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Study On Different Hematological Parameters And Heavy Metals Detection In Common Redshank (Tringa Totanus) In Okara, Punjab, Pakistan

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Abstract

The Common Redshank (Tringa totanus) is a wading bird found in wetlands, marshes, and coastal regions across Africa, Asia, and Europe. Research on hematological parameters aids in understanding the health status of bird species like the Common Redshank. This study focuses on evaluating blood hematology and detecting heavy metals to assess stress levels of heavy metals in these birds. The research was carried out at three different sites in the district Okara, Punjab, Pakistan. We analyzed 30 blood samples for hematology variables which[1] suggested that all parameter doses did not show significant differences between males and females except Mean platelet volume (MPV) which shows a significant difference (P=0.0001). Five heavy metals including Lead (Pb), Chromium (Cr), Cadmium (Cd), Nickel (Ni), and Zinc (Zn) were detected. The concentration of Pb is higher than other studied metals in all samples. The hematological profile can indeed be impacted by elevated Pb levels in the body because Pb impacts on morphology of RBCs and platelets. Cd was not detected in the kidney and liver and it was present in low levels in the muscle (0.02ug/g). This indicates that the environmental Cd exposure is low. Samples were taken from various wetlands, where contamination is attributed to industrial activities such as leather and textile industries. The hematological and heavy metal content of common redshanks is not documented in scientific literature, particularly in Punjab, Pakistan. As a result, this study establishes a baseline for the next investigations focused on conservation and preservation initiatives for the common redshank environment in this area.

Keywords: *Avian Hematology, Metal Toxicology, Redshank.*

INTRODUCTION

Common Redshank (Tringa totanus) belongs to Kingdom Animalia, Phylum Chordata, Class Aves, Order Charadriiformes, Family Scolopacidae, and Genus Tringa. Tringa tetanus is a thrush-sized, white-rumped, tail-bobbing Eurasian wading wary (having the ability to fight) and noisy bird. This bird is widely distributed and most abundant in some regions. This species of bird is Least Concern by the IUCN. When disturbed, Redshank is the first to get panicked

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and give alarm calls to other waders (Acheson, 2023). Avian hematology is an essential diagnostic tool for evaluating unwell birds as well as for doing routine evaluations of young healthy birds. To make an appropriate diagnosis, blood profiles should be analyzed along with other essential pieces of information. A thorough history, clinical examination, further clinical pathology (such as fecal investigation), and imaging, typically in the form of orthogonal whole-body radiographs, are common components of a solid foundation (Low et al., 2006). Veterinary medicine can also benefit from knowledge of bird hematology, and these values can be employed as physiological indicators. When birds are kept in cage systems, hematological values are frequently employed as a health indicator to identify stress brought on by a variety of factors, including environmental, dietary, and pathological features (Hauptmanová et al., 2006; Bounou et al., 2000; Schmidt et al., 2007; Islam et al., 2004).

Due to mounting evidence that bird populations are especially susceptible to the impacts of human influence on the environment, the potential use of birds as environmental pollution monitors has been acknowledged since the 1960s (Bilal et al., 2021; Schutten et al., 2023). The position of these birds at the top of the food chain and the spatial integration of pollutant levels throughout their vast home ranges, birds of prey are among the bird species that are utilized in biomonitoring research the most frequently (Morrissey et al., 2023; Khan et al., 2023; Ratajc et al., 2023; Sattar et al., 2024).

Heavy metal detection provides a useful baseline for bio-monitoring of the contaminants in an area (Garg et al., 2022; Malik & Zeb, 2009). Heavy metal contamination is affecting the functional and structural integrity of the ecosystem. An explosive increase in urban activities is a cause of extensive environmental pollution (Tovar-Sánchez et al., 2018; Basharat et al., 2024). Heavy metal contamination in marshland is dangerous for water quality, leading to bad effects on aquatic fauna and flora. Organic and inorganic toxicants can bio-accumulate in the essential organs of different living organisms with time (Brraich & Jangu, 2015). Heavy metals affect birds more than other animals due to their having high metabolic rate (Eeva et al., 2003). The concentrations of heavy metals are generally not gender biased, but they affect when a bird is migrating from one area to another. Most elements show no significant differences between genders and between localities. Toxic element levels in waders are dependent on the migration distance. It is often observed that Cd accumulates in the liver and kidney with age (Migula & Augustyniak, 2000). The avian population is facing stress from different chemical toxicants due to increased industries in Pakistan especially Punjab (Qaisar et al., 2022; Bilal et al., 2024). So, the present study was planned to evaluate the hematological parameters and detection of heavy metals in the liver, muscles, and kidney of common redshank collected from different wetlands of the district Okara, Punjab, Pakistan.

