







Airport fauna management: Assessing Harris' Hawks (*Parabuteo unicinctus*) health state through hematological evaluation

*Gestão da fauna aeroportuária: avaliando o estado de saúde de gaviões asa-de-telha (*Parabuteo unicinctus*) através da avaliação hematológica*

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ABSTRACT: The Harris' Hawk is commonly used by falconers in falconry as a plan to avoid collisions between birds and aircraft, being trained to capture vultures, herons, Southern caracara, Southern lapwing, and pigeons. The aim of this work was to evaluate the hematological parameters in Harris' Hawks used in airport fauna management in order to assess the health of these birds, compare the results of hawks from similar characteristics and differentiate the parameters of trained and not trained hawks. This study has federal authorization under number 57551-1 (*Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio/Ministério do Meio Ambiente, Brazil)* on 08/30/2017. In this study, six females and three males of Harris' Hawks (*Parabuteo unicinctus*), trained with falconry techniques, were used to control of fauna at the Antônio Carlos Jobim-Galeão International Airport, from *Centro de Preservação de Aves de Rapina - CePAR*, located in Rio de Janeiro - RJ. All birds were over six months of age, clinically healthy and in good body condition. The following analysis were performed: weight, erythrocyte counts, hemoglobin dosage, hematocrit, quantification of the mean corpuscular volume, mean corpuscular hemoglobin concentration, count of leukocytes, basophils, eosinophils, heterophils, lymphocytes and monocytes, processed by microscopy. Compared to other studies of Harris' Hawks hematological parameters, this study presented decreased values for erythrocytes, hemoglobin, hematocrit, mean corpuscular volume and mean corpuscular hemoglobin concentration, while indicators such as leucocyte, heterophils and lymphocytes were increased. In conclusion, trained birds of prey are more susceptible to stressful factors, which can cause alterations in hematological parameters.

KEYWORDS: Birds of prey; clinical pathology; hematology; stress; weight.

RESUMO: O gavião asa-de-telha é utilizado na falcoaria como um método para evitar colisões entre pássaros e aeronaves, sendo treinado para capturar abutres, garças, caracará-do-sul, abibes-do-sul e pombos. O objetivo deste trabalho foi avaliar os parâmetros hematológicos de gaviões asa-de-telha utilizados no manejo da fauna aeroportuária, a fim de avaliar a sua saúde, comparar os resultados de gaviões com características semelhantes e diferenciar os parâmetros de gaviões treinados e não treinados para essa prática. Este estudo possui autorização sob número 57551-1 do Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio/Ministério do Meio Ambiente, Brasil) de 30/08/2017. Foram utilizados seis fêmeas e três machos de gaviões asa-de-telha (*Parabuteo unicinctus*), treinados com técnicas de falcoaria, utilizados pelo Centro de Preservação de Aves de Rapina - CePAR para controle de fauna no Aeroporto Internacional Antônio Carlos Jobim-Galeão, localizado no Rio de Janeiro - RJ. Todas as aves tinham mais de seis meses de idade, eram clinicamente saudáveis e possuíam bom estado corporal. Foram realizadas as seguintes análises: peso, contagem de eritrócitos, dosagem de hemoglobina, hematócrito, quantificação do volume corpuscular médio, concentração de hemoglobina corpuscular média, contagem por microscopia óptica de leucócitos, basófilos, eosinófilos, heterófilos, linfócitos e monócitos. Comparado a outros estudos de parâmetros hematológicos dos gaviões asa-de-telha deste estudo apresentaram valores diminuídos de eritrócitos, hemoglobina, hematócrito, volume corpuscular médio e concentração de hemoglobina corpuscular média, enquanto indicadores como leucócitos, heterófilos e linfócitos estavam aumentados. Conclui-se que aves de rapina treinadas são mais suscetíveis a fatores estressantes, que podem causar alterações nos parâmetros hematológicos.

PALAVRAS-CHAVE: Aves de rapina; estresse; hematologia; patologia clínica; peso.

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INTRODUCTION

The training of birds of prey for hunting, known as falconry, has been developed in Brazil for various purposes, for example, to control the population of fauna in imbalance. With the efficiency of the technique, Brazilian airports, such as the Antônio Carlos Jobim International Airport in Rio de Janeiro, uses falconry as a plan to avoid collisions between birds and aircraft. The Harris' Hawk is a raptor commonly used in falconry (Mello, 2016), being trained to capture vultures, herons, Southern caracara, Southern lapwing, and pigeons (CEPAR, 2017).

