Original article

Dimensions, mass and volume of the turtles kidneys (*Trachemys scripta elegans* WIED, 1839)

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Abstract

The *Trachemys scripta elegans* turtle species, which was described by WIED, in 1839, it belongs to the suborder Cryptodira and the Emydidae family, it came up from the Mississippi Valley, United States of America. It is probably the most widespread reptile species worldwide. This study aims to determine the dimensions (thickness, length and width), the mass and volume of their kidneys and establish a correlation between biometric parameters of the left and right kidneys, and those with biometrics body. The kidneys are located in the caudal portion of the coelomic cavity, parallel to the vertebral column, and disposed dorsally on the syntopic organs to them, adhered to the carapace, after the bridge, in close proximity to the oviduct, in females, and testicles, in males. They also have elongated morphology craniocaudalis, rough aspect and brownish. In literature, there is no data concerning to the dimensions, mass and volume of the turtles kidneys, specifically either the *Trachemys scripta elegans* species, and this is the first study determining such parameters. For most individuals, the variables (mass, volume and size) established correlations, it demonstrates the interdependence of biometric parameters and renal body of the turtle. And even where there was no correlation, the values were very close to the limit set by statistical analysis ($|r| > 0.5$). Similarly, we observed a significant correlation between the parameters of contralateral and intersex kidneys. So it follows thefore that the biometrical renal values of *Trachemys scripta elegans* is proportional to the somatometric.

Keywords: biometry, kidneys, turtle.

1 Introduction

The turtles are animals that have the body protected by an outward expansion of the vertebrae and ossification of the skin called carapace (dorsal), and plastron (ventral). These constitute the Chelonia or Testudines order, which can be divided into two suborders: Cryptodira, species able to collect the head and limbs inside the shell (tortoises and turtles, except for marine) and Pleurodira, those which just retract the neck laterally (tortoises).

The turtle of the *Trachemys scripta elegans* species, which was described by Wied in 1839, it belongs to the suborder Cryptodira and Emydidae family, it comes from the Mississippi Valley, United States of America. It is probably the most widespread reptile species worldwide. In Brazil, it was introduced as a souvenir in small animals stores. However, its illegal marketing and mismanagement have caused several problems. Among them, the competition and the risk of genetic extinction of native species in Brazil, as *Trachemys dorbignyi* caused by hybridization, since this species has a high invasive potential, since they are predators and have a wide range of climatic adaptation, and they also are generalist to use the habitat and food (VIEIRA and COSTA, 2006).

It's an animal that has many shades of green in its skin, plastron and carapace. A striking feature is the presence of red or orange stripes located on the lateral cervical region, caudal to the eyes. Juveniles have the carapace and skin ranging from yellow-green to dark green stripes. When adults lose the bright tones and it turns to olive-green. Males are smaller than females, their plastron is yellow with dark circular spots with a slight concavity. The nails of the forelimbs are long, the tail long and broad and cloacal opening that extends beyond the carapace margin, which in adults measuring about 13 and 29 cm in length. Females have short nails of forelimbs, tail is shorter, narrow and cloacal opening that does not extend beyond the carapace margin. Young individuals are carnivorous and feed mainly fingerlings, tadpoles and snails, and as adults, they incorporate vegetables to your diet, becoming omnivorous (ERNST and BARBOUR, 1989 apud VIEIRA and COSTA, 2006). They prefer aquatic environments quiet, calm, deep mud and with enough space so they can take sun, staying in one region, leaving only to hibernate or spawn. They live on average 30 years in captivity.

The turtle of the *Trachemys scripta elegans* species has a pair of asymmetrical kidneys, located in the caudodorsal portion of the coelomic cavity (ASHLEY, 1962). These organs are in close contact with the oviduct in females and testes attached

to its ventral surface, in males (TEIXEIRA, 2001). The turtle kidney is short compared to other species of reptiles, and it is composed of lobes that form a compact mass on the ventral surface, giving the appearance convoluted to the organ, similar to cerebral gyri (THOMSON, 1939; ANDREW, 1959). The renal capsule is adhered to the kidney, consisting of fibrous connective tissue (GETTY, 1986).