MATERIALS AND METHODS

Study Area

The research was carried out from three different sites of District Okara, Punjab, Pakistan like Lower Bari Doab Canal (LBDC) (30°48'32.58" N, 73°27'2.9556" E), Satluj River (30°22'60" N, 73°51'0" E), Renala Khurd (30°48'17.51" N, 73°35'59.99" E). The Common Redshanks are regular visitors of the study area, commonly seen in the evening around sunset. The average annual temperature in the study area is 39 °C and receives an average annual rainfall of 15.26 ± 0.22 cm (Saeed et al., 2017).

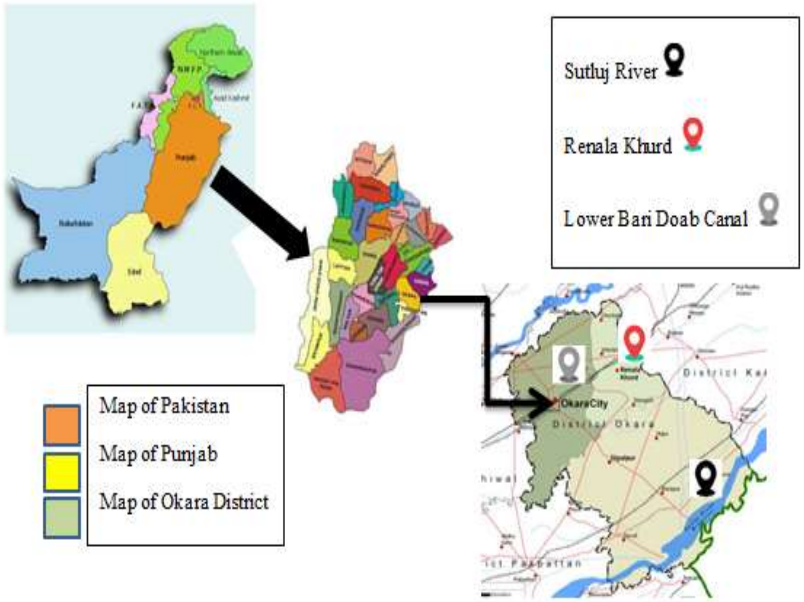

Figure 1: Google map of the study area

Samples Collection

The study area was visited during November and March 2023 to hunt Common Red-Shank. A total of 30 sexually mature specimens of both genders (15 males, and 15 females) were captured. The identification of male and female samples was done by using a morphometric key (Meissner et al., 2018). This collection was done in collaboration with the Punjab Wildlife Research Centre (Pakistan) and with taking help of local hunters holding hunting licenses.

Hematological Analysis

Each anesthetized bird had 5 µL of blood drawn from the jugular vein into an EDTA tube for hematology purposes. For the hematological profile, an automated hematological analyzer (Seamaty SMT-50) was utilized. The recorded hematological parameters included hemoglobin concentration (Hb), Packed cell volume (PCV), Mean corpuscular volume (MCV), White blood cells (WBCs) counts, Red blood cells (RBCs) counts, Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), Red cell distribution width (RDW), Platelet distribution width (PDW), and Mean platelet volume (MPV).

Heavy Metals Analysis

Heavy metal detection requires organ and body parts like the liver, kidney, and muscle tissues to be taken with the help of a surgical blade. The entire organ and body parts were dried in an oven at 100°C and ground to a powdered form in a grinder. Trace metals were analyzed by digestion of 10 g of ground sample in the conical flask and with 4ml of HNO_3 (conc.) and left overnight at room temperature. The following day 2 ml of H_2O_2 was added to the samples and heated on the hot plate, up to 120oC, and distilled water to make a volume of 50 ml. These samples were stored in the refrigerator until analysis (Aslam et al., 2021). Calibration curves were prepared separately for each metal by using different concentrations (i.e., 0.5, 1, 2, 5, and 10 ppm) of standard solutions. After a 6-fold dilution of the digested tissues with ultrapure water (MilliQ; Bedford, MA), Cd, Cu, Zn, Pb, Cd, and Ni concentrations were measured using an inductively coupled plasma–mass spectrometer (inductively coupled plasma–mass spectrometer 7500; Agilent). Detection limits were 0.003 lg Cd l -1, 0.003 lg Cu l -1, 0.01 lg, Zn l -1, 0.002 lg Pb l -1, 0. 007 lg Ni l-1.

