

## **The impact of lead and nickel in some hematological parameters in house sparrow (*Passer domesticus*)**

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### **ABSTRACT**

*The aim of this study was evaluation of environmental pollution with heavy metals such as Lead and Nickel on the living organisms in industrial areas, using the blood of House sparrow (*Passer domesticus*) as a bio-indicator of pollution by metals. For this purpose, a blood collection was performed on 32 house sparrows (*Passer domesticus*) males and females, which were captured in Mitrovica town (situated close to smelter “Trepqa”, down closed in 2000 year), Drenas town (near the Ferronickel smelter, pollution area) and in rural area (Ujmir village, not contaminated area). We have analyzed: number of RBC and WBC, hematocrit value (Hct) and hemoglobin count (Hgb) in blood of house sparrow. The results obtained indicate a reduction in the number of erythrocytes and leukocytes in significant degree ( $p < 0.01$ ) in the blood of sparrows caught in Drenas and Mitrovica compared with sparrows caught in Ujmir (control). Higher of hematocrit value ( $p < 0.001$ ) of sparrows caught in Ujmir compared with the sparrow population caught in Mitrovica and Drenas, while no significant differences in the amount of hemoglobin between the analyzed groups. However, the results are correlative; they “call” for further studies in the sparrow population and in the laboratory.*

**Keywords:** Metals, house sparrow, hematological parameters.

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### **INTRODUCTION**

Heavy metals as Lead and Nickel have toxic effects including both lethality and sublethal effects such as changes in behavior, development, reproduction, pathology biochemistry and hematology. The sources of heavy metals pollution include natural sources [1], mining or metal smelting [2], municipal waste, industrial effluents, application of sewage sludge and animal manure on agricultural land [3].

Hematology has an important role in the assessment of the health of birds. Many birds do not express clinical signs until late in a disease process and the signs that they do exhibit may be subtle and non-specific. Consequently, the use of hematological assays may aid in the early recognition of disease, thus facilitating the best opportunity for management and therapy to resolve the process [4]. In avian veterinary praxis the usefulness of blood test as complementary veterinary tools for the diagnosis is wide known. However, the performance of the blood test, obtaining enough samples, as well as the interpretation of the results still pose many difficulties in wild birds. The hematological values may be affected by time of day, moulting period, nutrition status, environmental conditions [5], [6], [7], [8].

In this study, we investigated hematology parameters as number of RBC and WBC, hematocrit value (Hct) and hemoglobin count (Hgb) in blood of house sparrow (*Passer domesticus*). The purpose of this study were the comparisons of blood parameters of house sparrow (*Passer domesticus*), caught in industrial polluted areas (Mitrovica and Drenas town) and reference areas (Ujmir village) to assess environmental pollution with heavy metals.

The chemical and physical forms of nickel and its salts strongly influence bioavailability and toxicity (WHO 1991). Nickel concentrations in the organs of most avian wildlife species in unpolluted ecosystems range from about 0.1 to 2.0 mg/kg d.w. and occasionally reach 5.0 mg/kg DW [9].

## MATERIALS AND METHODS

### Study areas:

The pollution of living environment in **Mitrovica** still presents an ecological problem (the area near foundry “Trepça” closed since 2000). The main recourses of pollution in Mitrovica, in the past had as starting point different technological departures (metals foundry, refinery, flotation, factory of accumulations and sulfuric acid battery) of “Trepça” combine and also superphosphates fertilizer factory. The work of these departments has made Mitrovica of the most polluted cities in Europe. The pollution level can be illustrated from some informations by Popovac [10], who find that the quantity of the emitted lead dust everyday from the Trepça foundry in 1979 was 5 to 6 tons. The concentration of lead in air in Mitrovica from the same period was 20-30  $\mu\text{g}/\text{m}^3$ . Trepça Foundry was closed in August 14<sup>th</sup> 2000 from the United States Forces. The research that was done from Shehu's [11], analysis of soil taken in the location around Mitrovica had notice high concentration. More than 13 years have passed by but the pollution left from Trepça's activities, threatens seriously the local environment and people's health.