The laboratory evaluation of blood cells provides valuable information about their health. Studies related to wild animal hematology have been held to determine qualitative and quantitative reference values from certain species, as Brazilian white-tailed Hawks (*Geranoaetus albicaudatus*), owls (*Megascops choliba*, *Asio clamator*, *Athene cunicularia*, *Pulsatrix koenigswaldiana*, and *Strix hubula*), Rufus-Winged Buzzards (*Butastur liventer*) and Changeable Hawk Eagles (*Nisaetus chirritus*) (Akatsuka *et al.*, 2019; De Araujo *et al.*, 2023; Hardian *et al.*, 2023; Pornpanom *et al.*, 2022). This knowledge is essential to rule out diseases, establish prognosis and monitor responses to therapy, especially for predators that usually mask clinical signs (Polo *et al.*, 1992).

Hematological reference standards vary by species. For birds, normality values have a wide variability due to the influence of intrinsic and extrinsic factors, such as their physiology, management, and the environment in which the bird is inserted to (Terry *et al.*, 2007). Therefore, the blood results expected must be influenced by the conditions in which they are submitted to.

The use of trained hawks is being classified as an effective biological management methodology, becoming an important specie in the work of the avian clinician. However, there are few studies on hematological reference standards (Dias *et al.*, 2017). The aim of this work was to evaluate the hematological parameters in Harris' Hawks used in airport fauna management in order to assess the health of these birds, compare the results of hawks from similar characteristics and differentiate the parameters of trained and not trained hawks.

CASE REPORT

This study has federal authorization under number 57551-1 (*Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio/Ministério do Meio Ambiente, Brazil)* and was approved by the Ethic Committee for Animal Use of *Universidade Federal Fluminense* under number 897/2017.

There were used nine (six females and three males) Harris' Hawks (*Parabuteo unicinctus*), trained with falconry techniques, for the control of fauna at the Antônio Carlos Jobim International Airport, from *Centro de Preservação de Aves de Rapina - CePAR*, located in Rio de Janeiro, Brazil. All the

birds were older than six months of age, clinically healthy and in good body condition.

Birds were kept in individual enclosures, on appropriate perches, with unrestricted access to water. The enclosures were airy, covered with tile and surrounded by galvanized steel wire netting, allowing direct sunlight in the early hours of the morning and late afternoon. During the activity, they were transported in plastic boxes with dimensions of 45x50x60 cm, and food was offered during wildlife control activity as a reward. The diet consisted of a variable amount of quails, mice or chicks, according to the metabolic needs of each individual. The food was kept frozen, and, on average, 40 grams of meat were consumed daily.

The blood samples were collected in the afternoon, after the fauna control activity, with the birds fed only in the morning shift. The maximum and minimum temperatures of the region were 28°C and 20°C, respectively. Before the collection, the birds remained at rest and were weighed with the aid of a precision scale. Physical restraint was performed with the birds hooded, while both feet were held, and the body was wrapped with a towel. Samples were obtained through puncture of the left external jugular vein, using 1 mL syringes and hypodermic needles of 13x0.45 mm, inclined at 45°. The amount of blood collected was 1 mL per bird, respecting the limit maximum of 0.5% of the body weight of each bird.

After removing the needle from the syringe, the blood was filled into tubes containing anticoagulant heparin in the proportion of 0.5 mL for each 1 mL sample. Then, slow homogenization and identification were realized, the samples were stored under refrigeration and, immediately, sent to a veterinary analysis laboratory. The following analyzes were performed: weight, erythrocyte counts, hemoglobin dosage, hematocrit, quantification of the mean corpuscular volume, mean corpuscular hemoglobin concentration, count of leukocytes, basophils, eosinophils, heterophils, lymphocytes and monocytes, processed by microscopy.

Data were analyzed using the Excel program in order to calculate average, confidence index (95%), margin of error, lower limit, upper limit, and standard deviation. The intervals were calculated by applying the values found in research to the probability density function formula, after being described as a normal distribution, and were added to the formula that considers the lower limit as the average less two times the standard deviation and the upper limit as the average plus two times the standard deviation.

The hematological values obtained were described (Tables 1 and 2). Weight and red blood cell count (erythrogram) were evaluated, which includes mean erythrocytes, hemoglobin, hematocrit, mean corpuscular volume and mean corpuscular hemoglobin concentration (Table 1). The white blood cell count (leukogram), as the mean leukocytes, basophils, eosinophils, heterophils, lymphocytes and monocytes were also reported as a result of the blood collection (Table 2).