Statistical Analysis

Data was tabulated and statistically analyzed by using relevant statistical methods (mean, standard error of mean, range). The significance of the difference between male and female gender was tested using paired T-test at 0.05 levels (Rizwan et al., 2021). Pearson correlation coefficient was calculated between different variables.

RESULTS

Data collected on different hematological variables of the Common Redshank sample is presented in Table 1. After applying statistical analysis there is no statistically significant difference between the hematological parameters except MPV (fL). Its p value is 0.0001 which is considered to be extremely statistically significant.

Five heavy metals like Lead (Pb), Chromium (Cr), Cadmium (Cd), Nickel (Ni), and Zinc (Zn) were detected in the current research work shown in Table 2. Lead Pb was present in the highest concentrations in different tissues as compared with other studied metals. Mean value of Pb in muscle (Min= 8.80µg) and (Max=8.350µg), liver (Min=8.310 µg) and (Max=8.350 µg) and in kidney (Min=8.020 µg) and (Max=8.060 µg). The hematological profile can indeed be impacted by elevated lead levels in the body. Lead poisoning can cause the blood to react in different ways like anemia, Changes in Red Blood Cell morphology, and effects on platelets. The concentrations of remaining metals are given in Table 2.

Table 1: Mean value range and standard deviation of Different hematology variables in Common Redshanks

Parameters	**Gender**	**Range**	**Mean**	**SEM**	**P Value**
WBC (10^3/µL)	Female	391.2-385.5	387.94	0.434	0.541^{NS}
	Male	393-386	389.46	0.541	
RBC (10^6/µL)	Female	4.09-4.01	4.03	0.007	0.6718^{NS}
	Male	4.12-4.01	4.06	0.008	
Hb (g/dL)	Female	21.9-21	21.19	0.055	0.1269^{NS}
	Male	24-20.1	21.8	0.319	
HCT (%)	Female	58.9-57.8	58.29	0.081	0.9490^{NS}
	Male	63-57	59.26	0.46	
MCV (fL)	Female	145-143.8	144.56	0.094	0.1977^{NS}
	Male	154-140.74	145.76	0.916	
MCH (pg)	Female	52.9-51.8	52.46	0.091	0.1662^{NS}
	Male	58.2-50.12	53.39	0.657	

MCHC (g/dL)	Female	36.8-36.1	36.39	0.056	0.6154 NS
	Male	39.34-33.8	36.60	0.412	
PLT ($\times10^3/\mu L$)	Female	12-11	11.53	0.13	0.1867 NS
	Male	13-10	11.86	0.21	
RDW-(fL)	Female	32.9-32.2	32.54	0.055	0.1135 NS
	Male	33.7-30.4	32.16	0.238	
PDW (fL)	Female	14.9-14.3	14.68	0.043	0.3242 NS
	Male	16-13	14.93	0.247	
MPV (fL)	Female	9.8-9.4	9.57	0.035	0.0001*
	Male	13-10	11.06	0.26	
NS: Not significant difference, *: Significant difference					

Table 2: Heavy Metals Concentration in different tissues of Common Redshanks

N = 30 for all samples

Metal	**Organ**	**Number of Samples**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**SEM**
		N	**(µg)**	**(µg)**			
Zinc	Liver	30	1.130	1.150	1.14033	0.007184	0.00131
	Muscle	30	1.670	1.690	1.68000	.008305	0.00152
	Kidney	30	0.840	0.880	.86000	.016609	0.00304
Cadmium	Liver	30	0.000	0.000	0.00000	0.000000	0
	Muscle	30	0.010	0.030	.02067	.008277	0.00151
	Kidney	30	0.000	0.000	0.00000	0.000000	0
Nickel	Liver	30	2.060	2.090	2.07333	.012685	0.00232
	Muscle	30	1.840	1.880	1.86000	.016609	0.00304
	Kidney	30	2.050	2.090	2.07000	.016609	0.00304
Lead	Liver	30	8.310	8.350	8.33000	.016609	0.00304
	Muscle	30	8.800	8.840	8.82000	.016609	0.00304
	Kidney	30	8.020	8.060	8.04000	.016609	0.00304
Chromium	Liver	30	0.450	0.460	.45700	.004661	0.00085
	Muscle	30	0.350	0.370	.36000	.005252	0.00096
	Kidney	30	0.250	0.290	.27000	.012865	0.00235

