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COMPARATIVE ASSESSMENT OF MORPHOMETRIC PARAMETERS OF SOME COMMON LIZARDS

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ABSTRACT

The aim of this study was to examine the differences in the major external features and body weight of some common lizards from two locations. Ten samples each of the male and female rainbow lizard (Agama agama africana) and wall gecko (Hemidactylus frenatus) were purchased from Itoku market in Abeokuta, Ogun state as well as Bode market in Ibadan, Oyo state. Morphometric parameters such as the forelimb length, hindlimb length, tail length, head length, body length and total length were measured. It was observed that the body lengths of both male and female Agama lizards showed significant difference at ($P \leq 0.05$) in terms of location- the male and female Agama lizards in Abeokuta was longer in body length than those from Ibadan. In wall geckos, it was observed that the length of the forelimb was significantly different at ($P \leq 0.05$) while the hindlimb length, head length and body length showed significant difference at ($P \leq 0.01$) in terms of location. However, there was no significant difference in the body weights of the male Agama, female Agama and wall gecko from the different locations at both ($P \leq 0.01$) and ($P \leq 0.05$) significant levels although mean values showed that the weights of the male and female Agama lizards in Abeokuta was more than that of Ibadan while the mean values of the wall gecko from both locations was the same.

Keywords: Morphometrics, Lizards, Comparative assessment, Ibadan, Abeokuta.

INTRODUCTION

Lizard, any of a group of scaly reptiles related to snakes. Lizards are the most abundant of all reptiles and are found throughout the world in tropical and temperate areas. There are about 3000 species of living lizards, including such well known types as geckos, chameleons, Gila monsters, iguanas and skinks. Lizards far exceed snakes – the next most numerous reptiles – in number of individual. Except under special circumstances, snakes are something of a rarity even when one looks at them; lizards, on the other hand, seem to be everywhere in many of the warmer parts of the world (Coborn, 1987). Like snakes, some lizards are legless. Others resemble snakes but have legs. Many large lizards look much like crocodiles.

Lizards vary in size, shape and colour. They have many different ways of moving about and defending themselves. In parts of the United States, many people mistake lizards for salamander. The salamanders are commonly called "spring lizards" or "wood lizards". Salamanders and lizards look much alike but they are not related although both are cold-blooded animals. These animals cannot keep their bodies much warmer or cooler than their surroundings. But lizards have dry, scaly skin and clawed toes. Salamanders are amphibians related to frogs, and have moist skin and no scales or claws. Lizards love to stay in the sun but salamanders usually avoid sunlight (The World Book Encyclopedia, 2003).

The skin of many large lizards, such as iguanas, chuckwallas and monitors is used for leather goods such as handbags, wallets and shoes. Lizards are also used for food, especially among impoverished people, and in some agricultural areas they serve an important role in insect control. Some lizards are also kept as pets (Encyclopedia Americana, 2001). Several features reveal the close relationship between lizards and snakes, the most important of

which is the possession of two copulatory organs called hemipenes, in the males. Many male vertebrates have no copulatory organs; some have one but only lizards and snakes have two. Lizards and snakes are also alike and distinguishable from all other reptiles, except the tuatara in having a transverse anal opening. No single feature distinguishes lizards from snakes – not even legs, since some lizards lack limbs of any kind.

However, unlike snakes, lizards usually have the following characteristics: a pectoral or shoulder girdle, that is, a skeletal support for attachment of front limbs; movable eyelids; an external ear opening; an eardrum, and a different skull structure with more skull bones (Encyclopedia Americana, 2001). Lizards are also often confused with salamanders, amphibians that they sometimes superficially resemble. Salamanders however, have elongate or round anal opening, smooth rather than scaly skin, and no more than four fingers on the front limb, rather than the lizards usual five. Lizards occur on most land masses insular as well as continental, in temperate and tropical regions. In general, they increase in diversity as well as in abundance towards the tropics (Encyclopedia Americana, 2001).

