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ORIGINAL ARTICLE

A Comparative Study of Morphometric Profiles and Hematological Analysis and Food Preference Between Male and Female Spotted Redshank (*Tringa erythropus*) Sampled from Different Wetlands of Punjab, Pakistan

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ABSTRACT

Background: Spotted redshank (*Tringa erythropus*) is a shorebird. Morphometric and feeding studies on birds were very important to understanding geographic distribution and it plays a key role in conservation of particular species.

Objective: The present research was conducted to investigate hematological variation, food preference, and morphometric profiles of the spotted redshank (*Tringa erythropus*).

Methods: Twenty samples (n = 10 for each sex) were collected from different wetlands. Blood was collected for hematological analysis and measuring tape was used for mensural profiles. For gut analysis, stomach was removed.

Results: Results showed that body weight of males was heavier than body weight of females. All parameters, like body weight, body length, total wing span, primary wing, tarsal, meta-tarsal, body circumference, and tail length had greater values in males as compared with females, except head size. The male head size was smaller than the female head size. A significant difference was recorded in all blood parameters except hemoglobin and monocytes between the both sexes. Analysis of gut showed that the spotted redshank mostly feeds on *Ceratopogonidae* and larvae of *Chironomidae*.

Conclusion: It is concluded that a significant difference was observed in morphometric profiles and hematological analysis and food preference between male and female spotted redshank (*Tringa erythropus*).

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INTRODUCTION

The spotted redshank is one of several species of shorebirds that migrate annually [1]. This specie was located in Great Britain, Greece, Egypt, southern Iraq, Yemen, Bangladesh, Burma, north eastern and north western India, Malaysia, Taiwan, Iran, southern China, Ireland, western France, parts of Turkey, Italy, central Africa and Vietnam [2]. Spotted redshanks are accidental wanderers in eastern North America. The spotted redshank bird is a prominent Palearctic bird that breeds in the northern part of this region and migrates to warmer climates in Africa, India, and Southeast Asia during the winter [3].

Morphometric studies on birds was very important to understanding geographic distribution and it plays a key role in conservation of particular species [4]. The spotted redshank bird is a 32-cm-long, medium-sized shorebird [5]. In breeding plumage, adults are spectacular because of their complete black appearance [6]. The bill is black towards the tip and dark red at the base [7]. Every part of its body from the top of its head to the bottom of its tail is black. Even the wings are black with white spots around the feather tips [8]. During flying, the upper wing is lighter in colour towards the secondary edge and within the wing, while the primary remains their usual black shade. wing underside is complete white [7]. There are dark spots and light bars across the tail, giving it a striped look [8]. Legs of this bird are red and long [9]. Its crown is black, and there is a white eye stripe that extends from the top of the bill, across the eye, and down the side of the head. This bird feeds in shallow marshes, estuaries, and ponds [10]. In the autumn, it is a non-descript-looking bird and can easily be overlooked [11].

Although animal physiologists have for a long time depended on a variety of blood indicators to evaluate the interactions between animals and their environments. It is a more common practise to analyse the physiological properties of blood in order to better understand the ecological and evolutionary processes that are taking place within populations of vertebrates. The interpretation of avian blood cells presents a number of challenges; the outcome of a haematology test is used by a veterinarian to assist in determining whether or not an avian is healthy. Present research was conducted to investigate the differences in morphometric characteristics, hematological and food preference between male and female spotted redshank.

MATERIALS AND METHODS

Ethical Approval

In this research work, all actions carried out on birds in accordance with Ethical Committee of University of Okara, Punjab, Pakistan (UO/ERC/2022/34B).

Study Area

Samples of birds were taken from different wetlands of Punjab, Pakistan. Birds were standard guests of that place. The normal annual temperature in Punjab is 39 °C, and the normal yearly rainfall is 15.26 ± 0.22 cm. An investigation was started at the start of winter (December, 2020) to start of summer (March, 2021). Twenty samples (10 individuals from each gender) were collected from the different sites for mensural measurements, hematology, and food preference.

Morphometric Parameters

Body mass was measured with an electrical balance. Wing span, body weight, primary wing, tail length, tarsal, metatarsal, body circumference, beak length, and head length were noted through the use of measuring tape. The length of the body was measured from the tip of the beak to the end of the tail. After measurements and blood samples, some birds were released in their habitat.

Hematological Analysis

After catching the bird accurately and gently, blood was collected by means of a syringe below the skin or the jugular vein and stored in EDTA tubes for hematological analysis following safety rules. Hematological parameters such as white blood cells, packed-cell volume, red blood cells, mean corpuscular volume, mean corpuscular hemoglobin concentration, mean corpuscular hemoglobin, platelets, mean platelet volume, red cell distribution width, neutrophils, lymphocytes, and eosinocytes were analyzed using automatic hematology analyzer.

