

Research Article

Comparative Studies of Water Leaf (*Talinu triangulare*), Pawpaw Leaf (*carica papaya*), Siam Weed (*chromolaena dorata*) and Growers Mash On the Growth of African Giant Snail (*Achatina achatina*)

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Abstract: African giant snails are delicacy for most African people particularly in the West African sub-region including Nigeria. This work was conducted to encourage domestication in this valued wildlife species in order to increase human protein consumption and reduce pressure on the ones in the wild. The process of farming or raising snails is simply called Heliculture. The experiment was carried out in the snail pen of the Wildlife and Range Management Department of the Federal University of Agriculture Makurdi, Benue State, Nigeria. A total of twenty snails were bought from Aba market, Benin City along with four Raffia baskets. The snails were randomly selected and arranged into four groups A, B, C and D with each group having five snails. Each snail were marked using an indelible marker and quarantine for five days. On the sixth day, each snail were weighed using a weighing balance to obtain the initial weight. Subsequently, the weight was taking for each of this group, weekly and for eight weeks. Data were then collected and subjected to descriptive statistics such as percentage count, analysis of variance (ANOVA) and regression to determine the relationship between length and weight gain. The results revealed that snails fed on *Carica papaya* leaf had the best value for weight gain (18.71g), while the least was *Talinum triangulae* with a weight gain of (4.86g). There was significant difference between the four groups and their mean weight. It was also observed from the study that *Talinum triangulae* was consumed at a high rate by the snails but still performed the lowest in weight gain which may be attributed to the low amount of nutrient content. Growers mash was consumed at a high rate by the snails but still the lowest in weight gain probably due to low amount of nutrient content. Growers mash was consumed at a slow rate but performed second highest which may be due to the high protein nutrient in the treatment. In conclusion, *Achatina achatina* appeared to grow well with feeds of high protein content/mixture. Therefore, the use of pawpaw leaf would be most beneficial for feeding *A. achatina*. Furthermore, this could be combined with Growers Mash for even better performance.

Keywords: Heliculture, Domestication, Habitat, Distribution.

INTRODUCTION

Heliculture, which is the process of farming or raising snails, has become very important in recent times because of increased animal protein shortage in Nigeria. Also, the availability of some edible snails in Nigeria, their popularity and acceptability nationwide, the potential for export, including the emerging technologies for their production have largely contributed towards the present renewed interest in snail farming (Amusaa and Omidiji, 1998 and Lameed, 2009).

Snail is a common name which is applied to most of the members of the molluscan belonging to the class Gastropoda that have coiled shells in the adult stage. In general sense, it includes sea snails, land snails and freshwater snails. Snail-like animals that naturally lack a shell or have only an internal shell, are often called slugs, and land species that have only a very small shell (that they cannot retract into) are called semi slugs, (Frederick, 2010). The Giant African Snail or the "Giant Ghana Tiger Snail" (*Achatina achatina*), the "Garden" or "Foolish Snail" (*Achatina fulica*), and *margies* or West Africa Snail or "big black snail" (*Achatina marginata*) are large terrestrial snails

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that can reach up to 20cm (8 inches) in length and 10cm (4 inches) in maximum diameter. These snails are about the size of an average-sized adult fish. The brownish shell with darker brown vertical stripes covers at least half of the length of the snail (Ohlweiler et al. 2010). The smaller of these snails (*Achatina fulica*) grow to the size of about 5-6cm long (shell length), while the larger ones (*Achatina achatina*) can have a shell length of between 15-16cm long. The average life span is about 5-6 years, but can live up to 10 years.

The land snail habitat ranges from the dense tropical high forest in Southern Nigeria to the fringing riparian forests of the deprived Guinea Savannah, (Ajayi et al. 2009) and (Odaibo, 2007). From November to March each year, Nigerian snails aestivate because of the hot dry weather. The two prominent snails species found abundantly in this part of the world are the edible giant land snails; *Achatina achatina* and *Achatina marginata* (Ajayi et al, 2009). They are found extensively in the Southern parts of Nigeria and the entire West African Coastal area, central and South Africa, where the weather is most favourable for their proliferation (Herbert and Kilburn, 2004). Snails are cold blooded animals and therefore sensitive to changes in atmospheric humidity and temperature. When rainfalls, the epiphragm breaks and very cold water stored inside before aestivation pours out of the aperture and the snails emerge to eat the new plant growth and the soft soil, (Odiabo, 2007).

