

Original Article

Revision of some mensural measurements, food preference, and haematological parameters in breeding pairs of blue rock pigeon, *Columba livia* sampled from punjab Pakistan

Revisão de algumas medidas mensurais, preferência alimentar e parâmetros hematológicos em pares de criação de pombo blue rock (*Columba livia*), amostragem de punjab, Paquistão

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Abstract

The present study describes the haematological profile, feeding preference, and comparison of morphometric characters of blue rock pigeon (*Columba livia*) breeding pairs. For this purpose, 25 pairs (25 samples per sex) were sampled through Mist nets from district Okara and Bahawalnagar, Punjab, Pakistan. Birds were then anaesthetized with a combination of ketamine HCL (10 mg/kg) and diazepam (0.2 mg/kg) and subjected to morphometric measurements. 5µL blood also was taken from the jugular vein of each anaesthetized bird for haematological analysis. Few pairs were also dissected to remove gastrointestinal tracts (GITs) for food preferences. Results revealed that there are no significant differences in the haematological parameters and feeding preference of breeding pairs of *Columba livia*. The gut analysis further revealed, the major portion of gut contents consisted of pea and corn in most of the pairs. Regarding the mensural measurements, significant differences were recorded in the body weight, length of the longest primary feather, and chest circumference, whereas the rest of the studied parameters remain nonsignificant between sexes. So, it is concluded that apart from 3 morphometric parameters (body weight, length of longest primary feather and chest circumference), both sexes are alike in term of morphometry, haematology and food preference.

Keywords: *Columba livia*, feeding preference, haematology, biometrics, Pakistan.

Resumo

O presente estudo descreve o perfil hematológico, a preferência alimentar e a comparação de caracteres morfométricos de casais reprodutores de pombo-rocha (*Columba livia*). Para tanto, 25 pares (25 amostras por sexo) foram amostrados por meio de redes de névoa do distrito de Okara e Bahawalnagar, Punjab, Paquistão. As aves foram então anestesiadas com uma combinação de cetamina HCL (10 mg/kg) e diazepam (0,2 mg/kg) e submetidas a medidas morfométricas; 5 µL de sangue também foram retirados da veia jugular de cada ave anestesiada para análise hematológica. Poucos pares também foram dissecados para remover o trato gastrointestinal (GITs) para preferências alimentares. Os resultados revelaram que não há diferenças significativas nos parâmetros hematológicos e na preferência alimentar dos casais reprodutores de *Columba livia*. A análise intestinal revelou ainda que a maior parte do conteúdo intestinal consistia em ervilha e milho na maioria dos pares. Em relação às medidas mensurais, foram registradas diferenças significativas no peso corporal, comprimento da pena primária mais longa e circunferência torácica, enquanto os demais parâmetros estudados permanecem não significativos entre os sexos. Assim, conclui-se que além de três parâmetros morfométricos (peso corporal, comprimento da pena primária mais longa e circunferência torácica), ambos os sexos são semelhantes em termos de morfometria, hematologia e preferência alimentar.

Palavras-chave: *Columba livia*, preferência alimentar, hematologia, biometria, Paquistão.

1. Introduction

The blue rock pigeon is a common bird throughout its range, which includes Bhutan, Nepal, India, Bangladesh, and Pakistan. This bird species is also observed in western

and southern Europe and North Africa (Ali and Ripley, 1983). In Pakistan, blue rock pigeons are found all around the country, except on the high plateaus and in the desert

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areas (Gibbs et al., 2001; Robert, 1991). They are also adapted to man-made structures such as bridges with emerald straps, long concrete plates, and brick or stone buildings (Ali et al., 2013; Haag, 1988; Sacchi et al., 2002).

A clinical haematological profile is necessary for the evaluation of the health profile of any organism (Pavlak et al., 2005). This clinical technique is used to evaluate avian activity, the health, and the physical state of living organisms (Tras et al., 2000). Many studies on the haematology of the blue rock pigeon have been published. Khan et al. (2011) described normal values of complete blood count, (Gayathri and Hegde, 1994) reported some sexual differences in haematology, Gylstorff (1983) reported the effect of age on haematology, and Pavlak et al. (2005) reported haematological differences related to age, gender, and season in blue rock pigeon. This technique may also aid in the management and improvement of pigeon breeding or the breeding program (Král and Suchý, 2000). As a result, the goal of this study is to establish a reference value for haematological parameters.

The blue rock pigeon is considered 'granivorous' in feeding and is closely related to human settlements due to its domestic origin. The birds are diurnal foragers who fly in large flocks and travel about 3-8 km per day in search of food. They also damage food crops while collecting grains (Baldaccini et al., 2000). These grains are from cereal crops, brassica, lentils, chickpea, and mug beans (Robert, 1991). They also feed on the seeds of trees, herbs, millet, and ground net (Ibrahim and Abdu, 1992).