Food Preference

After dissection, stomach of birds was removed and stored in separate polythene bags, tagged, and then transported to the laboratory in an icebox. Stomach was dissected and cleaned using conventional process testing sieves and content of each stomach was collected for further process. The contents of the gastrointestinal tract were examined under the microscope (IRMECO-SESYG306). The gut material was separated and then identified through using descriptions and through images of seeds that were readily accessible.

Statistical Analysis

All data values were studied using standard statistical methods like mean and standard deviation using IBM SPSS version 21. The importance of the difference was analyzed using a paired t-test at 0.05 level of significance.

RESULTS

Morphometric Study

A morphometric study was conducted on 20 randomly sampled birds, including 10 male and 10 female samples. Overall data is represented in Table **1**. Body weight, total length, total wing span, single wing span, primary wing, tarsal, metatarsal, tail length, body circumference, beak length, and head size were measured. A significant difference was observed between body weight, total wingspan, primary wingspan, metatarsal, and circumference of the chest in both sexes (Table **1**).

Hematological Analysis

Results of hematological parameters including hemoglobin, white blood cells, red blood cells, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), platelets, packed cell volume (PCV), mean platelet volume (MPV), red cell distribution width (RDW), monocytes, lymphocytes, neutrophils and eosinophils were shown in Figures **1** and **2**. A significant difference was recorded in all blood parameters except haemoglobin and monocytes between male and female sexes.

Table 1. Comparison of morphometric parameters between female and male spotted redshank.

Variables	Sex (n=10 each)	Mean ± SD	Ranges	T-value	P-value
Body weight (g)	Male	150.7 ± 3.69	145.3-156.6	2.412	0.0391*
	Female	141.9 ± 10.75	116.8-153.0		
Total body length (cm)	Male	31.04 ± 1.35	28.5-32.7	2.194	0.0559 NS
	Female	29.11 ± 1.98	26.1-31.8		
Tail length (cm)	Male	6.80 ±0.66	6.0-7.8	2.084	0.0669 NS
	Female	6.26 ± 0.32	5.7-6.7		
Total wing span (cm)	Male	50.92 ± 2.09	47.8-54.0	2.981	0.0154*
	Female	47.71 ± 3.13	44.2-52.3		
Single wing span (cm)	Male	22.68 ± 1.18	21.1-24.1	0.0995	0.9229 NS
	Female	22.78 ± 2.83	20.2-28.1		
Primary wing span (cm)	Male	16.85 ± 0.61	16.2-17.9	2.266	0.0497*
	Female	16.27 ± 0.80	15.2-17.8		
Tarsal (cm)	Male	5.59 ± 0.39	4.9-6.2	0.659	0.5258 NS
	Female	5.47 ± 0.45	4.8-6.0		
Meta tarsal (cm)	Male	3.94 ± 0.38	3.2-4.4	2.437	0.0375*
	Female	3.27 ± 0.65	2.3-4.3		
Circumferences (cm)	Male	18.82 ± 0.65	18.0-19.6	2.417	0.0388*
	Female	17.73 ± 1.59	16.1-20.4		
Head width (cm)	Male	2.91 ± 0.18	2.6-2.9	1.681	0.1272 NS
	Female	3.08 ± 0.25	2.8-3.7		
Beak length (cm)	Male	5.69 ± 0.27	5.3-6.1	1.380	0.2010 NS
	Female	5.46 ± 0.49	4.8-6.3		

(* = Significant (P<0.05), NS = Non-significant (P>0.05), SD = Standard deviation)