Table 1. Individual values, means, margin of error, inferior limit, upper limit, and standard deviation for the hematological parameters (Red Blood Cells) found in Harris' Hawks (*Parabuteo unicinctus*) used for airport fauna management.

| Harris' Hawk | Weight (g) | H ($\times 10^6/\mu\text{L}$) | Hgb (g/dL) | Ht (%) | VGM (fL) | CHGM (%) |
|--------------------|------------|---------------------------------|------------|--------|----------|----------|
| 1 | 694 | 240 | 10.80 | 41.00 | 170.80 | 26.30 |
| 2 | 656 | 247 | 10.00 | 40.00 | 161.90 | 25.00 |
| 3 | 466 | 249 | 9.80 | 39.00 | 156.60 | 25.10 |
| 4 | 454 | 1.71 | 9.20 | 40.00 | 233.90 | 23.00 |
| 5 | 634 | 2.82 | 9.40 | 40.00 | 141.80 | 23.50 |
| 6 | 685 | 2.79 | 9.80 | 38.00 | 136.20 | 25.80 |
| 7 | 719] | 2.62 | 10.10 | 41.00 | 156.50 | 24.60 |
| 8 | 473 | 2.37 | 9.90 | 36.00 | 151.90 | 27.50 |
| 9 | 663 | 2.56 | 8.80 | 32.00 | 125.00 | 27.50 |
| Means | 604.89 | 2.47 | 9.76 | 38.56 | 159.40 | 25.37 |
| Margin of error | 70.69 | 0.21 | 0.38 | 1.91 | 20.39 | 1.03 |
| Inferior limit | 534.20 | 2.26 | 9.38 | 36.65 | 139.01 | 24.33 |
| Upper limit | 675.58 | 2.68 | 10.13 | 40.46 | 179.79 | 26.40 |
| Standard deviation | 108.21 | 0.33 | 0.57 | 2.92 | 31.21 | 1.58 |

Weight (grams); H - erythrocytes; Hgb - hemoglobin; Ht - hematocrit; Mean Globular Volume - VGM; Mean Globular Hemoglobin Concentration - CHGM.

Table 2. Individual values, means, margin of error, inferior limit, upper limit, and standard deviation for the hematological parameters (White Blood Cells) found in Harris' Hawks (*Parabuteo unicinctus*) used for airport fauna management.

| Harris' Hawk | Leuc (cells/ μL) | Bas (cells/ μL) | Eos (cells/ μL) | Het (cells/ μL) | Linf (cells/ μL) | Mon (cells/ μL) |
|--------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------------|-----------------------------|
| 1 | 11,200 | 0 | 224 | 8,400 | 2,576 | 0 |
| 2 | 9,000 | 0 | 180 | 6,480 | 2,250 | 90 |
| 3 | 7,600 | 0 | 76 | 4,940 | 2,356 | 228 |
| 4 | 8,200 | 0 | 82 | 4,920 | 3,116 | 82 |
| 5 | 9,000 | 0 | 90 | 6,480 | 2,430 | 0 |
| 6 | 20,400 | 0 | 204 | 14,892 | 4,896 | 408 |
| 7 | 10,800 | 0 | 216 | 3,240 | 7,128 | 216 |
| 8 | 8,800 | 0 | 88 | 6,600 | 2,024 | 88 |
| 9 | 8,400 | 0 | 252 | 6,384 | 1,680 | 84 |
| Means | 10,377.78 | 0 | 156.89 | 6,926.22 | 3,161.78 | 132.89 |
| Margin of error | 2,571.67 | 0 | 46.87 | 2,166.61 | 1,145.41 | 85.12 |
| Inferior limit | 7,806.11 | 0 | 110.02 | 4,759.62 | 2,016.37 | 47.77 |
| Upper limit | 12,949.45 | 0 | 203.76 | 9,092.83 | 4,307.19 | 218.01 |
| Standard deviation | 3,936.30 | 0 | 71.74 | 3,316.30 | 1,753.21 | 130.28 |

Leuc - leucocytes (cells/ μL); Bas - basophils (cells/ μL); Eos - Eosinophils (cells/ μL); Het - heterophiles (cells/ μL); Linf - lymphocytes (cells/ μL); Monocytes (cells/ μL)