Morphometry is a general technique to identify and distinguish between the sexes of the same species. It also gives information related to the age, status and size of birds (Leisler, 1972). The physical measurement of wings and tails is important in the monitoring of flight as well as the migratory patterns of some birds. They also describe the flight characteristics and energetics of birds (Pilastro et al., 1995). Morphometric measurement can also be used for scientific study, e.g. sex differences, geological separation of the same species, and for the other characteristics of birds (Töpfer, 2018).

The main objective of our study was to report the haematological profile, feeding preference, and morphometry of blue rock pigeon samples from Punjab, Pakistan, and to provide standard reference haematological and morphometric values for studies to be conducted in the future.

2. Material and Methods

2.1. Sample areas

Blue rock pigeons (25 samples per sex) were sampled from cultivable fields through mist nets from the districts of Okara (31°05'51.0"N 73°32'36.0"E; 31°02'31.0"N 73°35'38.0"E; 31°02'18.0"N 73°31'20.0"E) and Bahawalnagar (30°12'12.0"N 73°43'17.0"E), Punjab, Pakistan. This area is semi-dry, with temperature ranges of between 15-25°C and 16-26°C respectively, especially in the winter season. The sampling was done between December 2018 to March 2019.

2.2. Morphometry

After capturing, the birds were anaesthetized with a combination of ketamine HCL (10 mg/kg) and diazepam (0.2 mg/kg) and subjected to morphometric measurements. Body weight was taken by using an electronic balance (0.001g). Body length, wingspan, wing length, length of the longest primary feather, tail length, tarsus, central toe length, chest circumference, bill size, and head size were recorded according to Eck et al. (2012) and Semakula et al. (2011).

2.3. Sample collection and haematological analysis

For haematology, 5µL blood was also taken from the jugular vein in an EDTA tube of each anaesthetized bird. An automatic haematological analyzer was used for the haematological profile. The recorded haematological parameters included haemoglobin concentration (Hb), White blood cells (WBCs) counts, Red blood cells (RBCs) counts, Packed cell volume (PCV), Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), Mean corpuscular haemoglobin concentration (MCHC), platelets, Red cell distribution width (RDW), Platelet distribution width (PDW), Mean platelet volume (MPV), Neutrophils, Lymphocyte, Monocyte, and Eosinophil. Animal ethics were ensured by all means.

2.4. Feeding analysis

Few pairs were also dissected to remove gastrointestinal tracts (GITs) for food preferences. Each gastrointestinal tract was stored in a 30% formalin solution. Each stomach was dissected to remove the food contents, washed properly and identified using a dissecting microscope (2-4X, IRMECO) with the help of descriptions and diagrams available for seed identification (Martin and Barkley, 1961).

2.5. Statistical analysis

The data was described using standard statistical methods, including means, SE, and range (SPSS v21). The significant difference was tested through an unpaired t-test at a 0.05 confidence level.

3. Results

The results of haematology showed non-significant differences in all parameters between male and female blue rock pigeon (Table 1).

Gut analysis also showed a non-significant difference in the weight of total food material, grains, pebbles, and digested material in both sexes (Table 2). However, the percentage of each type of food material was slightly different in male and female blue rock pigeon (Table 3).

The body weight, length of the longest primary feather, and chest circumference were the morphometric parameters that differed significantly in male and female (Figure 1 and Figure 2) while rest of the parameters were non-significant between breeding pairs (Table 4).

Table 1. Haematological profile of male and female blue rock pigeon.