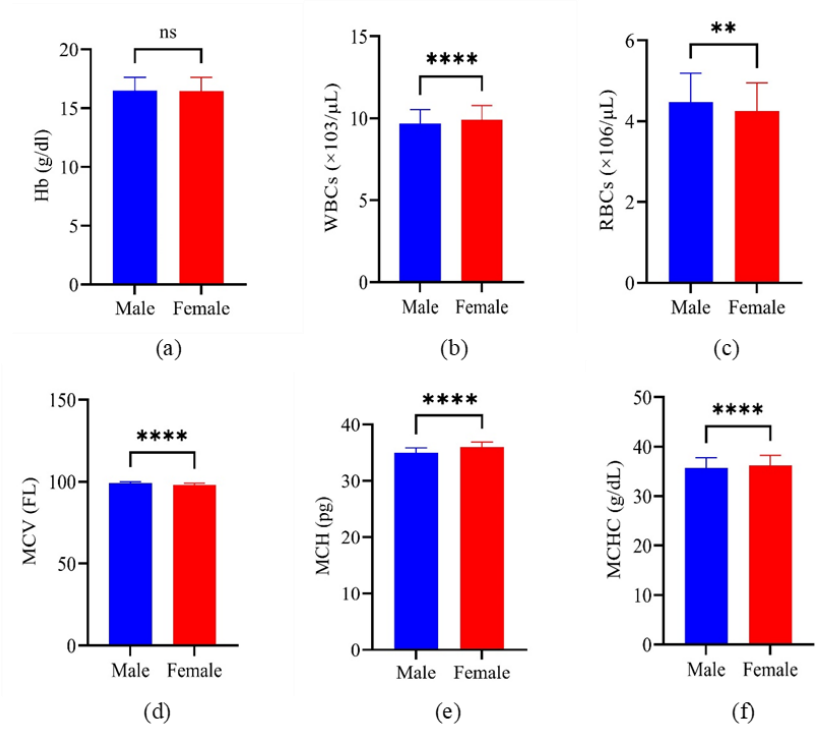

Figure 1. Comparison of (a) Hemoglobin, (b) White Blood Cells, (c) Red Blood Cells, (d) MCV, (e) MCH and (f) MCHC between male and female spotted redshank.

(= p < 0.05, ** = p < 0.01, *** = p < 0.001, **** = p < 0.0001)*

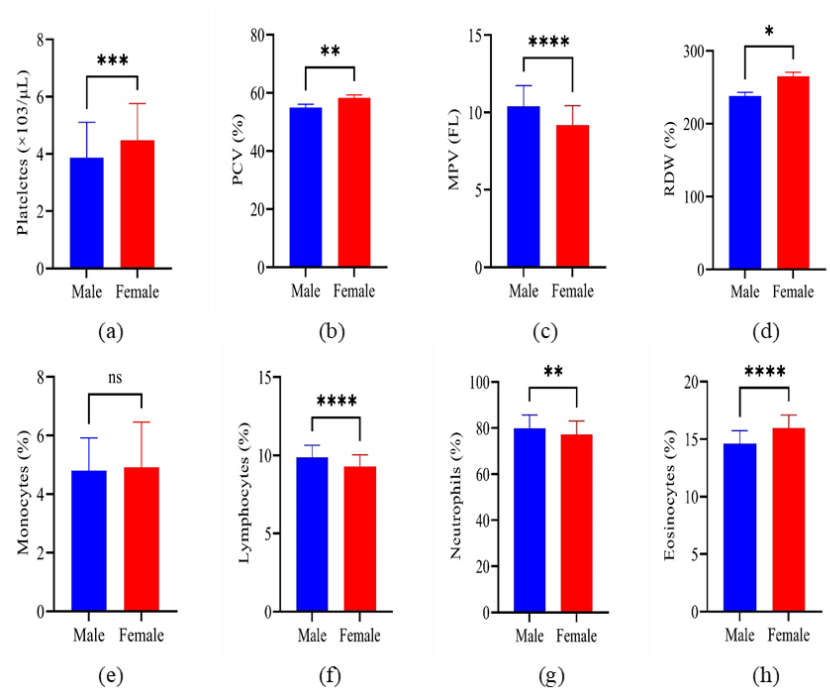

Figure 2. Comparison of (a) Platelets, (b) PCV, (c) MPV, (d) RDW, (e) Monocytes, (f) Lymphocytes, (g) Neutrophils and (h) Eosinophils between male and female spotted redshank

(= p < 0.05, ** = p < 0.01, *** = p < 0.001, **** = p < 0.0001)*

Food Preferences

The contents of the stomach were contained of larvae belonging to the families *Ceratopogonidae* and *Chironomidae*. The insects belonged to the families *Haliplidae*, *Odonata* and *Coleoptera*. In addition, plant matter and snails were found in the stomachs of the specimens. No significant difference between the male and female spotted redshank was observed when it came to the mean weight of gut, empty stomach, or the mean gut contents (Table **2**). There were no significant differences between male and female birds in the content of their guts; nevertheless, males did not have any insects from the order *Hemiptera* or *Odonata* in their food, while females did not have any insects from the family Ceratopogonidae or snails in their diet (Table **3**).

Table 2. Weight of gut parameters of spotted redshank (NS = non-significant).