DISCUSSION

The results of the intervals of the parameters found in this study in Harris' Hawks (*Parabuteo unicinctus*) used for airport fauna management for erythrocytes (2.26 – 2.68 $\times 10^6/\mu\text{L}$), hemoglobin (9.38 - 10.13 g/dL), hematocrit (36.65 - 40.46%), mean corpuscular volume (139.01 - 179.79 fL) and mean corpuscular hemoglobin concentration (24.33 - 26.40%) were lower when compared to the findings of Beynon; Forbes;

Harcourt Brown (1996) found in Harris' Hawks erythrocytes (2.63 - 3.5 $\times 10^6/\mu\text{L}$), hemoglobin (12.1 - 17.1 g/dL), hematocrit (40 - 55%), mean corpuscular volume (147 - 163 fL) and mean corpuscular hemoglobin concentration (30.1 - 33.0%).

Parga; Pendl; Neil (2001) made a comparison between two groups of Harris' Hawks, therefore, separated a group of trained and not trained hawks with falconry techniques. The values he found for not trained Harris' Hawks were: erythrocyte

($2.51 \times 10^6/\mu\text{L}$), hemoglobin (13.5 g/dL), hematocrit (42%), mean corpuscular volume (168.92 fL) and mean corpuscular hemoglobin concentration (31.42%) and for those trained were: erythrocyte ($2.54 \times 10^6/\mu\text{L}$), hemoglobin (13.17 g/dL), hematocrit (44%), mean corpuscular volume (171.95 fL) and mean corpuscular hemoglobin concentration (30.2%), showed that the values of the red blood cells of these two groups did not differ. In our study, the values found for erythrocytes ($2.26 - 2.68 \times 10^6/\mu\text{L}$), hemoglobin (9.38 - 10.13 g/dL), hematocrit (36.65 - 40.46%), mean corpuscular volume (139.01 - 179.79 fL) and mean corpuscular hemoglobin concentration (24.33 - 26.40%) were similar comparing with the author.

The results of the intervals of the parameters found in this study for leucocytes (7,806 - 12,949 cells/ μL), basophils (0 - 0 cells/ μL), eosinophils (110 - 203 cells/ μL), heterophils (4,759 - 9,092 cells/ μL), lymphocytes (2,016 - 4,307 cells/ μL) and monocytes (47 - 218 cells/ μL), were observed and compared with the findings of Beynon; Forbes; Harcourt Brown (1996) in Harris' Hawks with leucocytes (4,800 - 10,000 cells/ μL), basophils (0 - 1,550 cells/ μL), eosinophils (0 - 750 cells/ μL), heterophils (2,300 - 6,710 cells/ μL), lymphocytes (600 - 2,360 cells/ μL) and monocytes (200 - 1,490 cells/ μL). Our found values obtained significant differences compared with the author, heterophils and lymphocytes are increased, and monocytes, decreased.

According to the findings of Parga *et al.* (2001) for Harris' Hawks trained for falconry: leucocytes (5,660 cells/ μL), heterophils (3,360 cells/ μL) and lymphocytes (830 cells/ μL), observing the results of the Harris' Hawks (*Parabuteo unicinctus*) used for airport fauna management and comparing with the author, the data of our study obtained significant

differences, the averages found were high: leucocyte (10,377 cells/ μL), heterophils (6,926 cells/ μL) and lymphocytes (3,161 cells/ μL).

The hematological values vary according to the lifestyle of the bird of prey, due to the training and management, the captive birds, although they are adapted to the environment, are more susceptible to stress factors such as transport, water and food deprivation, exposure to light, high temperatures and social situations. In birds of prey, the most used parameter to evaluate stress is elevated heterophil values and decreased lymphocytes, because they are sensitive and present alterations in response to corticosterone (Gross; Siegel, 1986; Gross, 1989; McFarlane; Curtis, 1989). Leucocytes change slowly additive when the bird is exposed to stressors frequently, have less variable and long-lasting responses (McFarlane; Curtis, 1989; McKee; Harrison, 1995).

It is important to further study with birds of prey, studies in this area have so far been poorly developed, making it difficult to evaluate the animal in more detail.

CONCLUSIONS

In conclusion, the knowledge of hematological parameters in Harris' Hawks used for fauna management at airports aims to evaluate the state of health and prevent diseases. Due to the tropical climate of Rio de Janeiro and high temperatures in the summer, heat is one of the stressful factors, which makes essential monitoring by hematological laboratory tests to evaluate the level of stress. So, trained birds of prey are more susceptible to stressful factors, which can cause alterations in hematological parameters, specially to the ones influenced by corticosterone, as heterophils and lymphocytes levels.

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