**Drenas town** is located 20 kilometres far from Prishtina (capital of Republic of Kosovo) in the West. The smelter (Ferronickel) has operated since 1982. Ferronickeli has three open pit mines: the Dushkaja mine with estimated reserves of 6.2 million tonnes; the Suka mine-0.8 million tonnes and the Gllavica with 6.8 million tones. Ferronickeli smelter is well-known for final production of Ferro- nickel. In metallurgical processing the mineral base is treated by an oxide mineral of nickel (two sources) with the following average chemical structure: Ni+Co=1.2%; Fe=26.0%; SiO<sub>2</sub>=47.0%; CaO=2.5%; Cr<sub>2</sub>O<sub>3</sub>=1.2%; MgO=11.0%. The produced slag has the chemical structure as follow: Ni-0.08%; SiO<sub>2</sub> 55-57 %; MgO 10.0%; Fe total 20%; Ca) 4.0%. The capacity of the smelter in the technological lines (rotating furnace and electrical furnace) is about 12.000 t Ni/year [18]. In recent time, the smelter plant is active and it is known as “New CO Ferrocickel”.

### Blood samples and hematological analysis:

A blood collection was performed on 32 house sparrows (*Passer domesticus*) males and females, which were captured in Mitrovica town (situated close to smelter “Trepça”, down closed in 2000 year), Drenas town (near the Ferronickel smelter, pollution area) and in rural area (Ujmir village, not contaminated area). We have analyzed: number of RBC and WBC, hematocrit value (Hct) and hemoglobin count (Hgb) in blood of house sparrows. The determination of these indicators was done with an automatic device for hematological counting.

### Statistics:

Statistical elaboration of hematological parameters was done with the method ANOVA by determining the average of each indicator, standard deviation (SD), standard error of the average (SEM) and accuracy of difference through a Student test (tD). Probability was determined by a tabular method.

## RESULTS AND DISCUSSION

The results of our research on the number of erythrocytes (RBC), leukocytes (WBC), hematocrit value (Hct) and hemoglobin count (Hb) in the blood of house sparrow (*Passer domesticus*) caught in polluted industrial areas (Mitrovica and Drenas town) and reference area (Ujmir, village) are presented in table 1 and figure 1-4.

In our study, the number of RBC and hematocrit value in blood of sparrows from the reference site is higher in significant scale ( $p < 0.001$ ) compared with blood sparrows from contaminated sites, see table 1.

Table 1. Hematological values of house sparrow (*Passer domesticus*) from polluted site (Mitrovica and Drenas site) and reference site (Ujmir village).

Blood parameters	Reference site		Polluted site	
	Ujmirë (10)	Drenas (10)	Mitrovicë (10)	
RBC( $\times 10^{12}/L$ )	4.58 ± 0.3	2.94 <sup>***</sup> ± 0.5	3.17 <sup>***</sup> ± 0.7	
WBC( $\times 10^9/L$ )	7 ± 1.6	8.4 ± 2.1	8.9 <sup>**</sup> ± 1.6	
Hct(%)	55.1 ± 3.9	33.6 <sup>***</sup> ± 9.4	30.2 <sup>***</sup> ± 6.8	
Hb(g/L)	251.1 ± 49.9	287.6 ± 45.2	267.3 ± 16.6	

Note: Values are expressed as means ± SD. In parentheses ( ) number of birds. \*\* P<0.01; \*\*\* P<0.001.