According Reece (1996), the kidneys main functions are the urine production for excretion of waste products of metabolism, volume regulation and composition of the body's internal environment (extracellular fluid). It is also extremely important for the hormones secretion which are involved in systemic and renal dynamics regulation, for the production of red blood cells (erythropoietin) and calcium metabolism, phosphorus (D vitamin) and bones, and promote the hydrolysis of small peptides, conserving amino acids, toxic peptides and regulate effective plasma levels of some peptide hormones. It is for the kidney, it also maintain the electrolyte balance, regulate acid-base balance, keeping the pH constant blood and excrete exogenous substances such as drugs.

This study aims to determine the dimensions (thickness, length and width), mass and volume of the kidneys of turtle species *Trachemys scripta elegans* and establish a correlation between biometric parameters of the left and right kidneys, and those with biometrics body.

2 Material and methods

It was used a total of 40 specimens of the genus turtle *Trachemys scripta elegans* (WIED, 1839), from Sensory Psychophysiology Laboratory, Department of Experimental Psychology Institute of Psychology, University of São Paulo (IP-USP), where the body dimensions were measured with caliper approach milimetral (Vonder®) or millimeter tape measure, considering only the longest distance between points, to determine the height, length and width.

We obtained the volume and body mass through the method of Scherle (1970), where the specimens were immersed in graduated beaker containing water on an analytical balance, precision digital (Bioprecisa®), observing the displacement of fluid caused by the body volume animals and directly analyzing the display of the balance. Subsequently, the turtles went through the orthothanasia process and, after freezing, they were sent to the Wild and Domestic Animals Anatomy Laboratory at the Federal University do Vale do São Francisco, in Petrolina city, Pernambuco State (Latitude: 09° 23' 55"/Longitude: 40° 30' 03"/Altitude: 376 m).

Using hammer and chisel, we performed the opening in the bridge structure that connects the carapace to the plastron, removing them (Figure 1 and 2). Then the muscle was removed to facilitate the celiotomy and for blunt dilatation, broke up the renal capsule, isolating and excising the kidneys, hitting the adjacent tissues. Renal dimensions (thickness, length and width) were measured with a milimetral approach caliper (Vonder®) (Figure 3), being considered the greatest distances between points. For obtaining the mass and volume of the kidneys, it was promoted the Scherle method (1970), as previously described.

Regarding the nomenclature used, we adopted the Nominal Avium because there is no specific nomenclature for turtles, since, on the evolutionary scale, reptiles resemble much more to birds than to mammals. It was used for statistical analysis the *t* test, Pearson correlation coefficient and Folded F test (Equal Variances) using the Sas System Learning Edition 4.1 (2006) and Tinn-R (2009).

Figure 1. Using a chisel to open the bridge - Petrolina, PE, 2010.

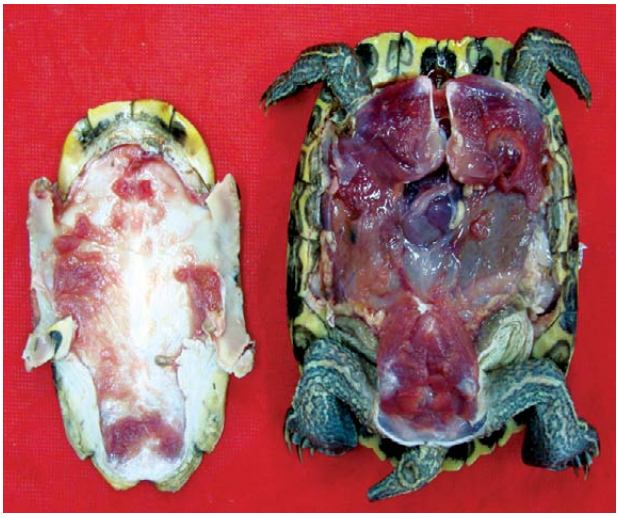

Figure 2. Plastron bounce – Petrolina, PE, 2010.