Snails thrive best on the temperature of about 10-23°C, (Albuquerque et al. 2009). Therefore, it is important to note that the organism can cause infections to man when the snail meat is not properly cooked and when the processing is not done under sanitized condition, (Fabguaro et al. 2006).

Achatina achatina is the largest land gastropod recorded in the Guinness book of records. In Nigeria, it

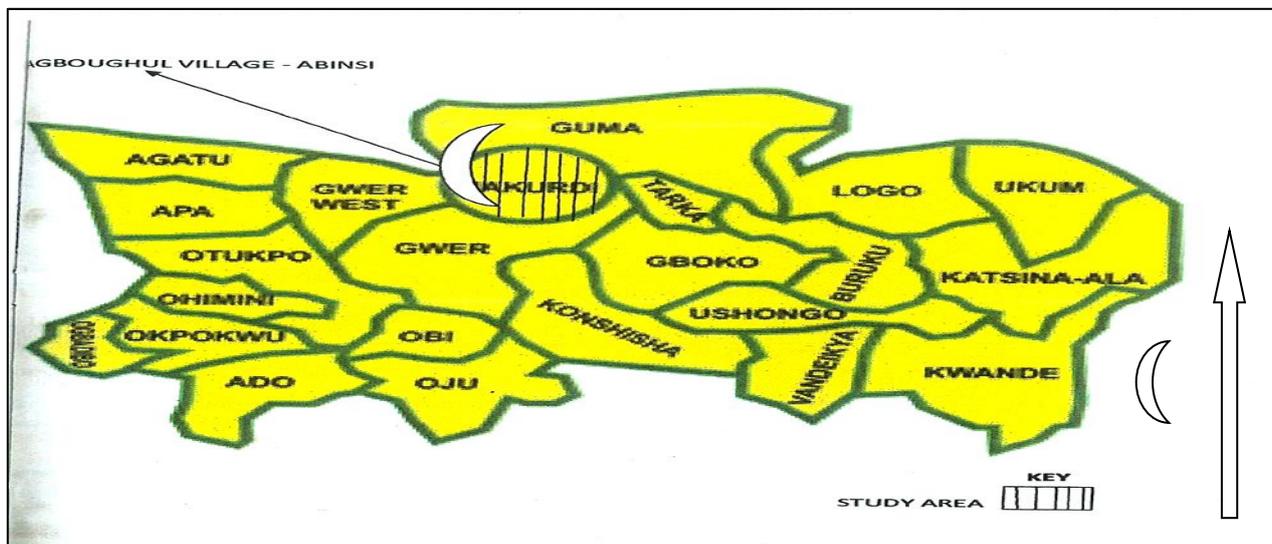
is the second most popular breed of snail kept. Snails are environmentally friendly and can be reared at the backyard. This is due to the fact that they are noiseless, odourless and the droppings are firm and can easily be cleared and disposed. Success in snail production involves among other things proper nutrition, (Ajayi, 1978) and Akinnusi, 1998).

The conventional feed comprises fresh leaves/shoot (pawpaw, lettuce, cabbage, cassava, cocoyam, African spinach, water leaf); ripe fresh fruits (pawpaw, banana, plantain, mango) and household/agricultural wastes (poultry litter, rice bran, palm kernel meal), (Ayodele and Asimalowo, 1999) and (Babalola and Akinsoyimn, 2010). In addition to these feeds, snails require calcium to build and repair their shell. Obviously, it is important that they get enough because without enough calcium their shell will become thin and rough instead of being thick, smooth and glossy. There is calcium in vegetable and fruits but this is not adequate for their need. There is therefore the need to supplement calcium in their diet. It is important to note here too that leaf such as *Euphorbia heterophylla* has been utilized successfully as sole feed for growing *Achatina marginata* snail species with the egg shell added to the soil for optimal performance, (Babalola and Owolabi, 2014).