Lizards lack the in-built body temperature control, many other animals have. So, most lizards live in places where the ground never freezes. Those that live in areas with cold winters must hibernate. Lizards thrive in the tropics and warm parts of the temperate zones. They are the most common reptile found in the desert and other dry regions. When the desert becomes too hot for comfort, lizards lie in the shade or under the sand to escape the sun's ray (Encyclopedia Americana, 2001). Lizards are extremely varied in form. There are long, slender snake-like racers; earthworm-like burrowers; stumpy-tailed short-bodied rock dwellers; long-tailed varieties capable of running swiftly on sand, earth and the surface of water; lumbering monsters living on land or in trees; spiny pancake-shape species; slick-skinned agile tree climbers and burrowers and still other too varied and numerous to describe.

The smallest lizards are certain geckos (Sphaerodactylus) that are about ¾ inch (1.9cm) long- the smallest of all reptiles. The largest lizards are the Komodo monitors, about 9 or 10feet (2.7-3.0m) long. Most are, however, less than 15inches (37cm) long. In several lizard families, especially the advanced ones, there are no external differences between the sexes. In other types of lizard however, there are some discernible differences between the sexes. Males of certain species for example have a somewhat enlarged head correlated with enlarged jaw muscles, and some have highly developed preanal pores. In most iguanas, males can be distinguished by their somewhat enlarged scales just behind the anus; in anoles, by their well-developed dewlap; and in some geckos, by postanal spurs and sacs. In some lizards, certain, though often minor, differences in colour pattern may occur, with one sex showing a heightening of colour, at least during the breeding season (Encyclopedia Americana, 2001).

The body of a lizard is covered with an epidermal layer of more or less horny keratin in the form of relatively thick keratinized, flexible skin. The scales vary greatly in shape and roughness: primitive lizards generally have small scales, and more advanced lizards have larger plates and larger scales which are sometimes accompanied by bony plates (osteoderms), shaped much like the epidermal elements but lying in the dermis under them. A very few small surfaces of the lizard body lack epidermal scales. For example, the so-called "mite pockets" - where the neck and limbs join the body - are partly bare-skinned. Some lizards have fused transparent eyelids similar to contact lenses (Smith, 1946).

Like other reptiles, lizards have few integumentary or skin glands. Paired scent glands are present at the base of the tail. In addition, many species have "femoral" or "preanal" pores occurring in a row or patches in front of the anus. These pores or glands are well developed only in males, being vestigial or absent in females. In mature males during the breeding season, a horny core grows out from each pore. This core produces a comb-like structure that the male rubs against the female, presumably to stimulate her sexually (Smith, 1946).

The limbs of lizards, especially the fingers and toes, show a wide variety of environmental adaptations. Some climbing species, for example, have broad pads on the feet to help them adhere to smooth surfaces. Most species have claws, but the claws may be long or short, slender or stout, depending on

the species' environment and way of life (Smith, 1946). Desert dwelling species generally have long limbs and fingers along the toes to aid them in getting a purchase on shifting sands; some water-dwelling types have the same adaptations. Slow-moving land types, on the other hand, tend to have short fingers and toes and heavy limbs and some borrowing types have only greatly reduced limbs or none at all (Smith, 1946). The tail is as useful to the lizard as one of its limbs. In length, it ranges from a scarcely visible nubbin to a structure several times the length of the body. In structure, it ranges from a flattened leaf-like affair to a whip-like or heavy club-like form complete with rings of heavy spikes (Mattison, 1989).

The tail has many uses. It serves as a balance for the body, especially in lizards that run on their hind legs with the fore part of the body in the air. It is prehensile in some grasping or hooking onto twigs or rough areas as the lizard climbs trees or cliffs. The tail also stores fat for use during winter hibernation and seems capable of absorbing moisture. In some species the tail is brightly coloured, serving as an ornament or aiding in camouflage. Some lizards wave the tail over the head, exposing a brightly coloured underside, as a warning or deceptive device and some, particularly those with spiny tails, use the tail for defense (Smith, 1946).