3 Results and discussion

The location and format of kidneys vary according to species: in lizards and crocodiles, they are elongated and located in the caudal portion of the coelomic cavity, in snakes, they have elongated and narrow shape, being next to one another, rather than occupy opposite sides cavity, in turtles, they are more compact (MESSER, 1947; MONTAGNA, 1959). Concerning to the turtle kidneys of the *Trachemys scripta elegans*, they were located in the caudal

portion of the coelomic cavity, confirming the observations of Solomon (1985), Pisano and Barbieri (1967), Grassé (1970) e Gans (1977), studying other species of turtles. Organs are arranged dorsally syntopic them (DULZETTO, 1967), adhered to the shell (Figure 4), after the bridge in close proximity to the oviduct in females and testes in males, as described by Teixeira (2001) studying the *Trachemys scritpa elegans*, and Faria (2003), in species of *Geochelone carbonaria* tortoises. Moreover, its length was greater than the width, corroborating Wake (1979), who states that the kidneys have elongated morphology craniocaudalis. It was noted also that these organs have rough aspect, as observed by Romer (1956), and brownish, similar to the kidneys of *Trachemys dorbignyi* described by Malvásio (1996).

The specimens studied showed kidneys with the dimensions (thickness, length and width), the mass and volume described in Table 1 and 2.

Comparing the variables of females and males, there was no correlation between length and width carapace and, volume and mass of the right and left kidneys, it means that each of these measures occurs independently between the sexes. For all other parameters there was no gender differences.

Analysing only the female data, it was noted that the width of the right kidney has no correlation with the thickness of it, unlike the left kidney. In both kidneys length has no correlation with thickness. When we compared variables related to right and left kidneys, it was observed that all are related. Despite differences in mean mass, volume and dimensions between the contralateral kidneys, the variables set a positive correlation, it means that the higher the biometric parameters of a kidney, the contralateral organ will have biometrics equivalent.

In males, the biometric variables of the kidneys established correlation, showing that all parameters are proportional. Moreover, comparing the left and right kidney, we could observe a strong correlation between their sizes, where the proportions of the right kidney followed those of the left.

Correlating carapace and kidneys, through the Pearson correlation test, it was noted that in females, there was no correlation between height and thickness of the carapace of the left kidney, perhaps due to the presence of functional ovarian on this antimere. However, all other parameters established correlation, demonstrating that the proportions of the kidneys accompanied the biometrical dimensions of the carapace. With regard to males, the body proportions of the animal established correlation with the kidney proportions, however, the length of the animals does not correlate to the variables of the organs, and the carapace width and height, they have slight lack of correlation to the volume of the kidney.

The values of the Pearson correlation coefficient for males and females, are described in Figures 5 and 6.

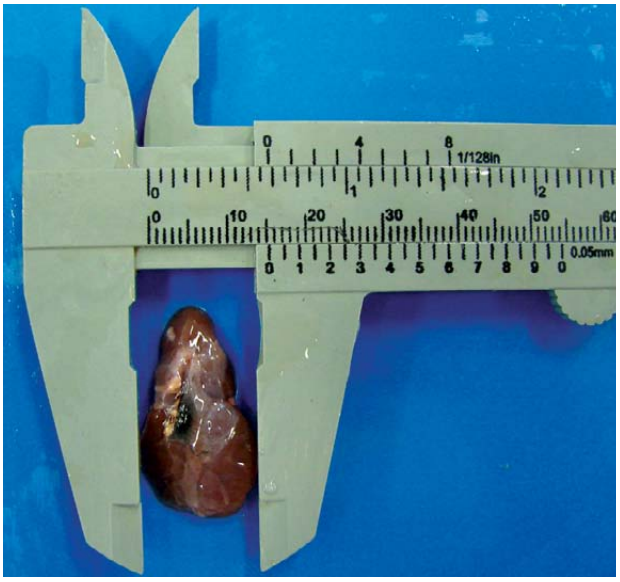

Figure 3. Measurement of Trachemys scripta elegans turtle kidney, using the milimetral approach caliper – Petrolina, PE, 2010.

