BIOMETRY, HEMATOLOGY AND GENETIC OF THE *CAIMAN LATIROSTRIS* (DAUDIN, 1801) IN BAURU (SP)

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VIEIRA, Tiago Quaggio; SILVA, Fabiane Bortoluci da; HEUBEL, Maricê Thereza Corrêa Domingues. Biometry, hematology and genetic of the *Caiman latirostris* (DAUDIN, 1801) in Bauru (SP). *Salusvita*, Bauru, v. 21, n. 3, p. 77-85, 2003.

ABSTRACT

The Caiman latirostris (broad snouted) is the only crocodilian that can be found in São Paulo state. This reptile is important for the maintenance of the aquatic ecosystems, and scientific research is quite important for the preservation of this species. The biometric and hematological parameters of 22 crocodilians were analyzed in this study. In the biometry, two body-length and eight head-length were taken from the animals. In the hematology, were analyzed: hematocrit, hemoglobin, red blood cell count (RBC) and the hematimetrics index. In the present study the animals were divided in 3 groups, based on biometric data: G1- for animal with less than 60 cm; G2- with more than 60.01 and less than 110 cm and G3- for animal bigger than 110 cm. The mean value was: G1-Ht (%)=19, Hb(g%)=9.75, RBC (:1000)=0.39, MCV(%)=49.91, MCH(pg/er)=25.23, MCHC(%)= 51.12; in relation to G2- Ht(%)=16.63, Hb(g%)=8.21, RBC (:1000)=0.38, MCV (%)=44.90, MCH (pg/er)=21.75, MCHC (%)=49.05 and in relation to G3- Ht (%)=17.33, Hb(g%)=9.95, RBC (:1000)=0.41, MCV (%)=43.19, MCH (pg/er)=24.69 and MCHC (%)=57.71. Only one electroforetic pattern was found suggesting a monomorphic pattern in these animals.

Received on: September 18, 2002
Accepted on: October 20, 2002

KEY WORDS: hematology, *Caiman latirostris*, biometry, genetics

INTRODUCTION

It is estimated that life appeared on earth some 3.5 million years ago. Since them living creatures have remarkably evolved and diversified resulting in millions of species inhabiting our planet. Many species have disappeared during the evolutionary process since the only to survive are those more qualified and that have a superior ability to adaptation.

Order Crocodylia calls the attention for showing little alteration along the last 200 million years, which shows its adaptative capability.

Crocodilians are reptiles occurring mainly in the tropical regions of the planet. Presently they are a seriously endangered species due to the antropic action and are quite important to their specific ecosystems since its presence in rivers, lakes, swamps, marshes and estuaries is vital to keep stable the population to whom they act as predators.

Out of the 23 existing species, six occur in Brazil, all of them belonging to the family Alligatoridae, namely: jacaré-açú (*Melanosuchus niger*), jacaré do pantanal (*Caiman yacare*), jacaretinga (*Caiman crocodilus*), the species of jacaré coroa (*Paleosuchus palpebrosus* e *Paleosuchus trigonatus*) and, finally, the jacaré de papo amarelo (*Caiman latirostris*).

The specie *Caiman latirostris* is the only to occur in the southeast region of Brazil and it is a medium sized animal (maximum length 3 m, although most do not exceed 2 m). The scientific name derives from the fact that the anima shows the widest skull, proportionally, among all crocodilians (BRITTON, 2001).

The broad-snouted caiman, according to Britton (2001), is a specimen that has been able to adapt well to antropomorphilized environments. There are healthy populations in lagoons, being this the reason to their survival.

Some authors describe the evolution, natural history, ecological importance, families, biometry, species and sub-species of existing crocodilians and making their characterization. Among them, Poubh et al. (1999) explore the natural history of these animals, their evolution, period of their appearance and diversification and their taxonomic classification.

Fuente (1979) described the ecological importance of crocodilians and cited also some information on the biometry of *Crocodylus niloticus*. According to this author the Nile crocodile attain a maximum length of 5 meters weighing one ton and, at birth, is only 30 cm length.

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According to Britton (2001), the broad-snouted caiman reaches maximum 3.5 m and is facing the threat of extinction in many areas where it is present.