Parameters	Gender		Mean	Range	SE	p-value
	n= 25 from each sex					
Hb (g/dl)	Male		21.57	19.4-23.9	1.06	0.5301 ^{NS}
	Female		22.93	20.7-25.8	1.23	
WBCs (*10 ³ /ul)	Male		386.33	383-390	1.66	0.5406 ^{NS}
	Female		384.67	382-387	1.19	
Total RBCs (million/cmm)	Male		3.27	2.5-3.7	0.31	0.8098 ^{NS}
	Female		3.13	2.5-3.7	0.28	
HCT/PCV (%)	Male		53.80	52.2-55.1	0.69	0.8914 ^{NS}
	Female		53.63	52.5-55.1	0.63	
MCV (fl)	Male		15.67	13-19	1.44	0.9999 ^{NS}
	Female		15.67	13-18	1.19	
MCH (%)	Male		59.63	56.3-63.2	1.63	0.4465 ^{NS}
	Female		57.47	54.6-60.2	1.32	
MCHC (%)	Male		38.17	34.5-40.5	1.52	0.894 ^{NS}
	Female		38.47	36.7-40.2	0.83	
Plateletes (*10 ³ /ul)	Male		16.33	13-20	1.66	0.9001 ^{NS}
	Female		16.67	14-19	1.19	
RDW (fl)	Male		45.87	43.7-47.5	0.92	0.8356 ^{NS}
	Female		45.47	43.5-48.2	1.15	
PDW (fl)	Male		16.83	14.6-19.7	1.23	0.1483 ^{NS}
	Female		13.70	12.1-15.2	0.73	
MPV (fl)	Male		12.00	9-16	1.70	0.41 ^{NS}
	Female		14.33	12-17	1.19	
Neutrophils (%)	Male		84.67	83-86	0.72	0.2417 ^{NS}
	Female		82.33	80-85	1.19	
Lymphocytes (%)	Male		8.00	7-8	0.47	0.3465 ^{NS}
	Female		6.33	4-9	1.19	
Monocytes (%)	Male		2.00	1-2	0.47	0.7247 ^{NS}
	Female		2.33	1-3	0.54	
Eosinophils (%)	Male		2.33	2-2	0.27	0.6779 ^{NS}
	Female		2.67	2-4	0.54	

^{NS} = Non-significant (P>0.05); SE = Standard error.

Table 2. Comparisons of different feeding content in male and female blue rock pigeon.

Types of food	Gender	N	Mean	SD	SE	t-value	P-value
Total weight of gut (g)	Male	25	9.17	1.31	0.46	0.09	0.932 ^{NS}
	Female	25	9.12	0.87	0.31		
Weight of empty gut (g)	Male	25	6.73	0.87	0.31	0.32	0.753 ^{NS}
	Female	25	6.50	0.60	0.21		
Weight of total food material (g)	Male	25	2.44	0.49	0.17	-0.17	0.869 ^{NS}
	Female	25	2.62	0.37	0.13		
Weight of grains (g)	Male	25	0.66	0.18	0.06	0.01	0.989 ^{NS}
	Female	25	0.59	0.44	0.15		
Weight of pebbles (g)	Male	25	0.60	0.06	0.02	-0.11	0.912 ^{NS}
	Female	25	0.72	0.37	0.13		
Weight of digested material (g)	Male	25	1.22	0.80	0.28	0.11	0.917 ^{NS}
	Female	25	1.02	0.21	0.07		

SD= Standard deviation; SE = Standard error.

4. Discussion

Although our study did not show any significant differences in breeding pairs of *Columba livia*, however, the mean values of haemoglobin concentration, MCH, MCV and MCH were found to be higher than Khan et al. (2011). Further, the numbers of total WBCs were significantly lower (383000-390000) than the findings of Khan et al. (2011) (860000-5320000). The remaining parameters are reported for the first time in the present study. The haematological profile is critical for monitoring the health of living organisms (Prinzinger and Misovic, 2010). Ihedioha et al. (2016) described no significant difference in hemoglobin concentration of male and female domestic pigeon. However, they found significant differences in other haematological parameters (PCV, heterophil, monocytes, basophils, lymphocytes and eosinophil).

The values of haematological profiles such as RBCs and WBCs and their parameters are high in pigeons as compared to other avian species, but these values are related to ducks and domestic fowls (Gayathri and Hegde, 1994). This occurred due to the high metabolic rate and powerful flight of the pigeons. Many studies reported that haematological profiles in the non-breeding season

are significantly high because of many hormonal actions as well. Prolactin was also higher in the blood plasma of nonbreeding male pigeons than in females (Hall et al., 1986).

Blue rock pigeons are granivorous in nature. They have adapted themselves to living in a man-made structure. From the present study, it is concluded that *Columba livia* feeds on different types of grains and pebbles. Corn, maize, peas, wheat, and rice are among the grains consumed by the *Columba livia*. Pebbles were also observed in the GIT. They used small pebbles for the grinding, breaking down and digestion of large-sized grains. Our study was supported Ali and Ripley (1983), Batool et al. (2020), Kaur and Dhanju (2013) and Robert (1991).

Body weight, body length, tail length, wingspan, length of the longest primary feather, chest circumference, head size, bill length, tarsus, and central toe length were the parameters described in the current study for blue rock pigeon morphometric analysis. The average body weight of an adult blue rock pigeon was 298.88 ± 10.26 in male and 280 ± 17.43 in females that were similar to the results described by Bhowmik et al. (2014) and Hena et al. (2012).

