglobin and red blood cell values (Frisancho, 1975; Ihedioha, 2004; Nepal *et al*., 2012). The significant differences between the pigeons sourced from the three locations in their absolute heterophil, monocyte, basophil counts and percentage lymphocyte, eosinophil and basophil counts may be attributed to possible differences in the condition of keeping and management of the pigeons at the sourced locations. These differences were however negligible even when they are statistically significant, as the minimum and maximum values lied within the same range.

The minimum and maximum values recorded for the body weights of the pigeons in this study (150.20 – 229.02) lied within the range reported for pigeons by Kigir *et al*. (2010) who studied pigeons in northern Nigeria. The lack of significant differences between the body weights of pigeons in this study concurred with

earlier reports that male and female pigeons may not be easily differentiated based on body size (Vogel *et al*., 1994). The findings in this study of slightly higher body weight of males relative to females which was not statistically different was in agreement with the findings of Kigir *et al*. (2010).

**Conclusion:** The haematological profile of domestic pigeons in Nsukka, Nigeria were in some respects comparable to that already reported in literature, but also varied in some respects. However, there were no sex-related significant differences in all the haematological parameters evaluated and the body weight.

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