The most amazing use of the tail is, however, in escape from predators. Most lizards can break the tail at will at any desired point, usually fixed, however, by the point at which a blow is received. The break occurs at a specially adapted fracture plane near the middle of a vertebra. These muscles contract the blood vessels and permit little blood loss. The dismembered tail gyrates conspicuously, attracting the attention of the enemy while the lizard is able to slip away unnoticed. The lizard soon regenerates a new tail, usually shorter than the old one, but one that can again be used for escape if the need arises. The vertebrae are not regenerated, but a cartilaginous rod replaces the lost vertebrae. Species lacking the fracture plane cannot break off their tail and do not regenerate a new tail if theirs is accidentally cut off (Smith, 1946).

The tail serves yet another unusual function. Thingy lizards have been known to break off the tail deliberately and eat it or to return to the site where the tail was lost and eat any remaining parts (Coborn, 1987). Found in most sub-Saharan Africa (Harris, 1964). *Agama agama* is often referred to as the African red-headed agama or common agama in the United States pet trade and popular literature (Frank and Ramus, 1995; Bartlett, 1999), and in specific literature as the African rainbow lizard (Romer, 1953; Daniel, 1960; Chapman, 1964; Harris, 1964; James and Porter, 1979; Cloudsley-Thompson, 1981; Sodeinde and Kuku, 1989). *Agama agama* is found in tropical, sub-Saharan Africa from Senegal east to Ethiopia and south to northern Angola and southern Tanzania. The colouration and pattern of this species varies over its geographic range, and over nine subspecies are currently recognized (EMBL Reptile Database, 2003). The subspecies in Florida is apparently *Agama agama africana*, which is imported for the pet trade from Ghana, Togo and possibly Benin (Foster, 2003). Dominant, reproductive males in the five Florida populations have tri-coloured tails as described for this subspecies by Harris (1964) and are identified to photographs by James and Porter (1979) and Cloudsley-Thompson (1981) of *Agama agama* from Ghana and Nigeria in West Africa.

The house gecko is grayish, pinkish or pale brown with darker flecks. The colour may vary, depending on the surrounding temperature. This tint can be uniform in colour, or more or less distinctly marbled with darker markings. The head is generally variegated with brown. On the side of the head, a more or less defined passes through the eye and in some individuals extends along the side of the body. The eyes are covered by transparent spectacles, pupils vertically elliptical with serrated edges. The lower surface of the animal is whitish. At night, the upper surface is light gray, tan or brown with scattered small spots, overall colour darker during the day (Edgren, 1950).

The nostril is pierced between the rostra, the first labial and three nasals. There are 10-12 upper and 8-10 lower labials. The mental is large, triangular or pentagonal. There are 2 or3 pairs of chin-shields; the median is in contact behind the point of the mental. The abdominal scales are moderate in size, cycloid and imbricate. The male has a series of 30

or 36 femoral pores which are not interrupted on the preanal region.

The tail is rounded, feebly depressed and covered above with very small smooth scales and six longitudinal series of keeled tubercles. The underside has a median series of transverse dilated plates. The tail serves in many species as an energy or fatlike storage which the animal uses under abnormal feeding conditions. They are also used in territorial posturing; male house geckos lift their tails and vibrate it briefly to ward off other males. Though fragile, the tail regenerates to its original shape if detached.

The limbs are relatively short and stout. It has toe pads on each of its toes that have thousands of microscopic, hair-like structures known as setae, project between the lamellae. The setae are forked at the end, enabling the gecko to grip the surface on which it is walking. With these adaptations, the gecko can climb vertical surfaces and run across ceilings (Norman, 2003).

This gecko is active at night, although it may be seen outside on cloudy days. This nocturnal and arboreal species is closely tied to human habitations. During the day, they can be found beneath surface debris and under loose bark of trees, in houses, in sheltered artificial hide a ways, such as electric installations, air condition units, lamps e.t.c. Male house geckos can be unfriendly and mean. This is especially true when there are many of them in one area and plenty of food.