Variables	Sex (n=10 each)	Mean ± SD	SE	P-value
Gut weight (g)	Male	2.36 ± 0.47	0.30	0.69 NS
	Female	2.43 ± 0.73	0.13	
Food material weight (g)	Male	0.58 ± 0.28	0.16	0.76 NS
	Female	0.87 ± 0.64	0.08	
Empty gut weight (g)	Male	1.78 ± 0.31	0.26	0.79 NS
	Female	1.56 ± 0.39	0.07	

Table 3. Weight of different food content in gut of spotted redshank.

Food Type	Sex (n=10 each)	Food Content (g)
Coleoptera	Male	7.61
	Female	7.47
Stones	Male	13.82
	Female	6.48
Odonata	Male	0.00
	Female	1.53
Haliplidae	Male	0.21
	Female	0.33
Hemiptera	Male	0.00
	Female	0.09
Chironomidae	Male	35.80
	Female	39.61
Ceratopogonidae	Male	0.40
	Female	0.00
Digested food	Male	40.60
	Female	42.46
Plant material	Male	0.89
	Female	1.78
Snails	Male	0.47
	Female	0.00

DISCUSSION

The present study was conducted to evaluate the blood parameters, mensural profiles, and food preference of spotted redshanks (*Tringa erythropus*) in different captive facilities from different wetlands of Punjab, Pakistan. A total of 20 bird samples (10 ♂, 10 ♀) of healthy spotted redshank were collected from all the captive facilities for determination of feeding activity, hematological and morphometric analysis. In this research work, body weight, total length, total wingspan, single wingspan, primary wing, tarsal, metatarsal, tail length, body circumference, beak length, and head size were measured. A significant difference was observed between body weight, total wingspan, primary wingspan, metatarsal, and circumference of the chest in both sexes. No significant difference was recorded between total body length, tail length, single wing span, tarsal, head size and beak length in both male and female spotted redshank. Previously, no literature was reported about the comparison of morphometry between male and female spotted redshank. The spotted redshank is a large shorebird. The average weight, length and wingspan of this bird are 121 to 205 g, 29–31 cm and 61–67 cm, respectively [5]. It has dark plumage for breeding, but in the winter, it becomes much paler. Between the months of August and February, juveniles go through a partial molt [12]. In breeding locations, male and female sandpipers weighed 135–170 g and 127–226 g, respectively; in wintering areas, the weights dropped to 97–166 g and 98–166 g, respectively [13].

Hematological parameters are useful tools for assessing the health status of mammals and birds [14, 15]. This tool also provides immunological status, information about the health status of animals, damage caused by harmful chemicals, and parasitic infections. The results of the current study provide biochemical reference values for birds of the same species. In this study significant difference was observed in all blood parameters except haemoglobin and monocytes between male and female sexes. All hematological parameters were higher than previous literature reported by Akmal, Ahmad [15] and Gaspar, Bargallo [14]. The higher concentrations of MCV, RBC, and MCH may be due to the high consumption of oxygen due to the intensive and frequent activities of male spotted redshank. Additionally, this could be one reason for higher levels of MCV, RBCs, and MCH to meet the oxygen needs of their growing bodies [16]. Platelets prevent blood loss at the site of vascular damage through a complicated clotting factor mechanism [17]. There is no discernible difference between the various bird species in terms of the ratio of hemoglobin to erythrocyte surface area. Even when different physiological and environmental conditions are present, the changes in the quantity and size of erythrocytes always progress in proportion to the changes in hemoglobin concentration. This is the case regardless of the specific circumstances. In the lungs of birds, this kind of adaptation seems to provide the best possible results for the process of blood oxygen saturation. which is kept at a pace that is rather constant because of the existence of air sacs and the exchange of gas that takes place between the blood and the air in the pulmonary capillaries in a cross-current fashion. It is anticipated that the hematocrit and hemoglobin concentrations would have a correlation in birds [18]. Significant post-treatment differences in dove were indicated in total white blood cells, heterophil lymphocytes, eosinophils, and monocytes [19].

Spotted redshanks mostly feed on the larvae of *Coleoptera*, *Chironomidae*, and *Diptera*. Some other invertebrate families, such as the *Haliplidae, Ceratopogonidae* and *Odonata* were found in a very few numbers of specimens. Other writers have documented findings that are comparable to these [20, 21]. Furthermore, just a few samples included plant matter.

CONCLUSION

Conclusion of current research stated that female and male spotted redshank have same morphometric measurements (except body weight, total wing span, primary wingspan, metatarsus, and body circumference), and significant differences were recorded between haematological variables (except haemoglobin and monocytes). Further, the stomach contents of the spotted redshank consist of *Coleoptera* and *Chironomidae* larvae along with adult *Ceratopogonidae*.

CONFLICT OF INTEREST

No potential conflict of interest was reported by all authors.

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