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Research Article

Growth performance of juvenile Nile crocodile (*Crocodylus niloticus*) fed on chicken fillet, fish and frog

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Abstract: This research was carried out to evaluate the best feeds and feeding methods that might give good growth performance for juvenile crocodiles, (*Crocodylus niloticus)*. This is because crocodiles nutrition is poorly understood. Therefore, this research is to provide varied alternative feeds for growing both captive and commercial crocodiles to maturity cheaply and as quickly as possible. In the study, Nile juvenile crocodiles were obtained from River Benue through the fishermen and quarantine for one week for aclimatization. Then, they were carefully introduced into each nine constructed pens/pools. These pens/pools were divided into three sub-groups or treatments. Trt 1 (1-3), Trt 2 (4-6) and Trt 3 (7-9) for the different feed treatments. Feeds were purposely selected based on their availability. Three feeds, chicken fillets (intestines), fishes (tilapia), and Frogs were selected and allotted to each treatment/group. Then their growth rates were determined through measurement of their length and weight twice a week for three months .The data collected were analyzed using descriptive statistics (frequency, %, mean values) and Analysis of variance (ANOVA). The results showed that treatment 1, (Trt 1) using chicken fillet feed have intercept a = 10.55 while exponent b (growth pattern) = 8.06 and exhibit positive allometric growth regression coefficient, R^2 = 0.96, indicating a significant growth. Treatment 2 (fish feed),(Trt2), intercept was, a= 6.05 and exponent = 5.04 with positive allometric growth and significant growth R^2 = 0.99. Also, treatment 3 (frog feed),(Trt3) has it intercept a = 5.05 and growth pattern, exponent , b = 4.40 with positive allometric growth and significant growth of R^3 (regression coefficient) = 0.98. This analysis means that the frog feeds (treatment 3) grew the juvenile crocodiles best, which was near isometric growth as this exhibited allometric growth increase in length, girth and size. There was moderate growth pattern with fish feeds while the least growth took place in the juveniles fed with chicken fillets (intestines). Frogs are known to be carnivorous and relatively abundant in fresh water. Therefore, crocodiles (carnivores) appeared to draw much energy from feeding on these frogs for their rapid growth and performance.

Keywords: Juvenile, Feed, Carnivore, Allometric growth and growth pattern.

INTRODUCTION

Nile crocodile, (*Crocodylus niloticus)* are found mostly in freshwater rivers and swamps. They love spending most of their tropical wet seasons in freshwater rivers and move to estuaries during the dry season or travel far out of the sea. They can also be found in the brackish water of mangrove-lined tidal rivers, creeks, lagoons and billabongs, (Leslic and spotila, 2001).

The Nile crocodile is found throughout Australia, especially in western Australia; Queensland, Northern territory, in multiple river systems like Adeliade, Daly and Mary rivers close to Darwin in new Guinea. It is also commonly found in some part of india, including the suburbans and Orissa's Blitarkanika Wildlife sanctuary, (leslie, and Spotila 2001). In Africa, particularly, Nigeria, they are common in most freshwater bodies such as rivers, ponds and estuaries. River Kaduna in the hinterland of northern Nigeria is noted for a lot of *Crocodylus niloticus.* That is why 'Kaduna' (Hausa) which means crocodile is named after the river, (Adam, 2011).

The adult crocodiles do not face any danger of predators. However, confrontation with other predators like tiger might lead to their death. Feral pigs and goannas are known to consume crocodile eggs. Baby

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Nile crocodiles may face danger from monitor Lizards, predatory fishes, as well as raptorial and aquatic birds (MCN ease & Joanen, 1981)

In adaptation, their nostrils and eyes are located atop their heads. These allow them stay beneath the water surface and yet able to see, smell, hear and breathe. There is a special valve located at the backside of the throat permitting the crocodile to keep it mouth open under water, yet preventing water from entering the throat. They also possess about 40 to 60 large, sharp teeth that allow them to eat various large and small animals, making them efficient predators. They are very lethargic as they require less energy on daily basis. Therefore, they can survive without food for several days/months. They locate their prey easily because of their excellent sense of hearing and possess colour pattern that camouflage them as logs partly submerged in aquatic habitat as well as excellent swimmers. In addition, the estuarine crocodile uses sound, visual, as well as chemical signals to communicate among themselves, (MCNease and Joahen, 1981).