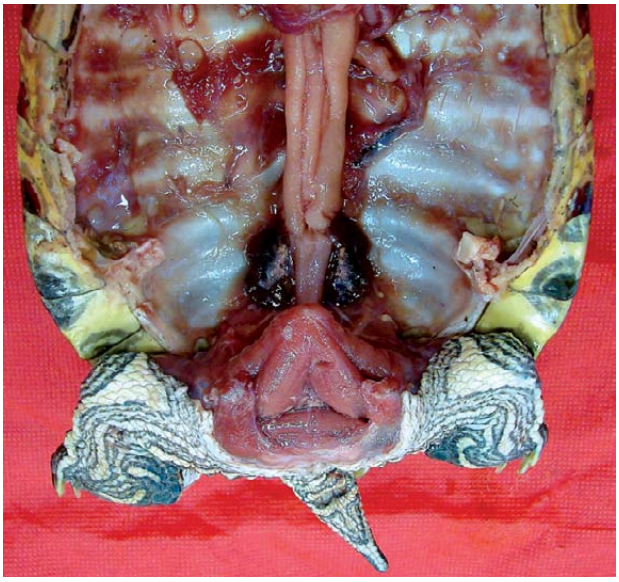

Figure 4. Positioning of the *Trachemys scripta elegans* turtle kidneys – Petrolina, PE, 2010.

Table 1. Means and standard deviations of size, mass and volume of the kidneys of female turtle *Trachemys scripta elegans* – Petrolina, 2010.

Parameters	Right kidney	Left kidney
Thickness (cm)	0.6038 ± 0.2271	0.5962 ± 0.1637
Length (cm)	2.8308 ± 0.6927	2.6077 ± 0.6286
Width (cm)	1.3115 ± 0.3445	1.3346 ± 0.3676
Mass (g)	1.1692 ± 0.6156	1.1192 ± 0.6203
Volume (cm^3)	1.2308 ± 0.6189	1.2577 ± 0.7479

Legend: cm – centimeter; g – grams; cm^3 - cubic centimeter.

Table 2. Means and standard deviations of size, weight and volume of kidneys from male turtle *Trachemys scripta elegans* – Petrolina, 2010.

Parameters	Right kidney	Left kidney
Thickness (cm)	0.567 ± 0.2387	0.567 ± 0.2387
Length (cm)	2.275 ± 0.4901	2.275 ± 0.4901
Width (cm)	1.175 ± 0.2563	1.175 ± 0.2563
Mass (g)	0.925 ± 0.3223	0.925 ± 0.3223
Volume (cm^3)	0.975 ± 0.3137	0.975 ± 0.3137

Legend: cm – centimeter; g – grams; cm^3 - cubic centimeter.

