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Comparative haematology of *Anas platyrhynchos* (Anseriformes) and *Coturnix coturnix japonica* (Galliformes)

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Abstract
Haematological study of adult female Indian runner duck and Japanese quail was conducted to evaluate the variation between two different poultry birds having different habitat. Results obtained in case of Japanese quail showed a higher total leucocyte count (p<0.05), lower haemoglobin value (p<0.001) and erythrocyte count (p<0.05) in comparison to Indian runner duck. Aggregates of RBC and deformed monocytes were also observed. This present study will be helpful in better understanding of different poultry birds having different habitats.

Keywords: *Anas platyrhynchos*, *Coturnix coturnix japonica*, Haematological analysis, Indian runner duck and Japanese quail.

1. Introduction
Poultry birds play an important role in the economy of India. It has been documented that use of blood examination is a way of assessing the health status of bird along with diagnosis and clinical monitoring of any disease [1]. This is because it plays a vital role in physiological, nutritional and pathological status of organisms[2]. Haematological parameters are related to the blood and blood-forming organs. Indian runner duck belongs to order Anseriformes that includes swimmers and possesses a cosmopolitan distribution in different habit and habitats, whereas Japanese quail represents order Galliformes, ground feeding domesticated or game birds having cosmopolitan nature. Here an attempt has been made to establish a comparative profile between Indian runner duck (*Anas platyrhynchos*) and Japanese quail (*Coturnix coturnix japonica*) with respect to their terrestrial and aquatic habitat respectively.

2. Materials and Methods
The investigation was undertaken at Cytogenetics Laboratory of P.G. Department of Zoology, Utkal University, Vani Vihar, Bhubaneswar. Blood samples were collected from ten birds of each female species, i.e, Indian runner duck (*Anas platyrhynchos*) and female Japanese quail (*Coturnix coturnix japonica*) from the local poultry farm located at northern Bhubaneswar, Odisha. Samples were collected by venipuncturing of ulnar vein of birds and it was transferred to the anticoagulant vials containing ethylene diamine tetra-acetic acid (EDTA). Blood smears were prepared at site on clean grease free slides and fixed with methanol for later staining [3]. For haematological parameters, viz., haemoglobin (Hb), total erythrocyte count (TEC), total leucocyte count(TLC) and packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC), the following procedures were adopted. The Haemoglobin concentration (Hb) was measured by Sahli's method [4]. RBC and WBC were determined using a Neubauer's haemocytometer. Haematocrit or PCV was determined by centrifuging blood at 3,500 rpm for 15 minutes by Wintrobe hematocrit tube method[5] and expressed in percentage. Erythrocyte indices such as MCV, MCH and MCHC were calculated according to standard formulae [6].
The slides were stained with Leishman's stain and observed under Hund Weltzar photomicroscope for differential leukocyte count. The data were analyzed statistically and presented as Mean±Standard Error (SE) by using statistical software Microsoft office excel 2007 and one way analysis of variance (ANOVA). Differences were classified as significant at p< 0.05, p< 0.01 and p< 0.001.

3. Results and Discussion

In the present study, hematology and differential leukocyte count of adult female Indian runner duck and Japanese quail (Table 1 and Fig.1) have been undertaken. The mean number of RBC in female Indian runner duck was 2.46±0.11 millions/mm^3 of blood where as in female Japanese quail it was 2.16±0.84 millions/mm^3 of blood. The number of RBCs remained more in Indian runner duck than Japanese quail. This difference was statistically significant at p<0.05. The reason for the differences may be due to differences in species or it may be due to environmental factors. The haemoglobin concentration (g/dl) of female Indian runner duck was observed to be 13.76±0.31 and in case of female Japanese quail it was 10.09±0.49. This indicates that it is significant (p<0.001) in female Indian runner duck than that of female Japanese quail. PCV, MCV and MCH (p<0.001) of female Indian runner duck are higher in comparison to Japanese quail. In case of Indian runner duck, females have higher erythrocyte count and PCV during pre-nesting period[7]. The packed cell volume (PCV) values were almost three times the values of Hb%. The mean packed cell volume (PCV) was more in female Indian runner duck (41.24±1.40) than that of female Japanese quail.

The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) of the female Indian runner duck were observed to be 192.21±7.66, 64.15±2.13, 33.59±1.08 where as in female Japanese quail, the value was 127.59±10.03, 42.16±48 and 33.19±0.3 respectively. However, the increase or decrease in values of PCV depends on metabolic rate [8]. PCV, MCV and MCH show highly significant (p<0.001). The present study revealed an increased value for total leucocyte count of Japanese quail at p<0.05 in comparison to that of female Indian runner duck. Also, monocyte revealed significant differences at p<0.01 level where as the percentage of MCHC, lymphocyte, heterophil, eosinophil, basophil showed no significant difference (Table 1).