However, in captivity, the keepers offer balanced diet that will maintain the animal's fitness. Each food should have range of amino acids, vitamins and minerals, proteins, fats and carbohydrates for their healthy fitness and growth. In their natural habitat, juvenile crocodiles including adults jump above water to catch an overhanging prey. They crush and swallow smaller preys immediately, (Revol, 1995).

They can survive on rather small quantities of food for a long period. Juveniles always restrict their diet to smaller animals like insects, crustaceans, amphibians, smaller reptiles and fishes.

Ironically, exploitation for skins and meat has proved to be a valuable tool in Nile crocodile conservation, providing an incentive for people to protect the species and its habitat. Although listed on appendix 1, (red) of the convention on international Trade in Endangered species (CITES), meaning most international trade in the species is banned. However, it has been downgraded to appendix ii, (yellow) in a number of countries, allowing a certain level of commercial utilization and trade, mainly in the form of ranching. In this system, eggs or hatchings are taken from wild and reared in captivity. This practice is acceptable as this may even help boost Nile crocodiles numbers as it improve the survival rate of the young since a proportion of these may be returned to the wild. These sustainable use initiatives are also thought to be responsible for the lack of illegal trade in the species, (Revol, 1995).

It is important to note that conflicts with humans present appear to be the greatest threats to the Nile crocodiles. Humans are intolerant to crocodiles and therefore deliberate destruction of nests and killings of adults are common. Crocodiles may also come in conflict with fishermen, damaging nets when trying to remove fish from them, (Ross, 1998).

The Nile crocodiles show a shift in diet with increasing body size. Young ones feed on invertebrates such as insects, small fish, amphibians and crustaceans and changing to vertebrates such as fish, turtles, birds and mammals as they mature, (Modha, 1967)

Just like other reptiles, the Nile crocodiles control its body temperature by entering the water when hot and basking in the sun when cool. Many are often sighted along river banks and may also dig dens, which it uses to retreat from adverse environmental conditions.

Breeding usually takes place during the dry season. However, exact timing varies with location. Mating takes place in the water. The female Nile crocodile can lay up to 60 eggs, cover them with sand and guard them for the entire incubation period which is usually about 90 days, (Molla, 2011).

METHODOLOGY

STUDY AREA:

The study was conducted in the markurdi Zoological garden as the juveniles were collected from River Benue between Agboughoul village and Abinsi settlements.. It lies within latitude 008^0 33.79'E and $07^0$44.42'N and longitude $008^0$33.79'E and $008^0$34'NE. It shares boundary with the Benue state university and situated 4km but a half(1\2)km off along makurdi – Gboko express way.

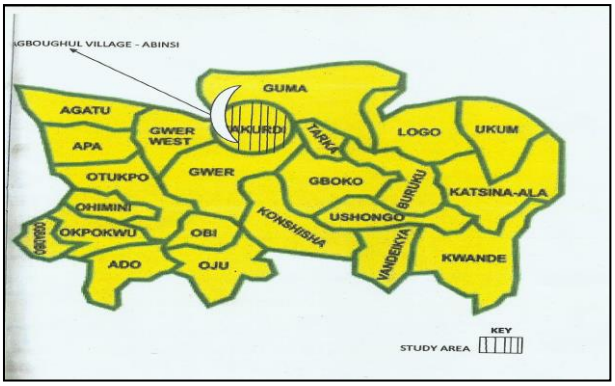

Fig 1: Map of the study Area. Source.www/goggle.com

STUDY DESIGN

Nile Juvenile Crocodiles were collated from the River Benue by fishermen and habituated in the pool provided in the zoological garden for two weeks. Then, the Nile juvenile crocodiles each were isolated and put in each of the nine constructed pens/pools. The Nine pools/pens were subdivided into three group/treatment as follows:

A. Group 1-3 (Trt1) were fed with chicken fillets (intestines)
B. Group 4-6 (Trt2) were fed with fish.
D. Group 7 – 9 (Trt3) were fed with frog.

