OBSERVATIONS ON THE QUALITATIVE AND QUANTITATIVE STRUCTURAL CHARACTERISTICS OF THE REPTILIAN KIDNEYS.

A Thesis submitted to the university of Nairobi in partial fulfillment for the degree of master of science in Veterinary Anatomy.

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1993.

ABSTRACT

Thirty two reptiles belonging to the orders Chelonia, Crocodilia, and Squamata were examined in this study. The order Chelonia was represented by the pancake tortoise *('Malacochersus' tornieri)*, the order Crocodilia by the nile crocodile *(Crocodylus niloticus)*. The order Squamata was represented by the savanna monitor lizard *(Varanus exanthimatus)*, the chamaeleon *(Chamaeleo jacksoni)*, and the sand boa *(Eryx colubrinus)*. The groups of reptiles studied are also characterised by the differences in their habitats and their modes of excretion of nitrogenous waste.

The aim of this study was to investigate the qualitative and quantitative characteristics of the kidneys of these reptiles, and to compare these characteristics among the groups of reptiles studied, and with those reported in previous studies on other reptiles, fish, birds, and mammals. Comparison of these parameters may throw light on the function of the reptilian kidney.

All the kidneys were fixed by perfusion with 2.3% glutaraldehyde in 0.2 M phosphate buffer. The kidneys were fixed *in situ* through their renal supply. The reptilian kidneys are supplied by renal arteries and portal veins and drained by the renal veins. In these reptiles a strong

correlation between kidney volume and body weight (r=0.951) was observed and the allometric model relating kidney volume (V_k) and body weight (W) was $V_k=29.8W^{0.752}$. The fixed right kidney of each reptile was processed routinely for light and electron microscopic studies. The reptilian renal lobule is marked at the periphery by the tributaries of the renal portal veins (afferent veins) and the collecting ducts and by the branches of the renal arteries and tributaries of efferent veins at the central axis. The nephron of the reptilian kidney comprises of a renal corpuscle, proximal tubule, distal tubule and the connecting tubule which drains into a collecting duct at the periphery of the lobule. These kidney structures could be distinguished on the basis of their histological characteristics and their staining reactions when stained with Gomori's trichrome, alcian blue and Harris's haematoxylin.

Stereological analyses were made on paraffin sections of left kidneys of the reptiles by point counting morphometry using a Zeiss integrating graticule to estimate the volume proportions and subsequently the absolute volumes of the renal components. Sections of kidney tissue obtained at random were sampled at two levels: i) at the first level of sampling (magnification x 35) the volume densities of main renal components (i.e. parenchyma, blood vessels larger than capillaries, and excretory duct system)

were analysed; ii) at the second level of sampling (magnification x100) the volume proportions of renal components forming the parenchyma (i.e. the renal corpuscles, the proximal tubules, the distal nephron which is formed by the distal tubule and connecting tubule, and the blood capillaries) were estimated.

The reptilian kidney was found to consist of a large volume proportion of parenchyma (range 76-95%), and relatively smaller volume proportions of the excretory duct system (range 2-12% and blood vessels larger than capillaries (range 3-17%). The parenchyma of the reptilian kidney consists of a large volume proportion of proximal tubules (range 23-75%) and relatively smaller volume proportions of distal nephron (range 6-23%), blood capillaries (range 11-29%), and renal corpuscles (range 2-5%). The mean values for the volume proportions of the proximal tubules, distal nephron, blood capillaries, and renal corpuscles in the kidneys as a whole ranged from 22-64%, 6-20%, 12-25%, and 2-4% respectively.

A strong correlation was found between the absolute volumes of kidney components and body weight in the reptiles. The allometric models and correlation coefficients (r) for the relationships between the respective volumes of the renal parenchyma (V_p), excretory duct system (V_{ex}) blood vessels larger than capillaries (V_b) proximal tubules (V_{pct}), distal nephron (V_{dn}), blood capillaries(V_{bc}), renal corpuscles

(V_{rc}), and body weight (W) were as follows; $V_p = 28.5W^{0.717}$, $r = 0.94$; $V_{ex} = 1.13W^{0.804}$, $r = 0.83$; $V_b = 0.37W^{1.077}$, $r = 0.94$; $V_{pct} = 9.95W^{0.789}$, $r = 0.93$; $V_{dn} = 3.66W^{0.762}$, $r = 0.79$; $V_{bc} = 3.72W^{0.833}$, $r = 0.66$; $V_{rc} = 0.23W^{0.981}$, $r = 0.98$.

The reptiles were grouped into three groups according to the following sets: (a). terrestrial and non terrestrial; (b). lizards from wet and dry habitats; (c). male and female chamaeleons. The differences between kidney volume per gram body weight and those between the respective volume proportions of the parenchyma, excretory duct system, blood vessels larger than capillaries, proximal tubules, distal nephron, blood capillaries, and renal corpuscles in the groups of reptiles with contrasting characteristics were assessed by Student's t-test. The quantitative parameters of the reptilian kidney were shown to be influenced by the order, body size, sex, and the habitat.