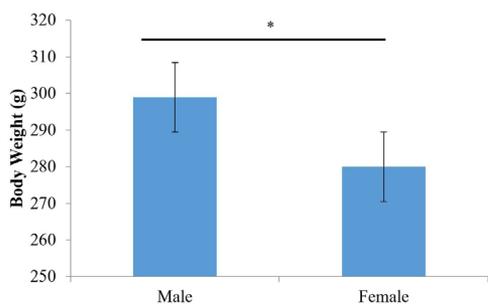


Figure 1. Comparison of body weight between male and female blue rock pigeon (* = p <0.05)

Table 3. Percentage of different type of grains and pebbles in all samples.

Type of Food	Percentage by weight of food material (%)	
	Male (n=25)	Female (n=25)
Pebbles	23.68	30.78
Corn	10.28	12.31
Pea	13.29	11.21
Rice	1.30	0.61
Wheat	1.77	1.24
Rice husk	0.33	0.00
Digested material	49.34	43.86

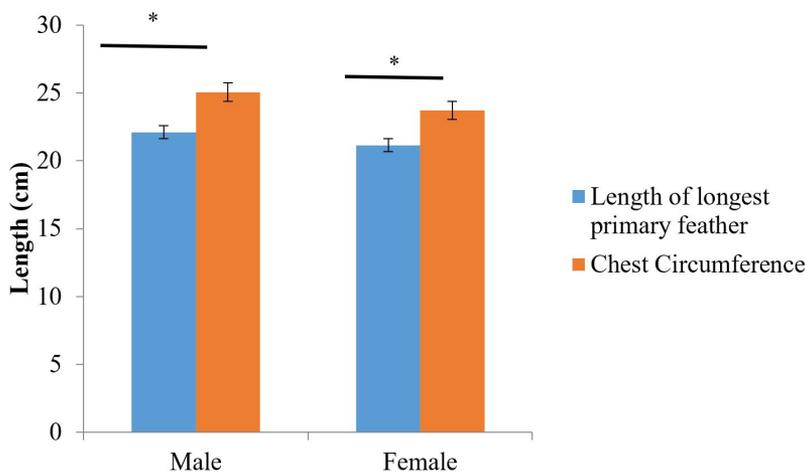


Figure 2. Comparison of length of the longest primary feather and chest circumference between male and female blue rock pigeon (* = p <0.05)

Table 4. Comparisons in morphometry of male and female blue rock pigeon.

Characters	Gender		Mean	Range	SE	P-value
	n = 25 from each					
Body Weight (g)	Male		298.88	275-310	3.36	0.0270*
	Female		280	252 - 308	6.16	
Body Length (cm)	Male		32.91	31.7-34.5	0.31	0.4217 ^{NS}
	Female		32.51	31 - 34	0.33	
Wingspan (cm)	Male		62.24	58.4-65.7	0.88	0.3322 ^{NS}
	Female		60.98	56.7 - 64.6	0.77	
Wing length (cm)	Male		26.23	23.5-28.1	0.46	0.7229 ^{NS}
	Female		26.45	24.7 - 27.9	0.36	
Length of longest primary feather (cm)	Male		22.11	21-23.2	0.23	0.0164*
	Female		21.14	20.3 - 22.6	0.24	
Chest circumference (cm)	Male		25.05	24-27	0.38	0.0139*
	Female		23.70	23 - 25	0.24	
Head size (cm)	Male		6.4	4.4-7.4	0.92	0.2218 ^{NS}
	Female		5.9	5.2-6.8	0.26	
Bill length (cm)	Male		2.76	1.4-3.4	0.24	0.3815 ^{NS}
	Female		2.49	1.9 - 3.4	0.15	
Tarsus (cm)	Male		3.10	2.4-3.7	0.12	0.7432 ^{NS}
	Female		3.16	2.7 - 3.8	0.12	
Central toe length (cm)	Male		3.74	3.1-4.6	0.15	0.2184 ^{NS}
	Female		3.51	3.2 - 3.8	0.06	
Tail Length (cm)	Male		11.15	9-12.7	0.40	0.7861 ^{NS}
	Female		11.01	9.8 - 11.8	0.23	

^{NS} = Non-significant (P>0.05); SE = Standard error; * = Significant (P<0.05).

The average wing length in our study was 26.23 ± 1.29 for male and 26.45 ± 1.02 for females which were also supported by Ali and Ripley (1983) and Vaurie (1965). The outcomes of our study were also similar to Robert (1991) in the case of body length, bill length, wingspan and tail length, while the remaining morphometric parameters in our study were reported for the very first time.

5. Conclusion

This study revealed no significant difference in feeding contents and haematological profile in breeding pairs of blue rock pigeon. Only body weight, length of the longest primary feather and chest circumference were significantly different. Both sexes showed same feeding preferences for grains and seeds.

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