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Haematological Values of the Helmeted Turtle, Hinged-back Tortoise and Monitor Lizard

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ABSTRACT: The haematology of three reptiles, the helmeted turtle, *Pelomedusa subrufa* (Lacepede 1788), hinged-back tortoise, *Kinixys erosa* (Schweigger, 1812) and the Nile monitor lizard, *Varanus niloticus* (Linnaeus, 1758) collected from towns in southwestern Nigeria was investigated. Values of the blood parameters differed between species and fell within the range reported for reptiles. The Nile monitor lizard had the highest red blood cell (RBC) count, packed cell volume (PCV) and haemoglobin content (Hb). Values of the red cell indices, mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) were highest in turtles; and the mean corpuscular haemoglobin content (MCHC) was highest in the tortoise. Leukocyte count varied within and among species.

Key Words: Haematology; Species differences; Chelonia; Squamata; Hinged-back tortoise; Helmeted turtle; Monitor lizard; Red cells; Leucocytes.

Introduction

Determination of the health and physiological status of vertebrates is often based on physical examination and evaluation of haematological and clinical biochemical values. Despite advances in the husbandry of captive reptiles over the last ten years, haematological values are still not available for most species. Yet these values are the easiest to determine when evaluating the health status of animals.

Blood values have been published for some South African reptiles (Pienaar, 1962), the African puff adder (Otis, 1973), some Zambian snakes (Simbotwe, 1983), and the Agama lizard (Sodeinde and Ogunjobi, 1994). Johnson and benson (1996) presented values for ball pythons and Divers *et al*., (1996) for iguanas.

The three species we investigated, the Helmeted turtle (*Pelomedusa subrufa*), Hinged-back turtle (*Kinixys erosa*) and Nile monitor lizard (*Varanus niloticus*) are important in Nigerian traditional medicine (Sodeinde and Soewu, 1999) and are also eaten as a delicacy (Anadu *et al*., 1988). The species are kept alive for the trade in traditional medicine, exported illegally for international trade (Honneger, 1980, 1985) and have potential for exhibition as zoo animals (Morris, 1994). The health status of individuals of these species in captivity is usually neither known nor determined.

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The primary objective of this study was to determine the normal blood values for the three species for future use as benchmark. We also wanted to check for differences in values among the species and to proffer reason(s) for such differences.

Materials and Methods

Apparently, healthy Helmeted turtles and Hinged-back tortoises were obtained from Ago-Iwoye (6^o58'N, 3^o54'E); and monitor lizards from Epe (6°58', 4°00'E). The animals were kept for 24 hours in cages in the laboratory to acclimate them to the laboratory environment. After this acclimation period, each turtle was weighed alive on a top-loading electric balance and each monitor lizard on a portable scale. Weight was recorded to the nearest g in each instance. Snout-tail length and body width were measured to the nearest cm.

Blood was obtained by cardiac puncture from each animal anaesthetized with either directly into microcrotainer tubes coated with the anticoagulant, ethylene diamine tetracetic acid (EDTA). Each blood sample was analysed for the major blood parameters. Details of methods used for haematological analyses are as described in Sodeinde and Ogunjobi (1984).

The packed cell volume (PCV) was determined by haematocrit technique. Red blood cells (RBC) and white blood cells (WBC) were counted in the improved Neubauer haemocytometer after 1:200 dilution of whole blood. The haemoglobin (Hb) concentration was determined by a cyanmethaemoglobin method. Mean corpuscular volume (MCV); mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin content (MCHC) were calculated from RBC, PCV and HB using standard formulae (Thompson, 1969).

For each parameter duplicate samples were run for each animal and the values averaged. Means were expressed ± SE and multiple comparisons of values were made using one-way ANOVA with species as treatment and the number of individuals of each species as replicates.

Results

Table 1 shows measures of body size for the three species. The species with the smallest body size was the hinged-back tortoise and the largest was the monitor lizard.

The ranges and means of the blood parameters and the red cell indices are shown in Table 2. There were significant differences between the values obtained for the three species. The Nile monitor lizard had the highest RBC, PCV and Hb and the Hinged-back tortoise the highest MCV and MCH. The MCHC values for the Nile monitor lizard and helmeted turtle were similar amd significantly greater than the value for the hinged-back tortoise.

Table 1: Body mass (g) and snout-tail lengths (cm) for the three species. The number of each species examined is shown in parentheses.

Measures/Parameters	Monitor lizard (*Varanus Niloticus*) (10)		Hinged-back tortoise (*Kinixys Erosa*) (5)		Helmeted Turtle (*Pelomedusa Subrufa*) (5)	
	Body mass	Snout-tail length	Body mass	Snout-tail length	Body mass	Snout-tail length
Mean	3200.0	47.6	218.1	15.5	1276.0	17.9
S.D.	1100.0	7.4	195.1	1.0	195.0	1.1
Range	1450-5700	42-63	555-1098.4	15-17	980-1450	17-19

Table 2: Ranges ® and mean (M) haematological values (±SD) of the three species. Number of individuals of each species is given in parentheses. Means along each row with same superscript are not different (P>0.05).