Hematological values are influenced by various factors including breed, sex, age and reproductive status, circadian rhythm, handling procedure and nutrition status of animal[9]. The differences among these birds are due to different habitats they inhabit; however, some similarities are also noticed as they have common ancestry. MCV measures the average size of individual red blood cell [10]. Accelerated erythropoiesis may also cause an increase in MCV values when iron is abundant in surroundings. Erythropoietin enables release of large amount of reticulocyte into the circulation and consequently increasing the MCV values and this increase in MCV usually preceded by acute or severe haemorrhagic or haemolytic anaemia [11]. However, variation in the values of the PCV, Hb and MCHC does not appear to be age related while variations in the values of MCV and MCHC may be dependent of age as reported by same authors [12]. As both MCH and MCHC are directly proportional with the Hb concentration, an increase in Hb will elevate MCH and MCHC. This observation is in agreement with earlier findings, in other species of birds, such as captive waterfowl [7].

Table 1: Hematological parameters of female Indian runner duck and Japanese quail

Serial No.	Parameters	Indian runner duck (n=10)	Japanese Quail (n=10)	F value
1	Hb(g/dl)	13.76±0.31	10.09±0.49	38.63***
2	RBC(millions/mm³)	2.46±0.11	2.16±0.84	4.58*
3	WBC(thousands/mm³)	6282±343.23	8968±1088.40	5.53*
4	PCV (%)	41.24±1.40	30.62±1.67	23.57***
5	MCV (fl)	192.21±7.66	127.59±10.30	25.29***
6	MCH (pg)	64.15±2.13	42.16±3.48	29.00***
7	MCHC (%)	33.59±1.08	33.19±1.03	0.07^{NS}
8	Lymphocyte (%)	41.3±3.09	43.2±2.29	0.24^{NS}
9	Monocyte (%)	22.9±1.9	15.5±0.98	11.97**
10	Heterophil (%)	23±3.69	31±1.94	3.67^{NS}
11	Eosinophil (%)	10.8±0.59	9.2±1.12	1.58^{NS}
12	Basophil (%)	2±0.49	1.1±0.34	2.21^{NS}

Note: * significant at (p<0.05), ** significant at P<0.01, *** significant at P<0.001 and not significant (NS)

Increase in leucocytes may occur due to some parasitic infections and may influence haematological values [13] which could be a contributing factor. During present investigations, abnormality in monocyte count was noticed which is possibly be due to chronic active inflammation, that lead to heterophilia and monocytosis [14] (Fig. 2). Aggregations of RBC in both cases have been observed. Hence, the data presented in this study may serve as an important reference point for future health related and diagnostically integrated health studies of poultry birds.