MATERIALS AND METHODS

Study area:

This study was carried out in the snail pen of the Department of Wildlife and Range Management, of the University of Agriculture, Makurdi. The University is located at North Bank in Makurdi, the Capital of Benue State, Nigeria. Benue State is within the co-ordinates of latitude 7^o.47¹ and 10.01 North and longitude 7^o.8¹ and 8^o.8¹ East. The University of Agriculture, Makurdi is located 2 kilometers at the Northern Bank of River Benue that transversed through the State Capital.



Climate and Vegetation:

Benue State generally has a sub-humid climate with two distinct seasons; the wet and dry seasons. The rainfall ranges between 1,200mm- 1,500mm per annum.

Temperature is generally very high during the dry season, particularly in March and April, along river valleys with high relative humidity especially during the rainy periods. Makurdi, the State Capital records average maximum and minimum temperature of 35°C (day) and 29°C (night) at dry season and 32°C (day) and 24°C (night) during rainy season respectively.

Benue State lies within the Southern Guinea Savannah with tall, coarse grasses and tough on maturity.

The Rearing Unit (SNAIL PEN)

Hutch boxes were used for the experiment. The hutch boxes were rectangular, single-chamber wooden boxes with lids, placed on wooden stilts above the ground at a suitable height for easy handling. The stilts were fitted with metal conical protectors or aprons, to prevent vermin from crawling or climbing up the stilts to attack the snails in the boxes. In the middle of the lid is an opening covered with wire netting and nylon mesh. In the floor of the box are a few holes through which excess water could drain out. The boxes were filled with sieved organic matter rich soil to a depth of 18-25cm. The boxes were placed under trees to protect snails from scorching sun or torrential rain.

Experimental Design:

A total of twenty (20) live- snails were brought from Aba market in Benin, Edo State, Nigeria with four

(4) raffia baskets. The snails were quarantine for five days before the experiment began.

The snails were randomly selected and arranged into four groups (A,B,andD) with each group having a total of five snails. Each snail in the group was numbered using an inedible marker.

Each snail in all the groups were weighed using a weighing balance to get the initial weight, and then weekly, on the same day of the week to get the weekly weight gained. Water was sprinkled all over the snail pen every morning to get it moist. Also, the dietary stuffs were weighed every two day before feeding the snails and remnant were collected after every two days. The number of eggs laid in each group were counted and the eggs were collected and cubated in a plastic container filled with sand. The period from which the eggs were laid to the hatchery, and the number of litters produced were noted. The four diets allotted to the various groups were:

- Group A(Carica papaya leaf)
- Group B (Chromolaena odorata)
- Group C (Talinum triangulae)
- Group D(growers mash)

The study lasted for eight weeks from January to February, 2017.

Data Analysis

Data collected were subjected to mean value percentage and Analysis of Variance (ANOVA) was used to determine the level of significance among the variables. Regression analysis was used to determine the relationship between the length of the Snails and the weight gained (growth).

Result

Table1. Body Measurements and Condition Factor

Body Measurements	Diet				P-Value
Table.2 Growth Performance Indices					
Growth Performance Indices	Water		Diet		P-Value
	Leaf	Siam weed	Grower Mash	Pawpaw Leaf	
IMW (g)	57.64±1.26	56.36±0.54	59.15±0.65	58.70±0.20	
MFW (g)	62.50±0.40c	68.80±1.00b	70.94±0.06b	77.41±0.16a	<0.01
WG	4.86±1.68c	12.44±0.46b	11.79±0.59b	18.71±0.03a	<0.01
% WG	8.47±1.68c	22.06±0.60b	19.95±1.22b	31.88±0.16a	<0.01
SGR	8.12±1.55c	19.93±0.49b	18.18±1.01b	27.67±0.12a	<0.01
FCR	463.90±82.10a	175.80±6.50b	185.71±9.29b	116.70±0.21b	0.01

Means on the same row with different superscripts are statistically significant (p<0.05)

Key

- MIW= Initial mean weight (g)
- FMW= Final mean weight (g)
- WG= Weight gain
- % WG= Weight gain %
- SGR= Significant growth rate
- FCR= Feed conversion ratio