Regarding the biometry Verdade (2000) proposed a regression equation between body length and skull length for *Caiman latirostris,* discussing age and sex as variation sources for alometric models. The equations helped in the estimation of the body length after the skull dimension and related alterations in the skull form during the onthogenic process. All the dependent variables of age showed also dependent on the size and, thus, on the growth rate that, according to the author, is probably related to the difficulty to calculate the age o crocodilians based only in the univariable curves of growth.

Verdade (2000) detected sexual dimorphism in the alometric growth of the skull that may be evolutionary related to the visual acknowledgment of the sex when individuals show only the top part of the head above water surface.

Regarding hematology, the hematological methods are important in the diagnoses of diseases in animals as well as to contribute to the characterization of new species. Furthermore, the blood test have a basic role in the evaluation of the health and physiological condition of crocodilians.

Moura et al. (1999) used 10 species of alligators from the "pantanal" (*Caiman yacare)* to analyze the blood cells collecting 5 ml of peripheral blood from each animal. The morphological analyzis was done after Lesihman staining and to the cytochemical study it was used PAS, Sudab black B, o-toluidine and bromophenol blue. The study identified 7 types of cells: erythrocytes, thrombocites, heterophiles, eosinophiles, basophiles, lymphocytes and monocytes.

Birds are also cited as having types Hb A and Bb D hemoglobin with the same b chain as turtles (RUCKNAGEL et al, 1988). It was possible to verify that many species were analyzed regarding the hemoglobin and that these species showed a small variation that made possible the characterization of species and the investigation of the evolutionary tendency such as that of iguanas and snakes, as compared to mammals.

This study has the objective to (a) determine the following hematological parameters: hematocrit (Ht), concentration of hemoglobin (Hb), erythrocyte count (Eri) as well as the following hematimetric indexes: mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC); (b) to electrophoretic characterize the hemoglobins of the broad-snouted caiman (*Caiman latirostris*); and (c) to proceed external biometry of the animals.

MATERIAL AND METHODS

Sixteen specimens of *Caiman latirostris* were analyzed from the lagoons of the Duratex S.A. (Agudos –SP), one of the Sitio São José (Avaí-SP) and five others, being two from the Municipal Zoo of Bauru and three from the Duratex S.A. Data were collected from October 2000 to June 2001.

The samples were captured with the help of a rope and , whenever possible, by hands. The capture was proceed at night using flashlights to spot the animal. The animals were labeled and the sex determined.

The animals were measured leading to the following measures: total length (Tl), cloacal length (Cl), total superior head (Tsh), head superior width (Hsw), head inferior width (Hiw), interorbital (Io), lateral mouth (Lm), mandible thickness (Mt), eye ball cavity (Ebc) and diameter of the eye ball (Ebd), according to FIGURE 1. It was calculated the mean and the standard deviation of the data obtained. The biometric values were analyzed after Gallego et al. (1995) in three groups of animal according to their length: G1 (up to 60 cm), G2 (from 60.01 to 110 cm) and G3 (more than 110 cm). (FIGURE 1)

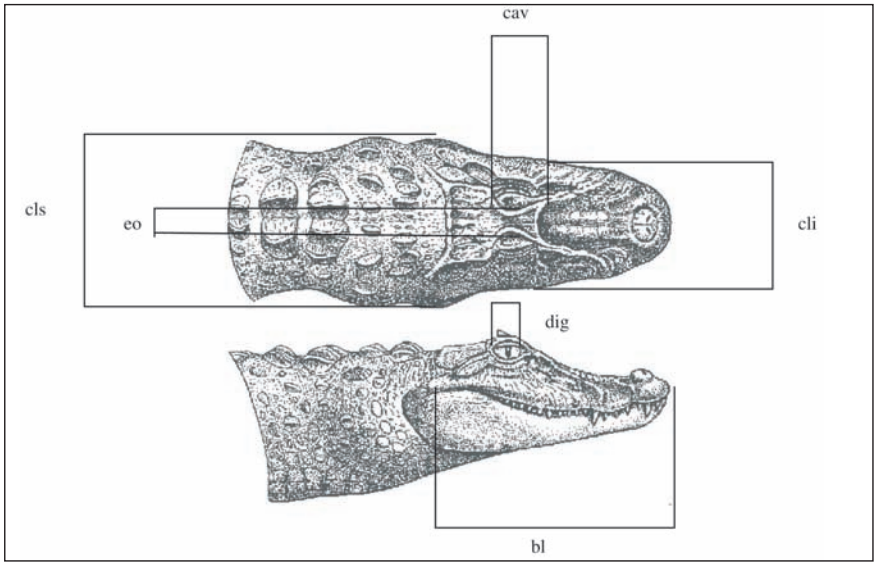

FIGURE 1 - Measurements in *Caiman latirostris (hsw*;io;lm;ebc;hiw). Lateral and superior views. Source: <http//www .flmnh.ufl.edu/cnhc/csp_clat.htm> (2002).