Feeds were collected locally, the chicken fillet were collected from the chicken butchers. The fishes were bought from the market fish sellers at Wadata market while the frog, were collected from the fishermen under the new bridge in Makurdi.

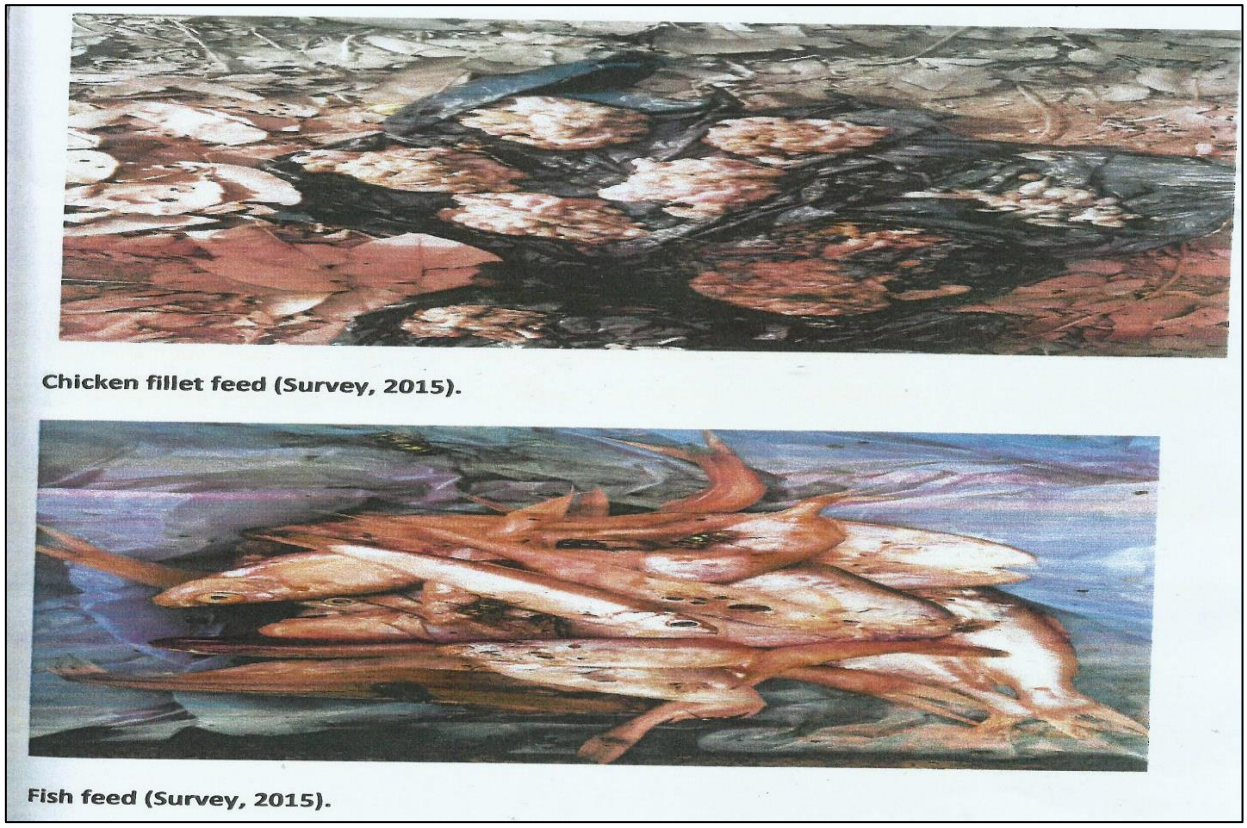

Plate1: Chicken fillets (above) and Fish Feeds (below).

Plate2: Frog Feeds Field survey (2015)

The method employed in administering these three (3) feeds to the juvenile crocodiles varies depending on size and nature of the feeds. All the feeds were cut and chopped to boneless size before feeding in each treatment.

Plate3: Preparation of the crocodile feeds Field survey 2015.

Plate4: Weight measurement at project site. Field survey (2015)

Weight taking at project site **Field survey (2015)**

Table 2: Regression of *Crocodylus niloticus* fed with three kinds of Diets.

