

Contribution of pawpaw plant (*Carica papaya*) to the performance of giant African land snail

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SUMMARY

Procurement of cheap and affordable feeds has been a problem to intensive management of microlivestocks like snails in Nigeria. This study examines the impact of *Carica papaya* (pawpaw) leaves and fruits on the growth and reproductive performance of giant African land snail, *Archachatina marginata*. A total of sixty individual snails (115.2 ± 0.01 g) were randomly allotted to five treatments of twelve snails each (each treatment has three replicates of four snails each). The treatments are chicken mash (control), fresh pawpaw leaves, old pawpaw leaves, unripe pawpaw fruit and ripe pawpaw fruits. The snails were fed with these diets *ad libitum* for 12 weeks. Results showed that snails fed ripe pawpaw fruits recorded the highest weight gain (31.6 g) followed by snails fed with chicken mash, while those fed old pawpaw leaves had the least weight gain (10.4 g). Also, snails fed ripe pawpaw fruit laid the highest number of egg (45), while snails fed with chicken mash and old pawpaw leaves laid no egg. It can thus be concluded that ripe pawpaw fruit contributes better to the growth and reproductive performance of *A. marginata* than other parts of the plant.

Contribución de la planta de papaya (*Carica papaya*) a la nutrición del caracol de tierra gigante africano

RESUMEN

La adquisición de alimentos baratos y asequibles ha sido un problema de manejo intensivo de microganados como los caracoles en Nigeria. Este estudio examina el impacto de las hojas y frutos de *Carica papaya* (papaya) en el desempeño de crecimiento y reproducción de caracol de tierra africano gigante, *Archachatina marginata*. Un total de sesenta caracoles ($115,2 \pm 0,01$ g) fueron asignados al azar a cinco tratamientos en grupos de doce (cada tratamiento tiene tres repeticiones de cuatro caracoles). Los tratamientos fueron con mezcla para pollos (control), hojas de papaya frescas, hojas viejas de papaya, fruta de papaya inmadura y frutos maduros de papaya. Los caracoles se alimentaron con estas dietas *ad libitum* durante 12 semanas. Los resultados mostraron que los caracoles alimentados con frutos de papaya madura presentaban la ganancia de peso más alta (31,6 g) seguida de los caracoles alimentados con mezcla para pollos, mientras que aquellos que se alimentan con papaya madura y hojas tenían la menor ganancia de peso (10,4 g). Además, los caracoles alimentados con fruta de papaya madura pusieron mayor número de huevos (45), mientras los alimentados con mezcla para pollos y papaya madura no realizaron puesta. Por lo tanto se puede concluir que la fruta de papaya madura contribuye mejor al desempeño de crecimiento y reproducción de *A. marginata*.

ADDITIONAL KEYWORDS

Archachatina marginata.
Snail egg.
Pawpaw leaves.
Pawpaw fruit.

PALABRAS CLAVE ADICIONALES

Archachatina marginata.
Huevos de caracol.
Hojas de papaya.
Frutas de papaya.

INFORMACIÓN

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INTRODUCTION

One more major challenge of domestication is the ability to mimic perfectly the conditions in the wild so as to maximise the growth and reproductive potentials of the snails. Ademolu *et al.* (2012) reported that much still have to be done to achieve this task as a great gap exists between snails in the wild and those reared in captivity.

One major obstacle to efficient snail production in intensive and semi-intensive management system is high cost of feed materials. In livestock farming feed cost is responsible for 60-70 % of the total cost of production (Omole *et al.*, 2013). Snails are fed with various food items in captivity ranging from compounded

feed to plant materials (roughages). The plant materials varies from annual to perennial plants. Similarly, non-compounded materials like poultry dropping, pineapple peel, *Centrosema* sp., *Mucina* sp. were also consumed by snails (Eruvbetine, 2012). Recently too, Omole *et al.* (2013) used dry unpeeled sweet potato in the diet of snails as energy source. Also, non-conventional materials have also been given to snails which have the potential to reduce the cost of feed in intensive rearing system. However, in reality on these farms, snails were given pawpaw leaves and fruits of any age (green and yellow) especially during dry season and since age of the plants affects its biological properties (Osato *et al.*, 1993), the different leaves and fruits of pawpaw fed to snail will pre-

sent different nutrients and ingredients to the snails. The aim of the study is to investigate the influence of pawpaw leaves and fruits on the performance of *Archachatina marginata*.

MATERIAL AND METHODS

EXPERIMENTAL SITE AND PLANT MATERIALS

The experiment was carried out in the Animal house of Biological Sciences, Federal University of Agriculture, Abeokuta (FUNAAB), Nigeria. The dimensions of the house were 2.7 x 1.8 x 2.1 metre and there were two opened windows that allowed for cross ventilation. The snails were reared in wooden cages (60 x 60 x 24 cm), made of wood and chicken wire mesh, while the bottom was perforated for draining excess water. The cages were raised 10 cm above the ground with the four legs dipped in cans filled with used engine oil. Pawpaw leaves and fruits used in this study were obtained from pawpaw trees around the College of Natural Sciences, Federal University of Agriculture, Abeokuta, Nigeria.

EXPERIMENTAL SNAILS

Sixty (60) individual *A. marginata* (115.2±0.2 g) were used for this study. They were randomly allotted to 5 treatments (12 snails per treatments with 3 replicate of snails each) namely: fresh pawpaw leaves, old pawpaw leaves, ripe pawpaw fruits, unripe pawpaw fruits and chicken mash (control). The feeds were presented to the snails *ad libitum* at 7:00 pm everyday for 12 weeks. Similarly, drinking water was also made available in drinking trough for same period.