To the hematological study the blood of each specimen was removed by caudal punching with a 3 ml disposable syringe with 25 x 7 mm needle. From each specimen was collected a sample with anticoagulant EDTA 3%, which was sent under refrigeration to the University of the Sacred Heart.

The determination of the cor puscular volume or hematocrit, dosage of hemoglobin and hematimetric indexes such as mean corpuscular volume (MCV), mean cor puscular hemoglobin (MCH) and the mean corpuscular hemoglobin concentration (MCHC) were done according to the method described b y Vallada (1993). The erythrocyte counting was done according to Natt & Her rick (1952) and Domingues (1992), w hich is a procedure used for nucleated cells of birds and f ish.

To the separation of the hemo globins of *Caiman latirostris* it was used the technique of electrophoresis in cellulose acetate gel as adapted by Machado (1973) with discontinued borate buffer 0.09 M pH 8.6. The gel w as stained with Blue R and the discoloration of fraction with solutions of glacial acetic acid 10%.

The statistical analyzes of the v ariables and hematimetric indexes were done based in means and standard de viations according to Vieira (1991).

RESULTS AND DISCUSSION

The specimens of *Caiman latirostris* captured at Durate x S.A., Agudos (SP), at the S. José (Avaí-SP) and from the Municipal Zoo in Bauru were separated by sex but it was also possible to make a classification according to the seize of the animal. The means and standard deviations of the e xternal measures w ere in accordance with the expected finding (GALLEGO et al., 1995), but the level of significance was above 10% that shows the great biometric variability, being the same verified in the hematological values (TABLE 1).

TABLE 1 -Mean and standard deviation of the external measures in groups G1, G2 and G3 - *Caiman latirostris*

Groups	Tl	Pl	Tsh	Hsw	Hiw	Io	Lm	Mt	Ebw	Eyc
1 (n=9)	42.34 ±6.78	20.89 ±3.68	5.54 ±0.75	3.30 ±0.45	3.20 ±0.46	0.38 ±0.07	5.38 ±0.72	0.79 ±0.18	1.45 ±0.21	1.00 ±0.14
2 (n=9)	75.36 ±8.42	37.34 ±4.28	8.97 ±0.84	5.23 ±0.61	5.15 ±0.91	0.66 ±0.1	9.17 ±0.81	1.44 ±0.13	2.05 ±0.30	1.38 ±0.15
3 (n=4)	150.80 ±41.66	76.30 ±16.16	17.29 ±4.87	11.72 ±4.08	10.50 ±0.70	1.62 ±0.50	17.63 ±6.19	2.27 –	2.77 ±1.00	1.89 ±0.68

Tl= total lenght
Pl= partial leght (up to the cloaca)
Tsh= total superior head
Hsw= head supeior width
Hiw = head inferior width
Io= interorbital
Lm= later mouth
Mt= mandible tickness
Ebw= eye ball diameter
Eyc=eye ball cavity

The seize of the animal revealed some interesting findings: all males were smaller than females (exception for number A3, which was not captured at the 18MA lagoon of Durate x). Probably, this means that he belongs to the same of fspring since crocodilians, similar to chelonians, do not have sexual chromosomes, being the sex determined by the temperature of the nest.

Regarding the sexual dimorphism cited by Verdade (2000), related to the skull width, this was not observed in animal of groups G1 and G2. Reason for that could be the fact that they have not yet reached sexual maturity and such dimor phism only occurs is sexually mature animals. In group G3 it was not possible to observe the presence of dimorphism due to the fact that four animals in this group were males. Thus, it would be advisable to increase the sample size of the last group to verify the possible sexual dimorphism.

Regarding the biometry it was also possible to observe that, in all studied animals, the tail size is a little more than half the total length of the animal.

Yearlings (G1) have a higher value for hematocrit (Ht) than the elder (G2 and G3) indicating a probable pattern for the species.