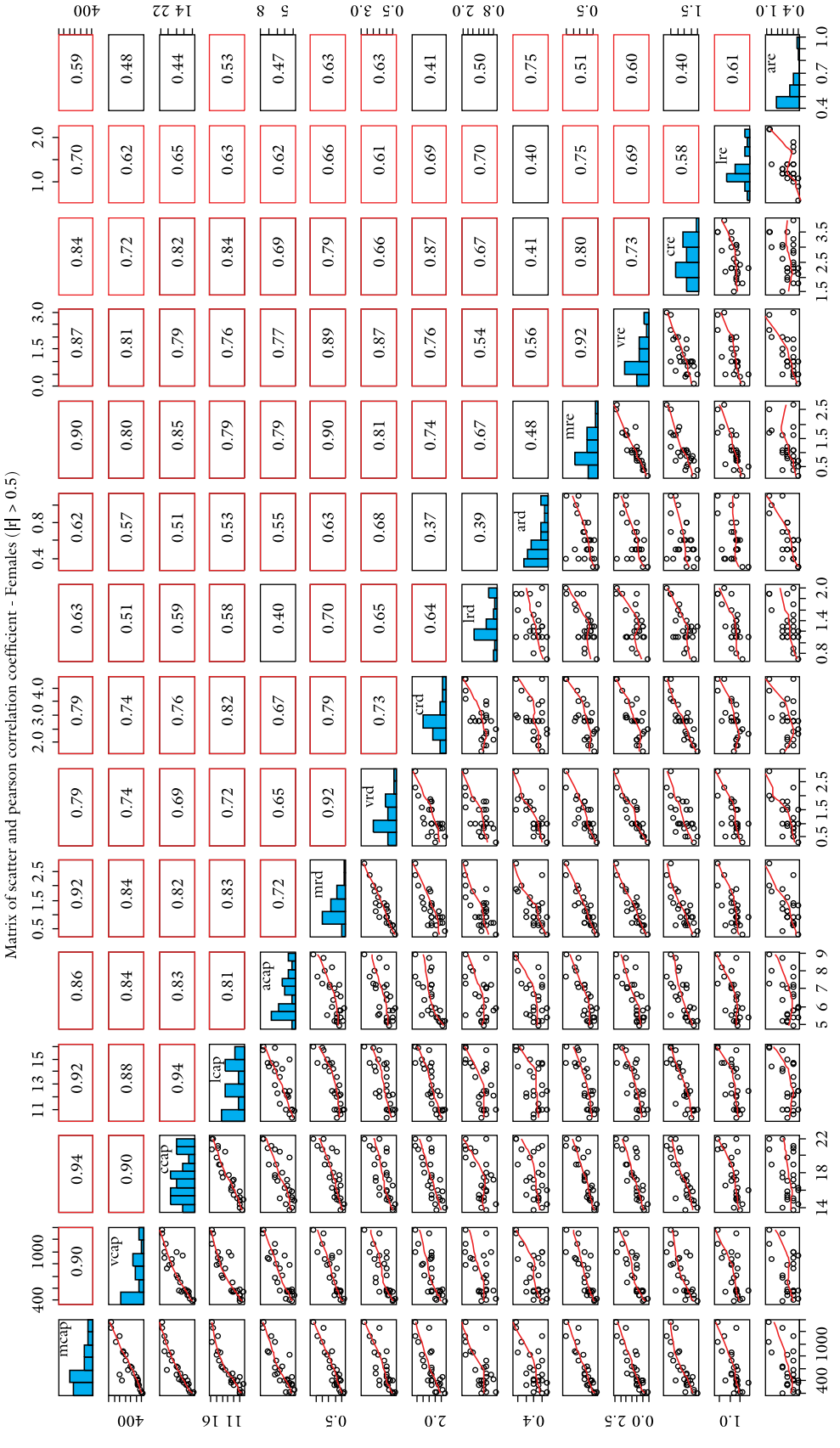

Figure 5. Matrix of scatter and Pearson correlation coefficient to compare renal and body parameters of female turtles *Trachemys scripta elegans* (| r | > 0.5) - Petrolina, 2010.