Both sexes vocalize, producing a loud chirp, usually uttered during aggressive interactions. Unlike other lizards, geckos have a distinctly audible voice and utter chirps and click sounds. The male uses the voice to advertise ownership of a particular area and to attract females (Bartlett, 1988).

Geckos are found to have excellent vision and good hearing. They also possess the visual attributes and sound producing mechanisms necessary for complex displays. Display types are categorized according to the display mechanism used. Visual displays are found to utilize colour, pattern, posture and movement. These displays are used in predator threat as well as in intraspecific social contexts such as aggression and courtship. Combined visual-acoustic displays involve colour, pattern, postures, movements and sound. Combined displays are used in predator threat and in intraspecific aggressive encounters. Acoustic displays have little or no visual component and involve sounds that may be single chirps or temporally patterned multiple chirps. The single chirps are associated with distress while the multiple chirps are heard in intraspecific social contexts. The displays of diurnal and nocturnal geckos are compared and it is found that differences are correlated with differences in their diet activity cycles (Bartlett *et al*, 1995).

Morphometrics is a field concerned with studying variations and changes in the form (shape and size) of organisms including measurement of lengths. Morphometric analyses are commonly performed on organisms and are particularly useful in analyzing the fossil record. Morphometrics in a broader sense of the term is also used to precisely locate certain areas of featureless organs and is used it describing the shape of other things (Zelditch *et al*; 2004). Morphometrics adds a quantitative element to descriptions allowing more rigorous fashion and permits numerical comparism between different forms; by reducing shape to a series of numbers. Further, statistical analysis can highlight areas where changes is concentrated, removing the need to explicitly declare an area for investigation before study.

Reptiles are rarely studied in many places because they comprise of species that are generally unloved due to their appearance, nature and activities. At present, not much scientific research have been conducted on Nigerian lizards and as such there are limited knowledge of the potential and values of lizards as environmental indicators especially in the South western region of Nigeria.

MATERIALS AND METHODS

Study Area

Ten unmutilated samples of male and female rainbow lizard (*Agama agama africana)* and wall gecko (*Hemidactylus frenatus*) were purchased from Itoku market in Abeokuta and Bode market in Ibadan. Abeokuta is a city in Ogun State in southwest Nigeria and is situated at 7°9′39″N and 3°20′54″E on the Ogun River; 64 miles north of Lagos by railway, or 81 miles by water. Ibadan (the town at the junction of the savannah and the forest), the capital of Oyo State, is the third largest city in Nigeria by population (after Lagos and Kano), and the largest in geographical area and is situated at 7°23′47″N and 3°55′0″E.

Formalin was sprinkled into a container with lid and the lizards were placed inside till they became inactive. Sensitive weighing scale was used to take the body weights of the lizards while thread and ruler was used to measure forelimb length, hindlimb length, tail length, head length, body length and total length. Pen and note pad was used to document the morphometric parameters measured. Statistical Package for Social Science (SPSS) was used to analyze the data collected using the independent sample t-Test.

RESULTS

Table 1: Comparison of morphometric parameters in Agama Lizards by Location

Parameter (cm)	N	Ibadan (mean)	Abeokuta (mean)	T-Value	Sig P	Remark
Fore limb Length	10	4.34	4.37	0.15	0.88	N.S.
Hind limb Length	10	5.89	5.81	0.51	0.61	N.S.
Tail length (cm)	10	17.19	17.27	0.29	0.78	N.S.
Head Length	10	3.72	3.79	0.83	0.42	N.S.
Body Length	10	6.08	6.38	2.21	0.04**	S
Total Length	10	26.96	27.44	1.09	0.29	N.S.

*** Significant at (P≤0.05); NS = Not Significant, S = Significant*

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Table 2: Comparison of morphometric parameters in Female Lizards by Location

Parameter (cm)	N	Ibadan (mean)	Abeokuta (mean)	T-Value	Sig P	Remark
Fore limb Length	10	4.09	4.17	0.497	0.62	N. S.
Hind limb Length	10	5.50	5.73	1.902	0.07	N.S.
Tail length	10	16.50	16.81	1.66	0.11	N.S.
Head Length	10	3.12	3.10	0.19	0.85	N.S.
Body Length	10	5.56	5.77	2.31	0.04**	S
Total Length	10	25.18	25.68	1.53	0.14	N.S.