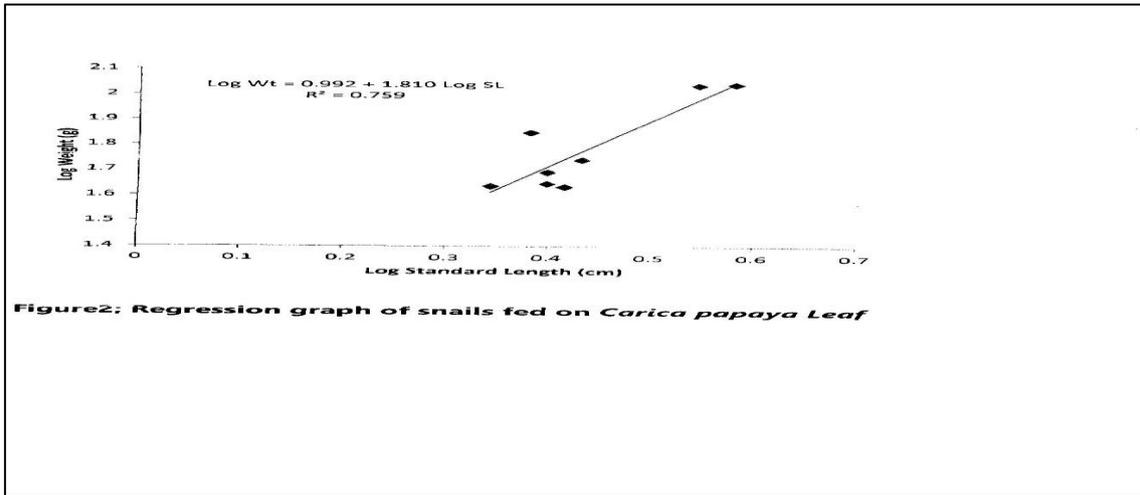


Figure2; Regression graph of snails fed on *Carica papaya* Leaf

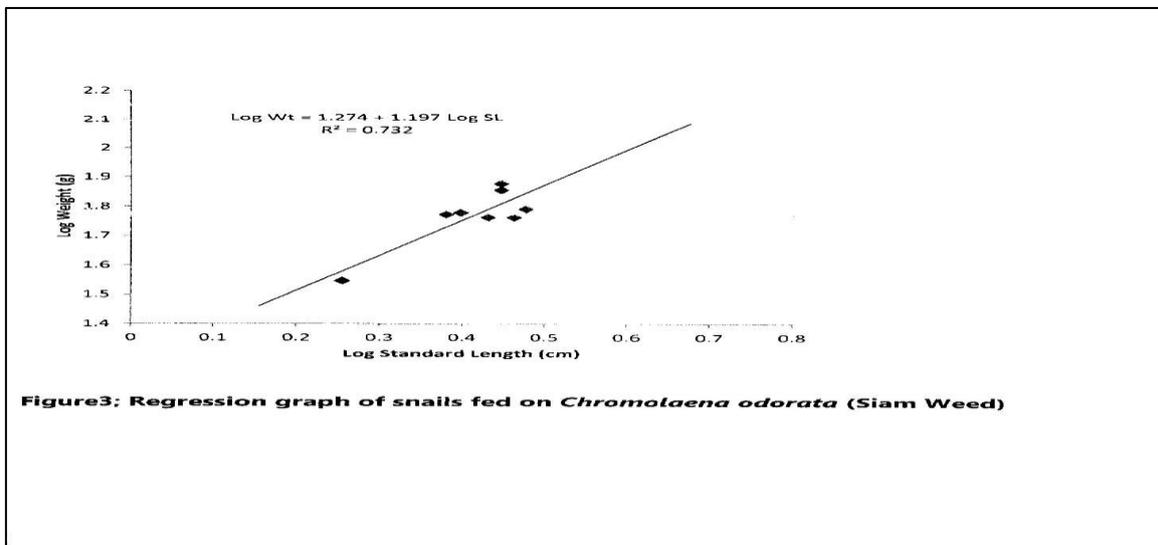


Figure3; Regression graph of snails fed on *Chromolaena odorata* (Siam Weed)