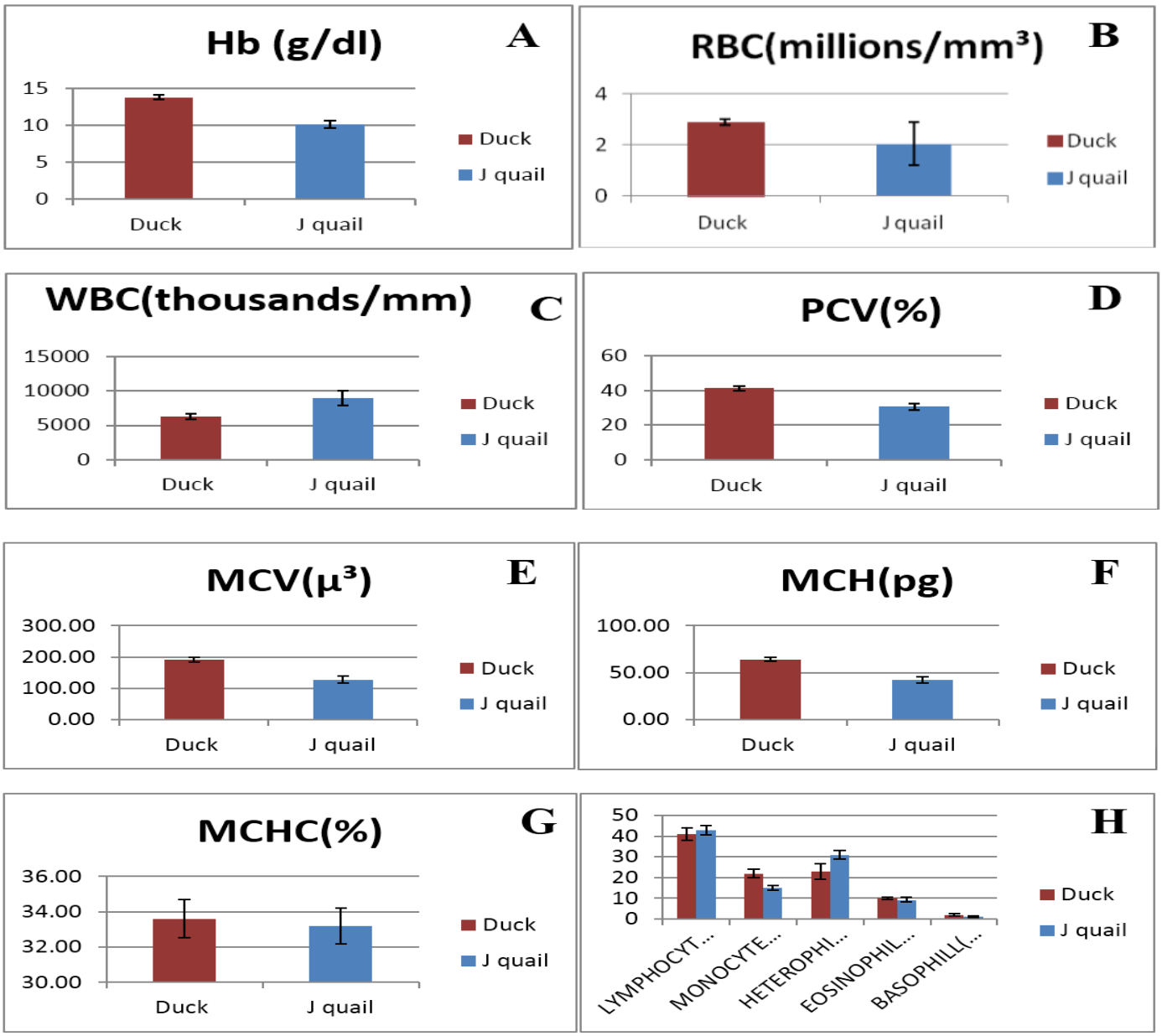
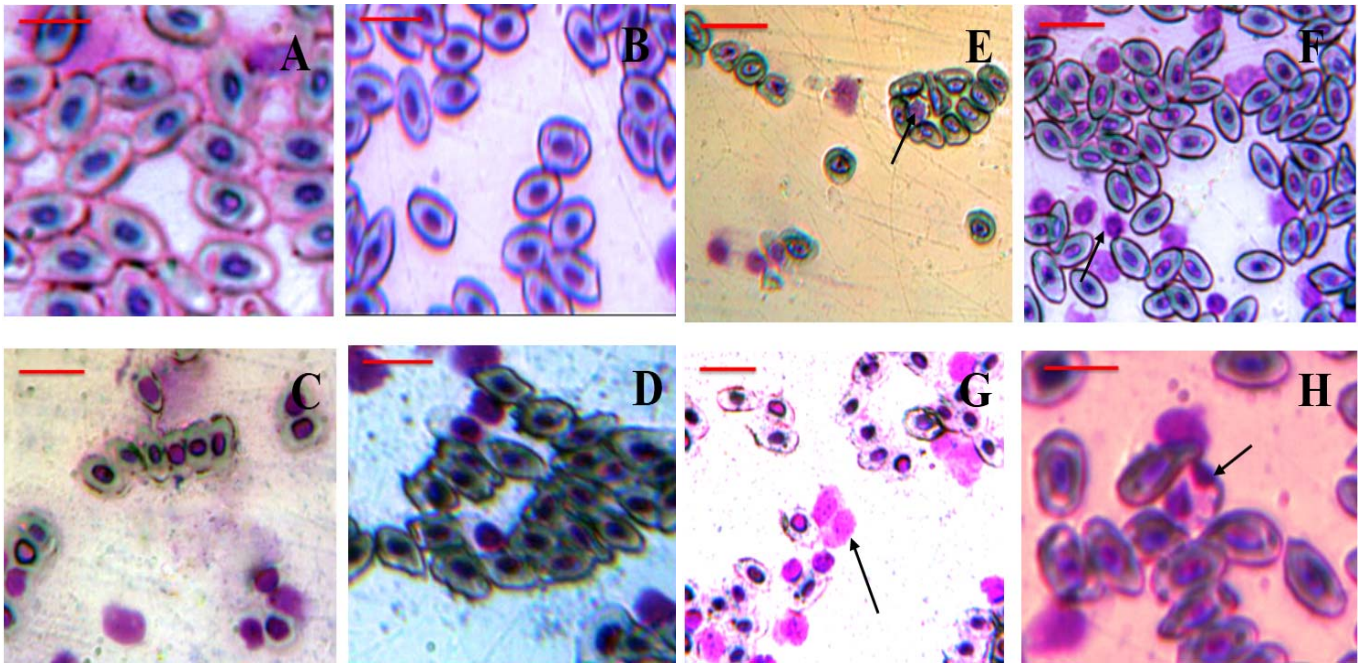


Fig 1: Haematological differences in Indian runner duck and Japanese quail (A) Hb (B) RBC (C) WBC (D) PCV (E) MCV (F) MCH (G) MCHC and (H) DLC.