** Significant at (P≤0.05); NS = Not Significant, S = Significant

Table 3: Comparison of morphometric parameters in Wall Geckos by Location

Parameter (cm)	N	Ibadan (mean)	Abeokuta (mean)	T-Value	Sig P	Remark
Fore limb Length	10	2.00	2.21	2.22	0.04**	S
Hind limb Length	10	2.45	3.08	4.56	0.00*	S
Tail length	10	6.20	6.02	0.69	0.50	N.S
Head Length	10	1.66	1.99	2.97	0.01*	S
Body Length	10	4.54	5.09	4.99	0.00*	S
Total Length	10	12.40	13.10	1.61	0.13	N.S

* Significant at (P≤0.01), ** Significant at (P≤0.05); NS = Not Significant, S = Significant

Table 4: Comparison of Body Weight in Agama lizard, Female lizard and wall gecko by location

Species	N	Ibadan (mean)	Abeokuta (mean)	T-Value	Sig P	Remark
Agama agama africana (male)	10	291.30(g)	304.27 (g)	0.26	0.81	N.S
Agama agama africana (female)	10	312.33(g)	317.93(g)	0.14	0.90	N.S
Hemidactylus frenatus	10	130.93(g)	130.93(g)	0.00	1.00	N.S

NS = Not Significant, S = Significant

DISCUSSION

Table 1 show that there were no significant difference in the forelimb, hindlimb, tail, head length and total length(s). However, agama lizards from Abeokuta had longer body length (6.38cm) than agama lizards from Ibadan.

Consequently, Table 2 shows that there were no significant differences in the length of fore limb,

hind limb, tail length and total body length of female lizards between the two locations. However, the body length of female lizard in Abeokuta was significantly higher than the body length (5.77cm) of female lizards in Ibadan.

However, Table 3 shows that Wall geckos in Ibadan were significantly shorter ($P \leq 0.05$) in forelimb (2.00cm), hindlimb (2.45cm), head length and body length than wall geckos in Abeokuta with length of 2.21cm, 3.08cm, 1.99cm and 4.54cm for fore limb, hind limb, head, body respectively. However, there were no significant differences in the tail length and total length for wall geckos between the two locations.

The results of the Comparison of the body weight and microbial load by species, sex and locations were presented in Tables 4 shows that there was no significant difference in the body weight of the agama lizards, female lizards and wall geckos collected from Ibadan and Abeokuta.

CONCLUSION AND RECOMMENDATION

This study illustrated that there was no significant difference in the morphometric parameters (forelimb length, hindlimb length, tail length, head length, total length) and body weight of both agama male and female lizard but there was significant difference in the body length in both locations with Abeokuta having longer body than those from Ibadan. Limb length strongly impacts locomotor performance; lizards with longer hindlimbs and shorter forelimbs achieve greater sprint speeds and jump farther (e.g., Bonine & Garland 1999; Toro *et al*. 2004) although there may be additional advantages to longer limbs that are unrelated to locomotor performance (Iraeta *et al*. 2011).

In the wall geckos, there was significant difference in the forelimb length, hindlimb length, head length and body length but no significant difference in the tail length and total length in both locations with Abeokuta having longer forelimb, hindlimb, head length and body length. However, longer limbs may not always be optimal for effective escape from a predator. As discussed above, shorter limbs may be advantageous for maneuvering in confined spaces, such as burrows, because they may achieve faster cycling frequencies and are easier to maneuver around obstructions. Shorter limbs may also be beneficial for stability on narrower surfaces (Enge *et al.*, 2004).

Therefore, further research is required in order to evaluate differential elongation of limb segments and also how it affects locomotor performance.