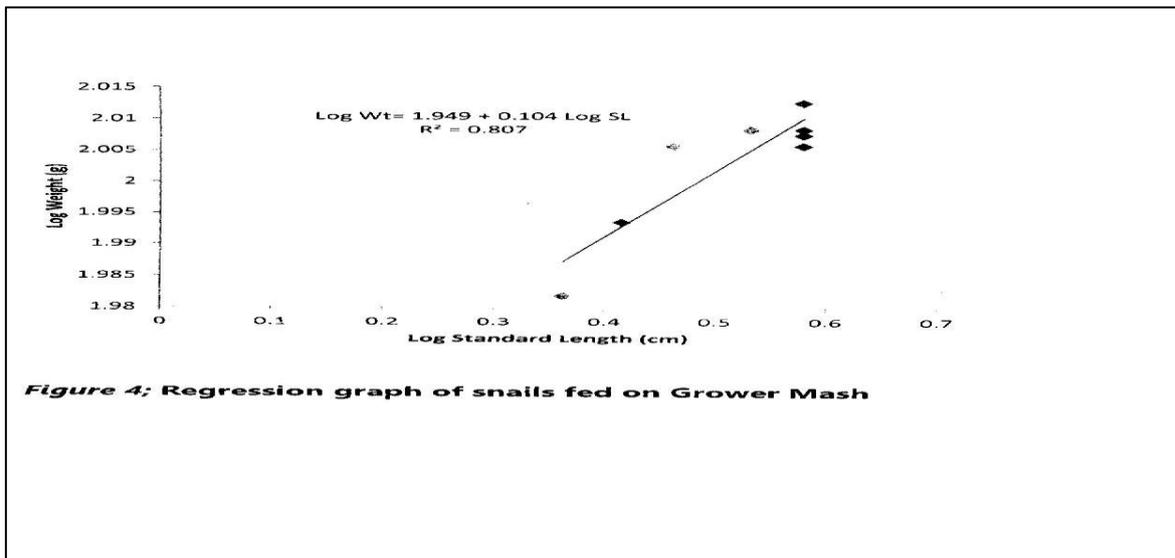


Figure 4; Regression graph of snails fed on Grower Mash

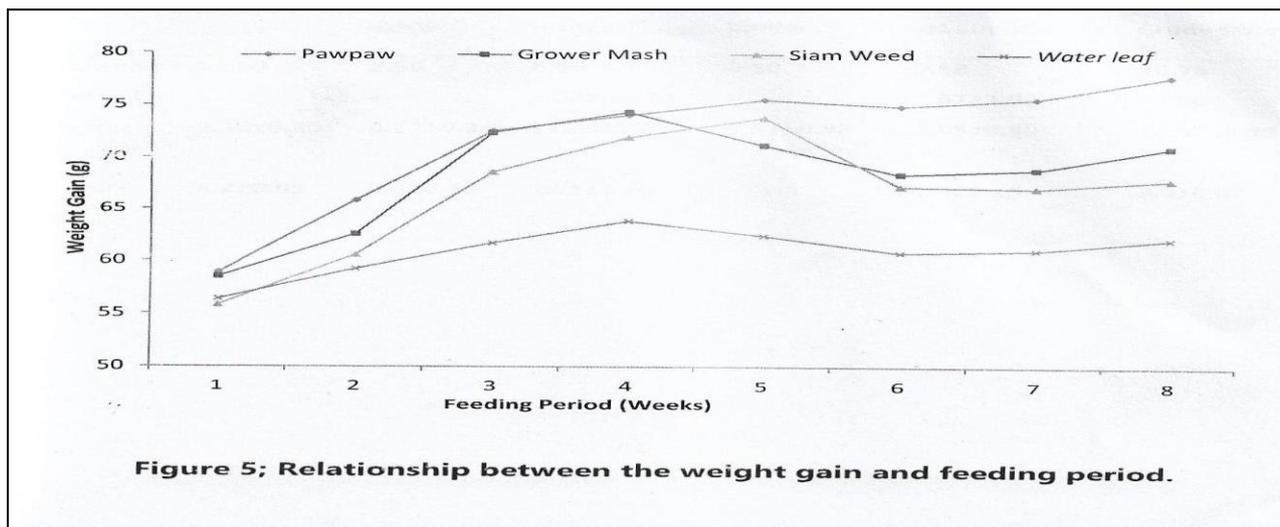


Figure 5; Relationship between the weight gain and feeding period.

Table 4: Proximate composition of Growers Mash, Pawpaw Leaf, Water Leaf, And Siam Weed.