Dessauer (1996) and Wallach & Boever (1983), apud Mader (1996) reported that values for hematocrit differ for *Alligator missippiensis (20-30%), Caiman sp.(26%), Crocodylus acutus (26%)* and *Crocodylus niloticus (35%)*. These values were superior to those of the studied animals. However, the mentioned authors did not mention the dimension, age and origin (capti vity or wild) of their animals. (TABLE 2)

TABLE 2 - Comparison of median and standard deviation of hematological parameters of the *Caiman latirostris* (G1, G2 and G3) and other specimens of crocodiles.

Species	Ht (%)	Hb (g%)	Ec (:1000.)	MCV (%)	MCH (%)	MCHC (%)
Caiman latirostris G1[1] (n=9)	19.00 ±3.69	9.75 ±3.99	0.39 ±0.10	49.91 ±11.32	25.3 ±9.25	51.12 ±14.39
Caiman latirostris G2[1] (n=9)	16.63 ±2.13	8.21 ±2.17	0.38 ±0.09	44.90 ±9.47	21.75 ±4.42	49.05 ±8.93
Caiman latirostris G3[1] (n=4)	17.33 ±4.93	9.95 ±2.54	0.41 ±0.11	43.19 ±12.41	24.69 ±6.07	57.71 ±2.92
Alligator missippiensis[2]	20-30	7.1-8.2	0.67	45.00	123.00	
Caiman sp.[2]	26.00	8.60				
Crocodylus acutus[2]	26.00	9.00				
Crocodylus niloticus[2]	35.00					

[1] - in this study
[2] - Dessauer and Wallach & Boever (1983) apud Mader (1996)

Ht = hematocrit
Hb = hemoglobin concentration
Ec = erythricute counting
MCV = mean corpuscular volume
MCH = mean corpuscular hemoglobin
MCHC = mean corpuscular hemoglobin concentration

Regarding the remaining hematological parameters it was observed that the above mentioned pattern is similar, that is, young animals have a tendency to present higher values. However, group G3 showed higher values for Hb, Erit and MCHC. This was, most probably, due to the fact that these animals were in captivity and regularly fed. The only way to give evidence to such pattern would be to collect samples from adults in their natural environment.

Crocodilians are the biggest predators in water environment, which is most frequently contaminated by industrial or agricultural pollutants. These substances can be cumulated in the body of the animal and may lead to alteration in the hematological pattern of the species, thus the importance for hematological characterization.

Regarding the electrophoresis of hemoglobin it was possible to make evident only one electrophoretic band suggesting absence of polymorphism among the studied animals. The hemoglobin migration was directed towards the positive pole since it has negative charges (FIGURE 2).

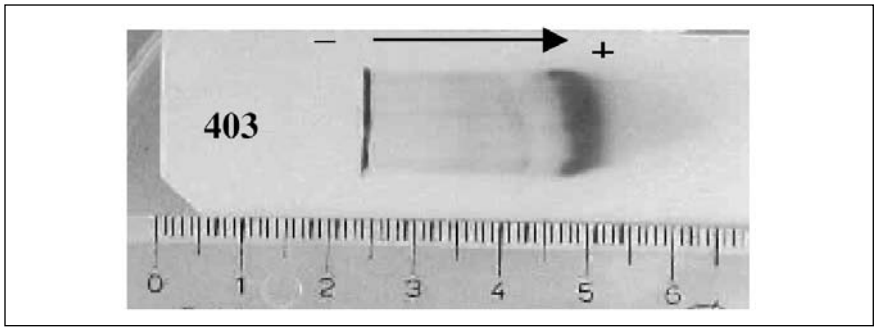

FIGURE 2 - Electrophoresis *Caiman latirostris* hemoglobin in cellulose acetate, borate buffer 0.09 M, pH 8.6.

Thomas et al. (1998) found similarities in the electrophoretic pattern between crocodilians and birds. This is additional evidence that these animals belong to the same evolutionary strain (Archossauromorpha).

Brazil has a large number of broad-snouted caiman in captivity. These animals are quite important since its descendents may be used to colonize the environment where the species has been extinct due to the human interference. It is interesting to know the normal hematological pattern of this species in the wild condition to, later on, identify possible pathologies in animals kept in captivity.

CONCLUSION

The biometric data, hematological values and the hematimetric indexes obtained in this study will permit comparisons with animals in captivity, making it possible to establish ideal conditions of care and also as bioindicators of environmental quality.

ACKNOWLEDGES

To the University of the Sacred Heart (USC) for the Scientific Initiation grants.

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