A negative correlation is present between muscle Cr and kidney Cr (r=-0.408, df = 29, P>0.05), Muscle Zinc correlated with kidney Zn(r=0.700, df = 29, P>0.01,d.f=29), liver Nickel(r=-.982, P>0.01,d.f=29), Muscle Nickel(r=1.00, P>0.01,d.f=29), Liver Lead(r=1, P>0.01,d.f=29), Muscle Lead(r=1, P>0.01,d.f=29) and Kidney Lead(r=1, P>0.01,d.f=29) are significantly correlated with each other(P>0.01, d.f=29), Liver Nickel and Muscle Zinc are negatively correlated with each other(P>0.01, r=-.982,d.f=29).

Levels of Zinc in kidneys were significantly correlated with Zinc in muscles (r=0.700, P>0.01,d.f=29), Nickel in muscles (r=0.700, P>0.01,d.f=29), Lead in the liver (r=0.700, P>0.01,d.f=29), Lead in muscles (r=0.700, P>0.01, d.f=29) and Lead in kidneys (r=0.700, P>0.01,d.f=29). Kidney Zinc and Liver Nickel (r=-0.655, P>0.01, d.f=29) are negatively correlated to each other(r=-6.55, P>0.02, d.f=29). Muscle Cadmium is significantly correlated with Liver Zinc(r=0.402, P>0.05, d.f=29)

Liver Ni is negatively correlated with muscle Zn (r=-0.982, df = 29, P>0.01), kidney Zn(r=-0.655, df = 29, P>0.01),,muscle Ni(r=-0.982, df = 29, P>0.01),kidney Nic(r=-0.982, df – 29, P>0.01),liver Pb(r=-0.982,f =m29, P>0.01, muscle lead(r=-0.982, df = 29, P>0.01), and kidney Pb(r=-0.982,df = 29, P>0.01).

Muscle Ni is significantly correlated with Muscle Zinc(r=1,P>0.01,d.f=29),Kidney Zinc(r=-0.700,P>0.01,d.f=29),Muscle Lead(r=1,P>0.01,d.f=29), (r=1,P>0.01,d.f=29),and Kidney Lead(r=1,P>0.01,d.f=29), while Muscle Nickel showed negative correlation between Liver Nickel(r=-0.982,P>0.01,d.f=29), and Kidney Nickel(r=-1,P>0.01,d.f=29),

Kidney Nickel is negatively correlated with Muscle Zinc(r=-1,P>0.01,d.f=29), Kidney Zinc (r=-0.700,P>0.01,d.f=29), Muscle Nickel (r=-1,P>0.01,d.f=29), Liver Lead (r=-1,P>0.05,d.f=29), Muscle Lead (r=--1,P>0.01,d.f=29), and Kidney Lead (r=-1.00,P>0.01,d.f=29), while Kidney Nickel and Liver Nickel show positive correlation(r=0.982,P>0.01,d.f=29).

Liver lead show positive correlation with Muscle Zinc(r=1, P>0.01,d.f=29), Kidney Zinc (r=0.700, P>0.01,d.f=29)Muscle Nickel(r=1, P>0.01,d.f=29) Muscle Lead(r=1, P>0.01,d.f=29) and Kidney Lead(r=1, P>0.01,d.f=29), while Liver Lead showed negative correlation with Liver Nickel (r=-1.00, P>0.01,d.f=29) Kidney Nickel. (r=-1.00, P>0.01,d.f=29)

Muscle Lead is significantly correlated with Muscle Zinc(r=1.00, P>0.01,d.f=29), Kidney Zinc(r=.700, P>0.01,d.f=29), Muscle Nickel(r=1, P>0.01,d.f=29),,Liver Lead(r=1.00, P>0.01,d.f=29) and Kidney Lead(r=1, P>0.01,d.f=29)while Muscle Lead showed negative correlation with Liver Nickel(r=0.982, P>0.01,d.f=29), Kidney Nickel(r=1.00, P>0.01,d.f=29)