Item	%Moisture%	Total Ash%	Crude protein%	Crude lipid%	Total Carbohydrate%	Crude fibre
Siam weed	59.50	2.50	6.56	0.10	20.58	10.76
Waterleaf	-	-	3.52A±0.32	-	10.87±3.99	12.00
Pawpaw Leaf	7.30±0.30	8.27±0.32	17.63±1.07	5.57±0.49	28.03±0.90	18.53±0.40
Grow Mash	8.2±0.03	5.6±0.12	13.5±1.65	-	62.4±2.10	3.4±0.07

DISCUSSION

Results obtained indicated that vegetable types can affect the growth performance of the African Giant land snail. Vegetable diets with high crude protein and dry matter content gave better weight gain performance than those with low crude protein and dry matter content. Snails appear to eat more of the vegetable diets as their main feed. The highest live weight gain by snails fed on pawpaw leaf might have been influenced by the crude protein content, which was highest among the vegetables used. This finding is similar to the report of Bobadoye et al (2010) who had good growth performance when Soya bean meal was replaced with Chromoleana leaf and mulberry leaf as source of protein in the diet of Achatina achatina. Ani et al (2013), reported that high protein levels in diets improved growth performance in snails with appropriate energy balance and recommended 24% crude protein + 3.2Mcal/kg metabolizable energy combination. Babalola and Owolabi (2014) also obtained better growth performance when high protein vegetable diets such as milk leaf (Euphorbia heterophylla) 22.7% crude protein, pawpaw leaf (Carica papaya) 29.3% crude protein and concentrate feed of 46.3% crude protein were fed to snails. It is also possible pawpaw leaf have some other intrinsic qualities which may include its phytochemical composition and content. However, from the proximate

analysis of the study, it was observed that *Carica papaya* leaf had higher moisture (17.50gm) protein (17.63gm), carbohydrate (28.03gm) and crude fibre (18.53gm) content than the other treatments used in the study. This explained why it gave the best yield in all the growth parameters investigated.

This findings suggested that the pawpaw treatment may contain important minerals that enhance shell growth such as calcium, magnesium, potassium etc. This view was in accordance with the report of Ayoola and Adeyeye (2010) who said that pawpaw (*Carica papaya*) has very high calcium (8612.50mg/kg) and potassium (2889mg/kg) levels.

The preference of snails for vegetable diets to feed concentrate in this study, agreed with earlier reports that the conventional feeds of snails consisting breadfruits, water leaf, pawpaw leaf and fruit, sweet orange, mango fruit, ripe fruit of plantain and banana and other feeds of plant origin as reported by Awesu (1980); Amusan et al (1998) and Ayodele and Asimolowo (1999). Apata et al. (2010) also obtained significant growth performance when snails were fed with three different vegetable leaves. Martin Bergey (2013) also reported rapid growth in snails fed with fresh plant materials (vegetables and fruits) as compared to snails given leaf litter as feed. The

preference for fresh plant materials is further confirmed by the findings of Omole et al. (2011), Alikwe et al. (2013) and Ani et al. (2014) who obtained better or similar growth performance in snails when concentrate feed was replaced with graded levels of pineapple waste, *Asplenium barteri* leaf and *Moringa oleifera* leaf meals at 10, 15 and 20% respectively. The result seems to indicate that concentrate feeds may be more useful only as supplements for extra minerals and energy source in snail feeding.

CONCLUSION

The African giant land snails (*Achatina achatina*) is a non- conventional wildlife animal protein source which is now being farmed/domesticated to reduce stress on the wildlife stocks and because of its high relished delicacy in Nigeria and some parts of Africa (Kola and Etela, 2011). Production of the snail can be sustainable economically only when both qualitative and quantitative feed requirements are known and established. The protection of snails in captivity like other farm animals require the provision of green leaves/vegetable with high crude protein and dry matter content for fast growth and quicker economic returns. Snails prefer fresh leaves and vegetable diets than concentrate feeds as they are more of the vegetable than the concentrate supplement provision.

Recommendations

- Combination of fresh vegetables with concentrated feeds such as Grower's Mash and *Talinium triangulae* is highly recommended for snail feeding in order to boost their growth.
- Breeding of snails which serve as protein source and to improve on their breeding should be encouraged. This would reduce dependence on wildlife species in the wild.
- Concentrate supplement should be provided only as an extra source of mineral and energy needs of the snails.

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