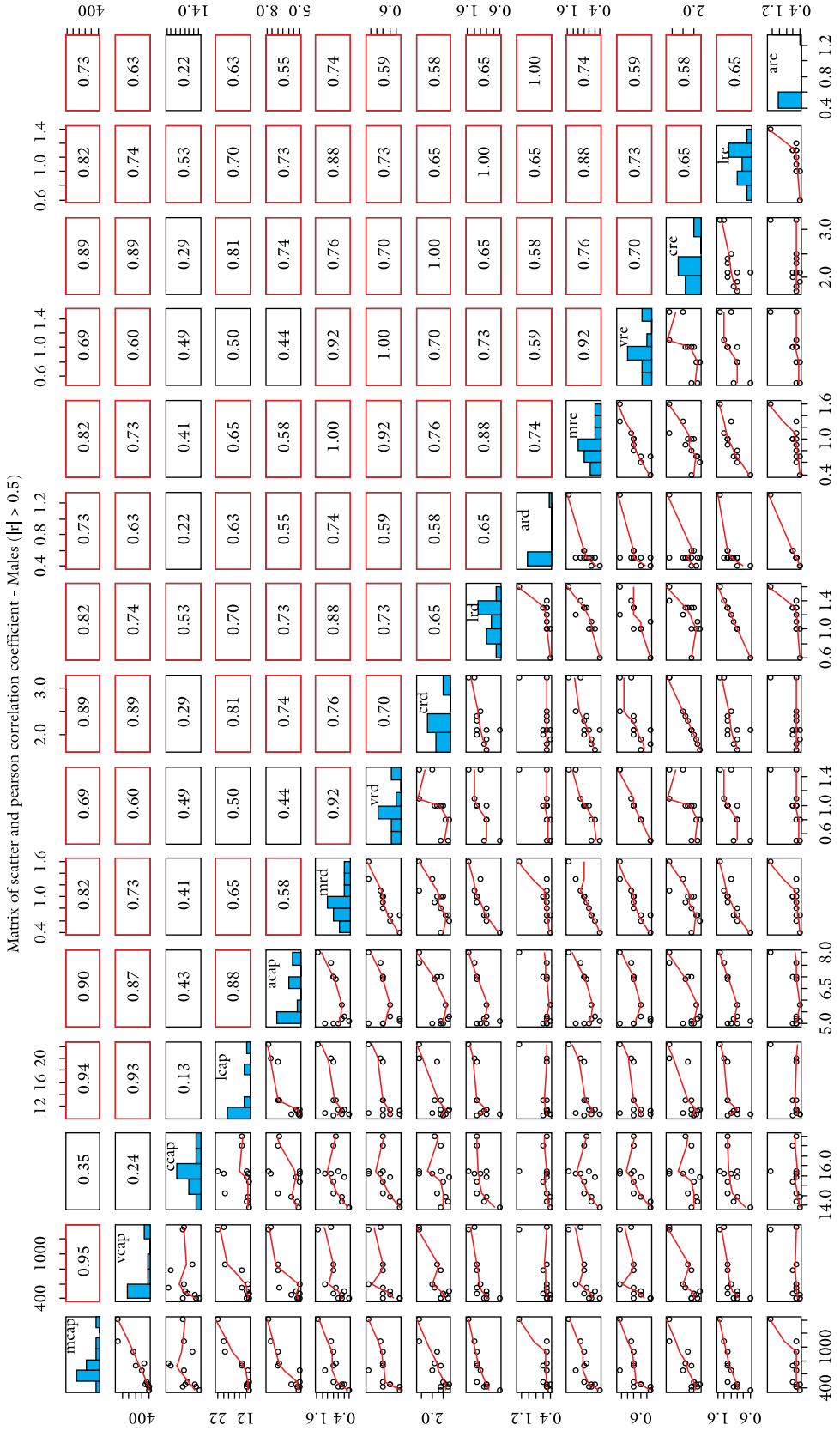

Figure 6. Matrix of scatter and Pearson correlation coefficient to compare renal and body parameters of male turtles *Trachemys scripta elegans* (| r |> 0.5) - Petrolina, 2010.

4 Conclusion

In the literature, there is no data concerning to the dimensions, weight and volume of the turtles kidneys, specifically either the species *Trachemys scripta elegans*, and this is the first study determining such parameters.

For most individuals, the variables (mass, volume and size) established correlations, demonstrating the interdependence of renal and body biometric parameters of the turtle *Trachemys scripta elegans*. And even where the variables did not correlate, the values were very close to the limit set by statistical analysis ($|r| > 0.5$). Similarly, we observed a significant correlation between the contralateral and intersex kidneys parameters.

It follows therefore that the values of biometrics renal *Trachemys scripta elegans* is proportional to somatometric, it means that the larger the animal, the greater their kidneys.

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