Kidney Lead is positively correlated with Muscle Zinc (r=1, P>0.01,d.f=29), Kidney Zinc(r=0.700, P>0.01,d.f=29), Muscle Nickel(r=1, P>0.01,d.f=29) Liver Lead (r=1, P>0.01,d.f=29)and Muscle Lead(r=1, P>0.01,d.f=29), while Kidney Lead is negatively correlated with Liver Nickel(r=0.982, P>0.01,d.f=29),Kidney Nickel(r=-1, P>0.01,d.f=29)

Table 3: Pearson Correlation Matrix of Different Metals in Liver, Muscle, and Kidney of Common Redshank

		Muscle Chromium	**Liver Zinc**	**Muscle Zinc**	**Kidney Zinc**	**Liver Nickel**	**Muscle Nickel**	**Kidney Nickel**	**Liver Lead**	**Muscle Lead**	**Kidney Lead**
Kidney Chromium	R	-.408*									
Muscle Zinc	R				.700**	-.982**	1.000**	-1.000**	1.000**	1.000**	1.000**
Kidney Zinc	R			.700**		-.655**	.700**	-.700**	.700**	.700**	.700**
Muscle Cadmium	R		.402*								
Liver Nickle	R			-.982**	-.655**		-.982**	.982**	-.982**	-.982**	-.982**
Muscle Nickle	R			1.000**	.700**	-.982**		-1.000**	1.000**	1.000**	1.000**
Kidney Nickle	R			-1.000**	-.700**	.982**	-1.000**		-1.000**	-1.000**	-1.000**
Liver Lead	R			1.000**	.700**	-.982**	1.000**	-1.000**		1.000**	1.000**
Muscle Lead	R			1.000**	.700**	-.982**	1.000**	-1.000**	1.000**		1.000**
Kidney Lead	R			1.000**	.700**	-.982**	1.000**	-1.000**	1.000**	1.000**	

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation matrix of five different metals viz Cd, Cr, Pb, Zn, and Ni in the liver showed non-significant differences except between Cadmium and Lead, Nickel and Lead which showed -0.866 and -0.982 correlation respectively at 0.01 level of significance.

Table 4: Correlation matrix of metals in the liver of Common Redshank

		Liver Chromium	**Liver Zinc**	**Liver Cadmium**	**Liver Nickel**	**Liver Lead**
Liver Chromium	R	1	-.278		-.117	.178
	Sig. (2-tailed)		.137		.539	.346
Liver Zinc	R	-.278	1		.177	-.173
	Sig. (2-tailed)	.137			.351	.359
Liver Cadmium	R					
	Sig. (2-tailed)					
Liver Nickel	R	-.117	.177		1	-.982**
	Sig. (2-tailed)	.539	.351			.000
Liver Lead	R	.178	-.173		-.982**	1
	Sig. (2-tailed)	.346	.359		.000	

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation matrix of five different metals viz Cd, Cr, Pb, Zn, and Ni in muscle showed a slight correlation, i.e. Zinc and Nickel correlate 01, same is the case with Zinc and Lead, both combinations showed a correlation value of 1 at 0.01 level of significance.

Table 5: Correlation matrix of metals in muscles of Common Redshank

Variable	**Correlation** / **Significance**	**Muscle Chromium**	**Muscle Zinc**	**Muscle Cadmium**	**Muscle Nickel**	**Muscle Lead**
Muscle Chromium	R	1	-0.158	-0.079	-0.158	-0.158
	Sig.		0.404	0.677	0.404	0.404
Muscle Zinc	R	-0.158	1	0	1.000**	1.000**
	Sig	0.404		1	0	0
Muscle Cadmium	R	-0.079	0	1	0	0
	Sig.	0.677	1		1	1

Muscle Nickel	R	-0.158	1.000^{**}	0	1	1.000^{**}
	Sig.	0.404	0	1		0
Muscle Lead	R	-0.158	1.000^{**}	0	1.000^{**}	1
	Sig.	0.404	0	1	0	
**. Correlation is significant at the 0.01 level (2-tailed).						

