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## 1 Introduction

Studies of hematology and survey for haemoparasites in birds have become very important in recent years, specially when related to the management and conservation of endangered species. Several studies, performed throughout Europe, have investigated the prevalence of haemoparasites in different species of birds of prey which play a very important role in ecosystem balance maintenance, mainly due to their position on top of the food chain. However, studies about haematzoa in raptors held in the Iberian Peninsula and particularly in Spain are still scarce. The purpose of the present study was to assess the possible relation between the presence/absence of these parasites with some variables, both clinical (age, sex, body condition) and hematological (Ht, TRBC and TWBC).

## 2 Material and Methods

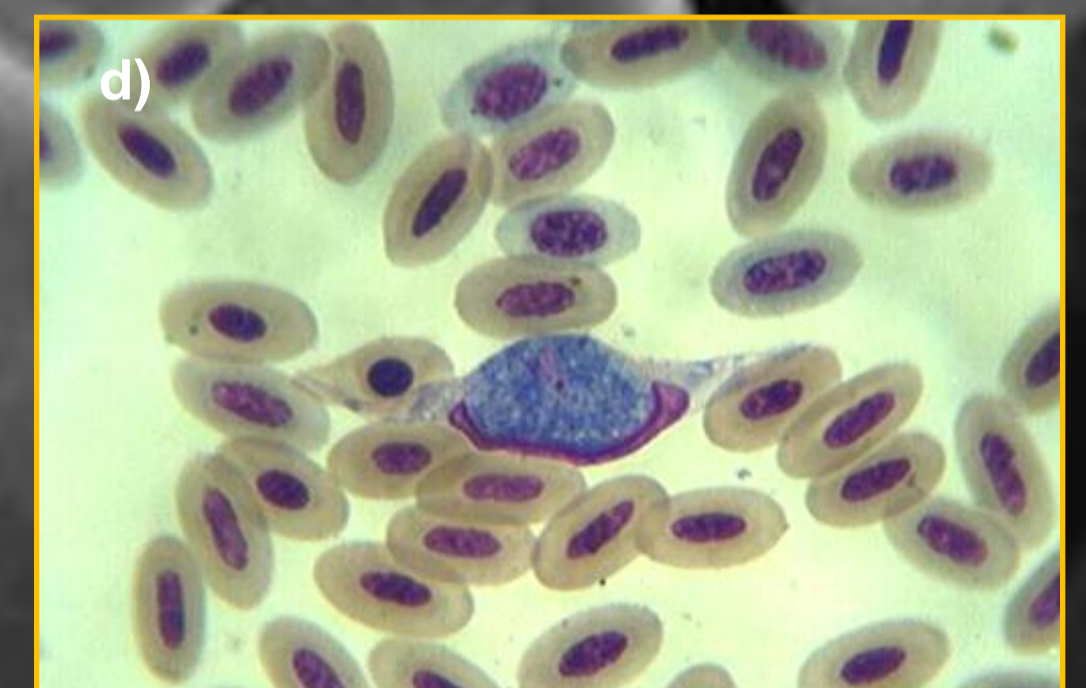
Between October 2009 and March 2010, 191 raptors admitted to the Wildlife Hospital of GREFA were sampled for hematological tests and blood parasites. This study included nine species of diurnal raptors and five species of nocturnal raptors, grouped in 4 categories: eagles, vultures, kestrels and nocturnal. A volume of 1-1,5ml of blood was collected from the ulnaris, jugular or metatarsal vein, depending on the size of the bird and the physical condition of the patient. A drop of whole blood was used to perform a blood smear and the remaining sample was directly transferred into a commercially available blood tube, containing EDTA. Blood smears were air dried and stained with modified Wright Giemsa stain (Samour & Pendl, 2009). Ht, TRBC, TWBC, differential WBC count and survey for haemoparasites were performed.



a) Blood sample collection in a Black vulture (*Aegypius monachus*) b) GREFA's hematology laboratory

## 3 Results

The average values of Ht and TRBC of the four groups, were within the normal range for most species and all species showed average values of TWBC within the normal range for birds with granulocyte differential counts, i.e. between  $5.00$  to  $25.00 \times 10^3/\mu\text{l}$ , with the exception of the Lesser Kestrel (*Falco naumanni*), with a very low TWBC. However, we found highly significant differences between the different groups, both on Ht, TRBC and in TWBC ( $P < 0,001$ ). Although no significant differences were found related to age or gender, highly significant differences were found related to the presence of haemoparasites ( $P < 0.001$ ), in Ht, TRBC and TWBC. The overall rate of infection was 35%, with a global prevalence rate of 34% in birds of Order Falconiformes and 43% in birds of Order Strigiformes. *Leucocytozoon*, *Haemoproteus*, *Plasmodium* and *Trypanosoma* genera were identified. *Plasmodium* was the most prevalent genus in the Order Falconiformes (23%) and *Leucocytozoon* the most prevalent genus on birds of the Order Strigiformes (36%).



c) Blood smear of a Lesser kestrel (*Falco naumanni*) showing numerous erythrocytes and thrombocytes. d) Blood smear of a Long-eared owl (*Asio otus*) showing a microgametocyte of *Leucocytozoon ziemanni*.

## 4 Discussion

The differences between these blood parameters can be justified by numerous stressful factors, such as handling, facilities differences, social group and even physiological factors, such as age (Campell, 1995; Clark, Boardman and Raidal, 2009). However, significant differences were revealed related to haemoparasites positivity, presenting the most infected animal groups, changes in the researched parameters. This study provided new data and raised new questions about the influence of haemoparasites on raptors health status, and on their involvement in their ecology, evolution and conservation. Therefore, it's very important to obtain new data, both in free living individuals and captive birds in Rehabilitation Centers, to determine the influence of stress-inducing factors in haemoparasites infections and its expression in clinical terms.

## 5 Citation Index

1. CAMPBELL T.W. (1995). Avian Hematology and Citology (2<sup>nd</sup> Ed.). Iowa: Iowa State University Press.
2. CLARK P, BOARDMAN W and RAIDAL S. (2009). Atlas of Clinical Avian Hematology. Oxford: Wiley-Blackwell
3. SAMOUR J and PENDL H. (2009). The value of hematology in avian clinical practice. In MARTELA, BAILEY T, CHITTY J, HARCOURT-BROWN N, HATT JM. And JONES M. (Eds), Proceedings of the 10<sup>th</sup> European Association of Avian Veterinarians Conference and 8<sup>th</sup> Scientific European College of Avian Medicine and Surgery Meeting, Antwerp, 17<sup>th</sup> – 21<sup>st</sup> March 2009, .283-289.