Characteristics		Nile monitor lizard *Varanus niloticus* (10)	Hinged-back Tortoise *Knixys erosa* (5)	Helmeted Turtle *Pelomedusa subrufa* (5)
RBC ($x10^{12}$/l)	R	1.05 – 3.00	0.21 – 0.48	0.11 – 0.52
	M	1.80 ± 78^{a}	0.26 ± 0.12^{bc}	0.34 ± 0.13^{b}
PCV (%)	R	17.5 – 38.2	11.2 – 32.2	9.1 – 24.4
	M	29.4 ± 6.5^{a}	20.4 ± 9.6^{b}	15.0 ± 5.1
Hb (g/dl)	R	6.04 – 12.90	2.12 – 5.20	2.68 – 7.80
	M	9.20 ± 14^{a}	3.30 ± 1.10^{bc}	4.96 ± 1.89^{b}
WBC ($x10^{10}$/l)	R	0.38 – 0.46	0.40 – 1.08	0.48 – 1.06
	M	0.40 ± 0.03^{b}	0.78 ± 0.39^{a}	0.80 ± 0.31^{a}
MCHC (g/dl)	R	28.9 – 35.1	13.2 – 25.6	32.4 – 34.9
	M	31.1 ± 1.1^{a}	17.7 ± 1.2^{b}	33.9 ± 17.4^{b}
MCH (pg)	R	26 – 100	85 – 350	80 – 124
	M	59.4 ± 25.9^{c}	178.0 ± 92.3^{a}	103.0 ± 17.4^{b}
MCV (fl)	R	60 – 260	375 – 1825	250 – 375
	M	180.8 ± 2.6^{c}	964.4 ± 693.5^{a}	310.0 ± 51.5^{b}

Discussion

The values obtained for the three species fall within the range reported for ectotherms (Sodeinde and Ogunjobi, 1994). The PCV range given for the reptiles in Pienaar (1962) and Duguy (1970) was 20% to 35%. Johnson and Benson (1996) however obtained a PCV of 18.3% for the ball python, *Python regius*. The PCV, RBC and Hb are lower in ectotherms than endotherms and values for aquatic or amphibious ectotherms tend to be lower than for terrestrial ones (Sodeinde and Ogunjobi, 1994). While the turtle had the least PCV its RBC and Hb values were higher than of the tortoise.

The monitor lizard spends shorter time in water than turtles and stays submerged for very short periods of time and is really a terrestrial form. The PCV, RBC and Hb values for the monitor lizard are high and are closer to those of terrestrial forms such as the boomslang and iguana (Table 3). We believe that the differences in values among the species reflect differences in activity due to life form and oxygen requirements, the form in which oxygen is available (whether dissolved or not) and the interplay between the primary red cell parameters (PCV, RBC and Hb).

The red cell indices are the best to use in checking out the above patterns because they show the relationships between the primary red cell parameters; MCV = (PCV/RBC) x 10; MCH = (Hb/RBC) x 10 and MCHC = (Hb/PCV) x 10. Large RBC sizes are associated with low RBC number. The size of RBC in amphibians is larger than in reptiles whose RBCs are larger than those of birds and mammals (Sodeinde and Ogunjobi, 1994). Consequently, the number of RBCs per volume is lower in ectotherms. For the Helmeted turtle despite the low PCV, the MCV ranked second behind the value for the Hinged-back tortoise. This indicates clearly that the number of RBCs for the turtle was low and consequently that the

RBCs are large. However, the much higher MCV value for the tortoise suggests that its RBCs are even larger. This would explain its higher PCV and lower RBC number.

Table 3: Comparison red cell values for other reptilian species. Values not given are indicated as NG and units of measurement are as in Table 2.

Species	PCV (%)	Hb (g/dl)	RBC ($x10^{12}$/l	MCHC (g/dl)	MCH (pg)	MCV (fl)	Source
Rainbow lizard (*Agama agama*)	28.9	6.10	0.78	21.9	82	385	Sodeinde and Ogunjobi (1994)
Green iguana (*Iguana iguana*)	31.0	8.10	1.41	26.3	59	228	Divers *et al* (1996)
Ball python (*Python regius*)	18.3	6.68	NG	NG	NG	NG	Johnson and Benson (1996)
Boomslang (*Dispholidus typus*)	27.8	7.40	1.42	26.5	52	196	Simbotwe *et al* (1983)

The amount of Hb carried per RBC (MCH) and per PCV (MCHC) is a good measure of blood iron content (Thompson, 1969) and an indicator of activity level and oxygen requirement. Higher haemoglobin concentration relative to blood volume indicates a more active life. The mean MCHC value obtained for the hinged-back tortoise appears to be an outlier in this respect.

Conclusion

We are aware that the few individuals of each species sampled limits the robustness of inferences we can draw from our data. The patterns in the values we obtained for the species do not entirely reflect their respective life forms and associated levels of activity. The hinged-back tortoise needs to be further investigated.

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