The correlation matrix of five different metals viz Cd, Cr, Pb, Zn, and Ni in the kidney showed a slight correlation, i.e. Zinc and Nickel have a negative correlation of .70(P>0.01), Nickle and Lead, showed correlation value of 1 (P>0.01) Pb and Zn also showed correlation with each other of 0.70(P>0.01). (Table)

Table 6: Correlation matrix of metals in the Kidney of Common Redshank

		Kidney Chromium	Kidney Zinc	Kidney Cadmium	Kidney Nickle	Kidney Lead
Kidney Chromium	r	1	-0.194		0	0
	Sig. (2-tailed)		0.305	.	1	1
Kidney Zinc	r	-0.194	1		$-.700^{**}$	$.700^{**}$
	Sig. (2-tailed)	0.305		.	0	0
Kidney Cadmium	r					
	Sig. (2-tailed)	.	.		.	.
Kidney Nickle	r	0	$-.700^{**}$		1	-1.000^{**}
	Sig. (2-tailed)	1	0	.		0
Kidney Lead	r	0	$.700^{**}$		-1.000^{**}	1
	Sig. (2-tailed)	1	0		0	
**. Correlation is significant at the 0.01 level (2-tailed).						

DISCUSSION

There has been an increase in hematological research on various facts of the biochemistry and physiology of birds, especially when it comes to figuring out what normal blood parameter values should be. Because it provides biological information on these species, their biology, and the detection of potential disease states, avian hematology has been used in ornithological studies (Granthon & Williams, 2017). Numerous variables, including physiologic state, age, sex, nutritional status, circadian rhythm, seasonal changes, and others, are known to affect hematological values, including chemical components (Ferrer et al., 2023; Baumbusch et al., 2021). In the current study, our main focus is to evaluate blood hematology and heavy metal detection of common redshanks collected from different wetlands of Punjab Pakistan.

In this study, there was a significant difference between the male and female sexes in every blood parameter except for MPV. Its p value is 0.0001 which is considered to be extremely statistically significant. Every hematological metric was smaller than those found in other studies by (Akmal et al., 2023; Gaspar et al., 2020) and larger than the values of (Ahmad et al., 2023). In the current study, the values of HB and RBCs are larger in males as compared to females. The increased oxygen consumption brought on by the male common redshank's frequent and intense activity may be the cause of the greater amounts of HB, WBCs, MCV, RBC, MCH, etc. Moreover, this may be one of the causes of their increased MCV, RBC, and MCH levels to fulfill their bodies' increasing oxygen requirements (Minias et al., 2020). In the current study, the number of platelets is larger in males as compared to females. Platelets use a complex clotting factor mechanism to stop blood loss at the site of vascular injury. Regarding the ratio of hemoglobin to erythrocyte surface area, there is no obvious variation among the different species of birds. In addition, regardless of the particular conditions, changes in the quantity and size of erythrocytes always progress in proportion to changes in hemoglobin concentration. In the case of birds' lungs, this type of adaptation appears to yield the best outcomes for the process of blood oxygen saturation, which is maintained at a relatively constant pace due to the presence of air sacs and the crosscurrent gas exchange between the blood and the air in the pulmonary capillaries (Sang et al., 2020). In birds, a link between the hematocrit and hemoglobin concentrations is expected. There were noticeable post-treatment variations in Dove (Columbidae) eosinophils, monocytes, heterophils, lymphocytes, and total white blood cells (Butrimavičienė et al., 2021; Noor et al., 2024). The value of HGB in female and male common redshanks matches with blue rock pigeon (Columba livia) remaining values like RBCs, WBCs, HCT, MCH, and MCHC, are greater than those blue rock pigeon (Columba livia) and platelets count, PDW, RDW, MPV in Common Redshanks are less than blue rock pigeon (Columba livia) (Aslam et al., 2021).