REFERENCES

Bartlett, R.D. and P.P. Bartlett. (1995). Geckos. Everything about selection, care, nutrition, disease, breeding and behaviour. Hauppauge New York: Barron's Educational Series. Pp 169.

Bartlett, R.D. and P.P. Bartlett. (1999). A Field Guide to Florida Reptiles and Amphibians.Gulf Publishing, Houston, TX. Pp 280.

Bartlett, R.D. (1988). Geckos: In search of Reptiles and Amphibians. New York: E.J. Brill.Pp.204.

Bonine, K. E. and Garland, T., Jr. (1999). Sprint performance of phrynosomatid lizards, measured on a high-speed treadmill, correlates with hindlimb length. *Journal of Zoology*, 248, 255–265.

Chapman, B.M. and R.F Chapman. (1964). Observations on the biology of the lizard *Agama agama* in Ghana. *Proceedings of the Zoological* Society *of London*, 143: 121-132.

Cloudsley-Thompson, J.L., (1981). Bionomics of the rainbow lizard *Agama agama* (L.) in Eastern Nigeria during the dry season. *Journal of Arid Environments*, 235-245.

Coborn, J. 1987. Snakes and Lizards. Ralph Curtis Books. Pp 205-213.

Daniel, P.M. (1960). Growth and cyclic behaviour in the West African Lizard, *Agama agama* Africana. Copeia 1960: 94-97.

Edgren, R.A. (1950). Notes on the Neotropical population of *Hemidactylus frenatus* Schlegel Natural History Miscellanea (55): 1-3.

EMBL Reptile Database. (2003). Available online at: *http//www/emblheidelberg.de/~uetz/Living Reptiles. html.*

Encyclopedia Americana, (2001). Lizards. Pp 621-624.

Enge, K.M., Krysko K.L. and Talley B.L. (2004). Distribution and Ecology of the introduced African Rainbow lizard, *Agama agama Africana* (Sauria: Agamidae), in Florida.

Foster, D.R. (2003). Archer, FL. Pers. Comm. Reviewed on 2007-01-10

Frank, N. and E. Ramus. (1995). A Complete Guide to Scientific and Common Names of Reptiles and Amphibians of the World. N G Publishers, Pottsville, PA. 377pp.

Harris, V.A. 1964. The Life of the Rainbow lizard. Hutchinson Tropical Monographs. 174pp.

Iraeta, P., Monasterio, C., Salvador, A. and Díaz, J. A. (2011). Sexual dimorphism and interpopulation differences in lizard hind limb length: Locomotor performance or chemical signalling? Biological Journal of the Linnean Society, 104, 318–329.

James, F.C. and W.P Porter. (1979). Behaviour-microclimate relationships in the African Rainbow Lizard, *Agama agama*. Copeia 1979: 585-593.

Mattison, C. (1989). Lizards of the World. Facts on file, New York. Pp. 105-118.

Norman, B.R. (2003). A new geographical record for the introduced house gecko, *Hemidactylus frenatus*, at Cabo San Lucas, Baja California, Mexico, with notes on other species observed. Bulletin of the Chicago Herpetological society. 38(5): 98-100.

Romer, J. D. (1953). Reptiles and amphibians collected in the Port Harcourt area of Nigeria. Copeia 1953:121–123.

Smith, H.M. (1946). Handbook of Lizards. Comstock Publishers. Pp. 55-83.

Sodeinde, O. A. and O. A. Kuku. (1989). Aspects of the morphometry, growth-related parameters and reproductive condition of agama lizards in Ago-Iowye, Nigeria. *Journal of Herpetology*, 1:386–392.

The World book Encyclopedia. 2003. Lizards. 12. Pp 399-401.

Toro, E., Herrel, A. and Irschick, D. J. (2004). The evolution of jumping performance in Caribbean Anolis lizards: Solutions to biomechanical trade-offs. American Naturalist, 163, 844–856.

Zelditch, M. *et al*. (2004). Geometrics for biologists. Academic press. Pp. 115. ISBN 012778460.