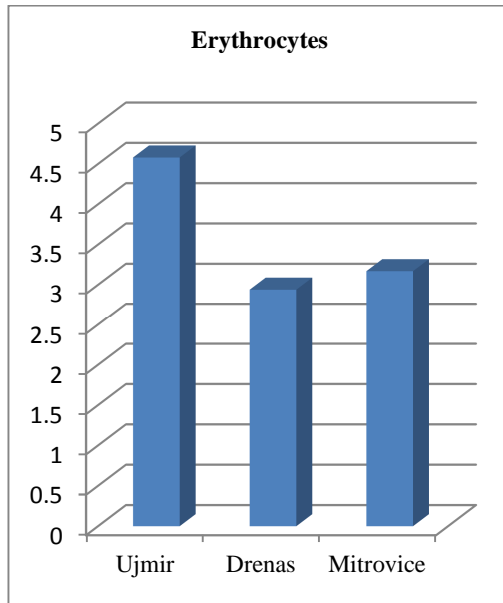


Figure 1

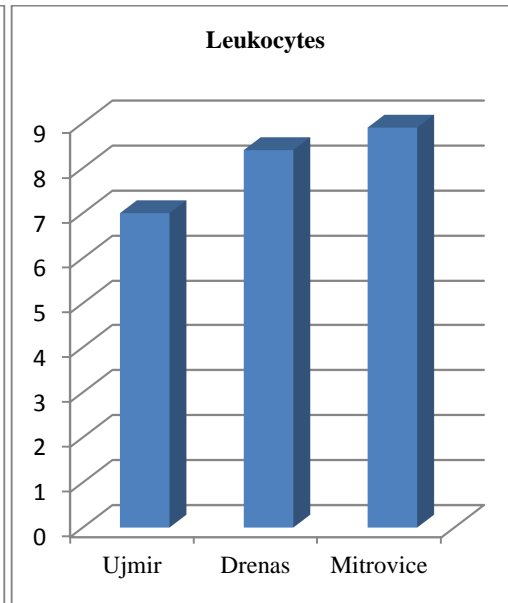


Figure 2

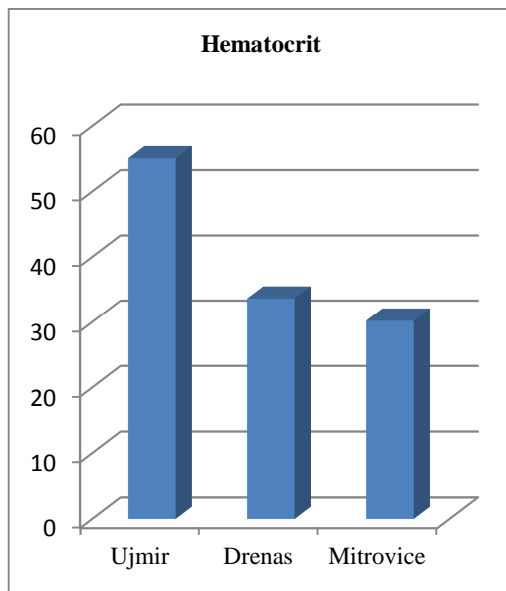


Figure 3

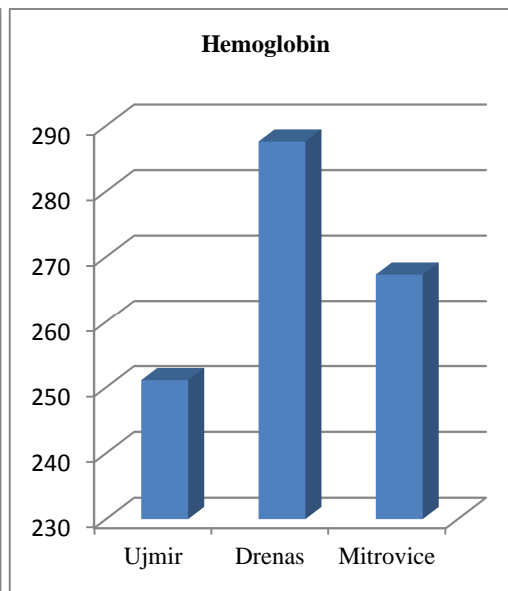


Figure 4

Changes in the number of red blood cells and hematocrit in the blood of the house sparrows, between localities studied may be a results from heavy metal poisoning, especially with lead and zinc intoxication, which can results in the appearance of immature and abnormal erythrocytes in the peripheral blood [12], [13]. Chronic lead toxicosis also may be associated with an in appropriate release of normal appearing, immature erythrocytes into the peripheral blood of no anemic birds. The total erythrocyte concentration and hematocrit of birds are influenced by species, age, sex, hormonal influences, hypoxia, environmental factors and disease [14]. Changes in erythrocyte and hematocrit occur in a predictable manner with increasing blood lead concentrations in birds [12].

Leukocytes in avian blood include lymphocytes, monocytes and granulocytes. The granulocytes are classified as heterophils, eosinophils and basophils. Heterophils are the most abundant granulocyte in most birds. The general causes of a leukocytosis in birds include inflammation, which may be associated with infectosis or noninfectosis causes, toxicities (i.e zinc), hemorrhage into a body cavity, rapidly growing neoplasms and leukemia.

The unchanged hemoglobin values of house sparrow (*Passer domesticus*) between localities studies can be comment based on the fact that lead anemia is a later clinical manifestation of lead plumbism.

### CONCLUSION

The results are correlative, they “call” for further studies in the sparrow population and in the laboratory. Biochemical and histopathological parameters and a bioaccumulation of heavy metals in the tissues must be analyzed to have a realistic view on current environmental pollution in these areas.

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