DATA COLLECTION AND ANALYSIS

The mean body weight gain was assessed by taking the weight of the snails on a sensitive measuring scale (Mettler PM-11k). The shell length was measured by the use of vernier caliper. Also the number of eggs laid was recorded on a daily basis. Data collected from this study were analysed by One-way Analysis of variance (ANOVA). Significant differences were separated by Duncan Multiple Range Test.

RESULTS

The growth performance of snails fed different diets is shown in **table I**. The highest weight gain was recorded by snails fed ripe pawpaw fruits followed by those fed with chicken mash. However, snails fed old pawpaw leaves recorded the least weight gain. The shell length gain was similarly influenced by the experimental diets. Snails on ripe pawpaw leaves had highest shell length gain while snails on chicken mash had least (**table I**).

Table II shows the reproductive performance of the snails fed different pawpaw based diets. No egg was laid by snails fed chicken mash and old pawpaw leaves throughout the period of the experiment. However snails fed with ripe pawpaw fruits laid a total of 45 eggs followed by 23 eggs laid by snails on unripe pawpaw fruits.

Table I. Growth performance of the snails fed pawpaw leaves and fruits* (Crecimiento de los caracoles alimentados con hojas de papaya y frutas).

Parameters	CM	OPL	FPL	UPF	RPF
Final weight (g)	138.2	132.5	120.3	130.0	152.9
Initial weight (g)	120.0	112.5	106.3	117.5	121.3
Weight gain (g)	18.2 ^b	10.4 ^c	14.0 ^c	12.5 ^c	31.6 ^a
Final shell length (cm)	8.29	8.41	8.15	8.25	8.76
Initial shell length (cm)	8.20	8.25	7.81	8.19	8.76
Shell length gain (cm)	0.09 ^c	0.16 ^b	0.34 ^a	0.06 ^c	0 ^d

CM= Chicken mash; OPL= Old pawpaw leaves; FPL= Fresh pawpaw leaves; UPF= Unripe pawpaw fruit; RPF= Ripe pawpaw fruit. *Mean values in the same row with different superscript are significantly different (p<0.05).

Table II. Reproductive performance of the snails fed pawpaw leaves and fruits* (Fertilidad de los caracoles alimentados con hojas de papaya y frutas).

Parameters	CM	OPL	FPL	UPF	RPF
Eggs number	—	—	11	23	45

CM= Chicken mash; OPL= Old pawpaw leaves; FPL= Fresh pawpaw leaves; UPF= Unripe pawpaw fruit; RPF= Ripe pawpaw fruit. *Mean values in the same row with different superscript are significantly different (p<0.05).

DISCUSSION

The highest weight gain was recorded by snail fed ripe pawpaw fruits followed by those fed fresh pawpaw leaves, while those fed old pawpaw leaves had the least. Pawpaw fruit contains high amount of water and sucrose which makes it tastes sweet and well digested (Odiete, 1999). Also, snails are reported to have efficient olfactory and gustatory cues which might have made them prefer ripe pawpaw fruits to other experimental diets because of its sweet taste (South, 1992).

Furthermore, ripe pawpaw fruit contains soft and easily digestible flesh with a good amount of dietary fiber which aid digestion and therefore makes nutrients more readily available to the animals than other feeds (Desmond and Layne, 1995). The better weight gained by the snails fed ripe pawpaw fruits might be as a result of good constituents of the fruit. According to Wilson (1974) ripe pawpaw fruit is a good source of vitamin C and A, potassium, calcium which play significant roles in body metabolism of animals.

Snails fed unripe pawpaw fruit and old pawpaw leaves had low weight gain compared to fresh pawpaw leaves and ripe pawpaw fruit. Unripe pawpaw fruit had been reported to contain high concentration of papain and carpaine (alkaloid) which are dangerous to the body if consumed in high amount (Krishma *et al.*, 2008). Furthermore, old leaves contain low nutrients which are later made available to its consumers. Ayoola and Adeyeye (2010) earlier reported that different leaves of *Carica papaya* (pawpaw leaves) have different phytochemical and nutritive values.

Snails on ripe pawpaw fruits laid highest number of egg while snails fed old pawpaw leaves did not lay any egg. A similar result was reported by Okonkwo *et al.* (2000). The inability of snails fed old pawpaw leaves to lay egg might be due to their dry nature and lack of nutrients. Old and yellow pawpaw leaves had been reported to have low nutrients, minerals and vitamins composition which are necessary for egg formation (Ayoola and Adeyeye, 2010). Similarly, Shenx and Xianch (2003) earlier observed that photosynthetic properties of leaves decreased with age. Diets have been admitted to influence the reproductive performance of snails in captivity (Abiona *et al.*, 2012) and increased nutrients in the pawpaw fruits might have influenced the albumen gland composition which is transferable to the eggs during the process of egg coating as opined by Ademolu *et al.* (2013a).

Various plant parts have different effects on animal tissues (Ademolu *et al.*, 2013b). This study agrees with this fact as snails fed fresh pawpaw leaves had highest shell length gain but had the little influence on the weight gained. This suggests that fresh pawpaw leaves contain high concentration of minerals like calcium and phosphorus which are needed for shell development but, are not well utilized by the flesh or other tissues.

It can thus be concluded that ripe pawpaw fruit contribute more significantly to the growth and reproductive performance of *A. marginata* than other pawpaw based diets. This calls for increase cultivation of *Carica papaya* as it is well consumed by both man and livestock. The good performance recorded by snails fed with ripe fruits and fresh leaves of pawpaw will definitely reduce the cost of production in snail farming as nothing or less will be spent on feed formulation as earlier observed by Omole *et al.* (2013).

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