Befouling of heavy metals has been of great concern especially in water bodies, because of their intrinsic toxicity, extensive accessibility, and persistence. Due to its persistent and non-biodegradable nature, heavy metals accumulate in vital organs in the body, including kidneys, bones, and liver, and have serious health concerns. Five heavy metals, viz., Lead (Pb), Chromium (Cr), Cadmium (Cd), Nickle (Ni), and Zinc (Zn) were detected in the current research work. Mean value of Pb in muscle (Min=8.80) and (Max=8.350), liver (Min=8.310) and (Max=8.350) and in kidney (Min =8.020) and (Max=8.060) that is match with the some previous literature that is conducted on some other seabirds (Barbieri et al., 2010; Costa et al., 2011; Mansouri et al., 2012). Our study also shows that the Pb values are less than (Malik and Zeb, 2009; Shehzad et al., 2022). The concentration of Zn in muscle (Min=1.130) and (Max=1.150), liver (Min=1.670) and (Max=1.690), and kidney (Min=0.840) and (Max=0.880). The concentration of Cd in muscle (Min=0.010) and (Max=0.030), liver (Min=0.000) and (Max=0.000), and kidney (Min=0.000) and (Max=0.000). Our finding shows that the concentration of Zn is less than in some previous studies (Barbieri et al., 2010; Costa et al., 2011; Mansouri et al., 2012; Malik and Zeb, 2009; Shahzad et al., 2022). Cd could not be detected in the liver and kidney of Common Redshank in current research work but in some other studies (Barbieri et al., 2010; Costa et al., 2011; Mansouri et al., 2012; Malik and Zeb, 2009; Shehzad et al., 2022) show that Cd is present in different avian species. The concentration of Ni in muscle (Min=1.840) and (Max=1.880), liver (Min=2.060) and (Max=2.090), and kidney (Min=2.050) and (Max=2.090).

The concentration of Ni is matched with (Costa et al., 2011) and less than that (Barbieri et al., 2010; Mansouri et al., 2012; Malik and Zeb,2009; Shehzad et al., 2022). The concentration of Cr in muscle (Min=0.350) and (Max=0.360), liver (Min=0.450) and (Max=0.460), and kidney (Min=0.250) and (Max=0.290). Similarly to Pd and Zn the concentration of Cr is also less than the literature (Barbieri et al., 2010; Costa et al., 2011; Mansouri et al., 2012; Malik and Zeb, 2009; Shehzad et al., 2022). In the current study, the concentration of Lead is higher than other studied metals in all samples. The hematological profile can indeed be impacted by elevated lead levels in the body. Lead poisoning can cause the blood to react in different ways. The body's ability to make hemoglobin is hampered by Lead. Red blood cells that have been exposed to Pb may undergo structural and morphological alterations that impair their capacity to perform as intended. White blood cells are essential parts of the immune system that fight infections, and lead poisoning may inhibit their growth and function. Additionally, exposure to lead may impact platelet function, resulting in heightened propensity for bleeding or bruising.

The samples were taken from different wetlands of the district Okara, Punjab, Pakistan. Because of industrial influences, such as leather industries, textile industries, chemicals industries, medicines industries, etc, are the main causes of this contamination (Qaisar et al., 2022; Afzal et al., 2024). The wastage of these industries, directly and indirectly, falls in these freshwater bodies like Lower Bari Doab Canal LBDC. Common redshanks (Tringa totanus) are a wading bird species found widely distributed and most abundant in some regions. This species of bird is the least concern by the IUCN. There is no scientific data available on the hematology and heavy metal in common redshanks all around the world, especially Punjab, Pakistan. So this is a baseline finding on the blood hematology and heavy metal detection of common redshanks in district Okara, Punjab, Pakistan. Future study is required on the same species in the same area to get comparable data that may be helpful for the conservation and preservation of Common Redshanks. Implement and enforce strict regulations on industrial emissions and waste disposal to limit the release of heavy metals into the environment. It is recommended that to determine the concentrations of heavy metals in the air, water, soil, and food, establishes routine monitoring procedures. This aids in tracking the reduction of exposure and locating the sources of pollution.

CONCLUSION

This study provides insight into the health and environmental conditions of the common redshank (Tringa totanus), a wading bird that can be found around the world. Bird populations are becoming more and more threatened by human activity, which emphasizes the necessity for careful observation and conservation measures. This study offers important new information by examining blood hematology and finding heavy metals in common redshanks from District Okara, Punjab, Pakistan. Possible physiological differences between male and female birds are highlighted by significant disparities in Mean Platelet Volume (MPV). The most common heavy metal found is Lead, which may affect the shape of platelets and red blood cells. On the other hand, low cadmium levels suggest little exposure to the environment. The study provides a basic understanding of the heavy metal content and hematological characteristics in common redshanks, especially about industrial contamination in Punjab, Pakistan. These results open the door to further studies to get comparable data on this species and focus on conservation and preservation programs for this species in the area. Enact and uphold stringent laws governing waste management and industrial emissions to reduce the amount of heavy metals released into the environment.

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