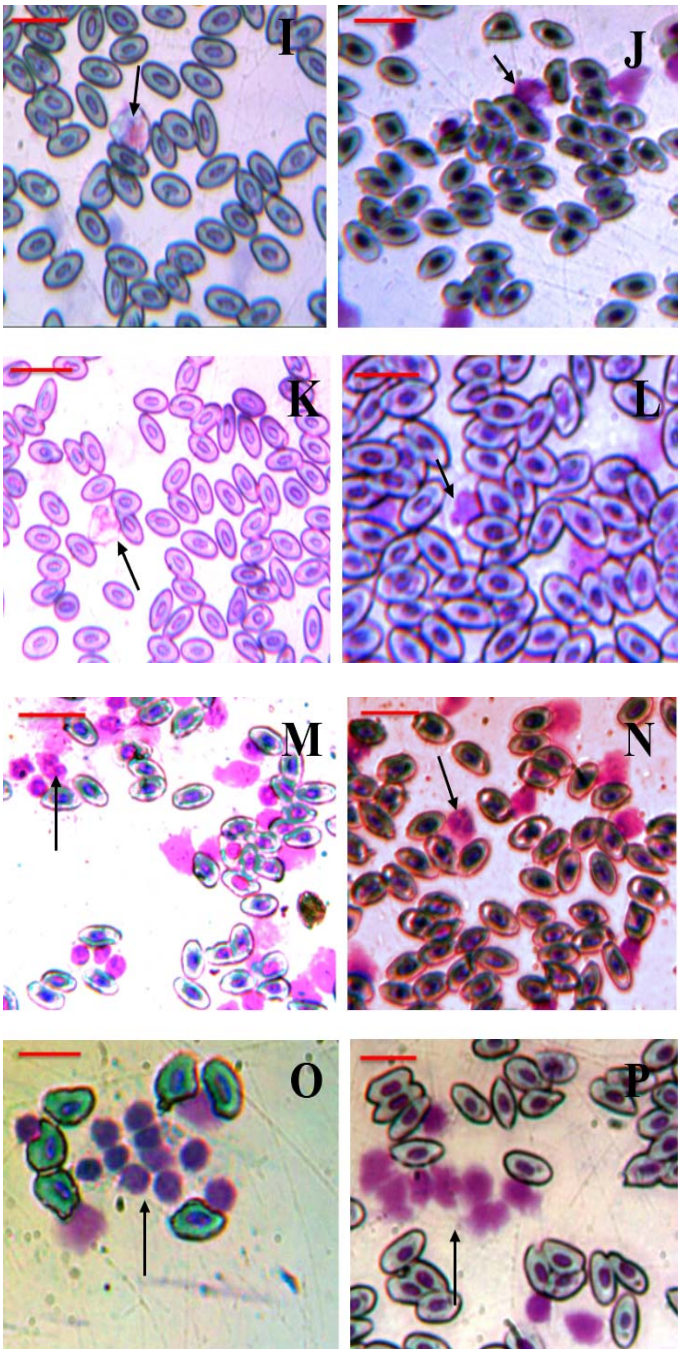


Fig 2: Blood cells of Indian runner duck and Japanese quail (A) and (B) RBC of duck and quail, (C) and (D) Aggregated RBC of duck and quail, (E) and (F) Lymphocyte of duck and quail, (G) and (H) Eosinophil of duck and quail, (I) and (J) Monocyte of duck and quail, (K) and (L) Abnormal monocyte of duck and quail, (M) and (N) Heterophil of duck and quail, (O) and (P) Thrombocytes of duck and quail (Scale: It means figures are captured at 40X with scale length 10 micron).

4. Conclusion

This study presents information on comparative haematology of the terrestrial poultry bird Japanese quail (*Coturnix coturnix japonica*) and aquatic bird Indian runner duck (*Anas platyrhynchos*) which can serve as a means to evaluate the physiological conditions and health status of poultry birds. This may be a useful indicator of status of their environment. As the threshold values of haematological data, for such parameters in poultry sector still remains incomplete and inadequate, the present data represent a baseline value, which may provide better understanding of different poultry birds dwelling in different natural habitats.

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