Treatment	Regression Parameter			Interpretation
	A	b	R2	
A: Chicken Filled Feed	10.55	8.06	0.96	Positive Allometry*
B: Fish Feed	6.53	5.49	0.99	Positive Allometry*
C: Frog Feed	5.05	4.40	0.98	Positive Allometry*

The table 2 indicated the different parameters used in assessing the growth pattern of the crocodile a = size, b = Wight, R^2 = growth.

- Positive allometry = Positive growth (girth + size).

Table 3: Variation in the Length, weight and condition factor of *Crocodylus niloticus* fed with three Different kinds of Diet.

	Treatment	Body Parameters								
		Length (cm) (Min Max Mean+SEM)			Weight (g) (Min Max Mean+SEM)			Condition factor (Min Max)))) Mean+SEM		
1.	**Chicken Filled Feed**	**32.20**	**41.70**	**37.09+0.29b**	**50.00**	**209.40**	**129.50+67b**	**0.147**	**0.361**	**0.226+005b**
2.	**Fish Feed**	**28.20**	**49.70**	**38.19+0.78b**	**70.00**	**246.30**	**146.28+5.57b**	**0.085**	**0.085**	**0.248+0.006b**
3.	**Frog Feed**	**42.70**	**62.00**	**52.63+0.62a**	**90.10**	**603.00**	**336.90+13.50a**	**0.107**	**0.297**	**0.322+0.023a**
	LSD		**1.67**			**24.68**			**0.04**	

From table 3, the mean weight of the treatment is 24.68 while the mean length was 1.67. this indicated that the juvenile crocodiles increased in weight faster than in length, and this agreed with Murphy et al, (1991) that the relationship between height(L) and weight(W) is may not linear.

DISCUSSION

Feeding is an important aspect of animal habit that determine their survival in an environment. In addition, types of feeds further dictate their fitness and longevity. However, there has being poor understanding about the nutrition ecology of Nile crocodiles. But as far as it is known, they hardly make use of vegetable based proteins because they are carnivorous in nature. They require enormous energy for all their activities. They cannot be starved into eating what they do not like as attempts to use dried and any constituted feed(s) or salted preparations failed, Murphy (1991).These agreed with the findings that Invertebrates predominate in the diet of the juvenile, (Morton, 2001). From the research work, the exponential analysis from the growth were greater than 3 and regression coefficient, R^2 approximately = 1 showing positive allometric growth and significant growth respectively. This is in line with the view of mariel, (2014) which said that in life science, if scaling, that is isometric in length and weight is plotted against girth size of the organism, the data should fall along a straight line with slope, b = 3, indicating that all the body parts grow approximately the same rate. However, if b is less than three (b>3), it becomes negative allometric growth meaning there is more increased in length than in girth and size. Treatment one (chicken fillet feeds), showed the least

isometric and significant growth. However, the highest isometric and significant growths were recorded with frog feeds. Both isometric and significant growth were moderate with fish feeds. This perfectly agreed with the work of Mariel (2014). Frogs and fishes are abundant in our natural water bodies and can be grown artificially in ponds. Therefore, rearing and semi-domestication of these Nile crocodile can be done in large quantities with the fishes frogs as feeds.

CONCLUSION

From the study, it is easy to raise large farms of Nile crocodiles, (this edible and valuable economical animal species) from cheap feeds as frog and fishes. These feeds are readily available in almost all our natural water bodies and can be grown in artificial ponds too.

Variation among individuals of the same set given the same treatment of feed may exist due to genetic differences, age and sex. The frog meat feed (mostly red meat), seems to grew the animals healthier than the other feeds. This confirmed the work of MCNease and Joane, (1981), 'the red meat' seems to produce or breed healthier looking animals probably due to the presence of red blood cells in the 'red meat'.

RECOMMENDATIONS

- Frog feeds should be made the main diet of juvenile crocodiles while fish can be part of the overall dietary plan.
- Chicken fillet feeds should also be used as complimentary feed.
- Separate sexes of juvenile crocodiles should be used in conducting similar research to determine those with fastest growth rate.
- The use of specific fish species and red meat of some domestic animals should be tried in growing the juvenile crocodiles.

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