THE EFFECT OF PHOTOPERIOD ON THE GROWTH AND BEHAVIORAL PATTERN OF *Achatina achatina* SNAILS

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Abstract

The study was conducted to evaluate the effect of photoperiod on the behavioral pattern of *Achatina achatina* snails. Ninety *Achatina achatina* snails of average weight were used for the study which lasted for 56 days. The snails were randomly assigned to three treatments and each treatment was replicated three times with 10 snails in each replicate. The snails were exposed to different light duration. Treatment 1 had 12 hours light and 12 hours darkness, Treatment 2 was subjected to 18 hours light and 6 hours darkness, Treatment 3 was subjected to 24 hours light. The data collected was analyzed using one-way Analysis of variance and Duncan Post Hoc Test. Data were collected on feed intake, weight gain, time of feeding and reproductive behaviors. The results of the experiment showed that there were no significant differences (P>0.05) in the final weight gain, average daily weight gain, total feed intake, average daily feed intake, feed conversion ratio, duration of courtship, duration of feeding and cost of feed per kg weight gain between treatments. The results also showed that there were significant differences in number of eggs laid and mating duration between treatments. From the findings, it was concluded that the best photoperiod for *Achatina achatina* snails is 24 hours light as it produced the best in feed conversion ratio and cost of feed per kg weight gain and that was recommended for the effective growth of *Achatina achatina* snails.

***Keywords**: Photoperiodism, growth and behavioral patterns, Achatina achatina snails*

Introduction

The importance of snail meat cannot be over emphasized; it is a good source of animal protein containing about 18% crude protein of high biological value (Akinnusi 2004). The meat contains all essential amino acids such as lysine, methionine etc. (Agbogidi *et al*., 2008). The meat is highly prized, contains low fat content and low cholesterol levels which make it a good antidote for fat related diseases such hypertension, etc. (Chinwuko 2003) The meat is rich in calcium, iron, phosphorus and potassium which are essential or macro- minerals needed for strong bones, osmo-regulation and metabolic activities in the body of man (Ayodele and Asimalowo 1999). Snail meat is a good source of vitamin A, B6, E and K which are required for proper utilization of primary nutrients such as carbohydrate, protein, fat and oil (Omole *et al.*, 2006).

Achatina achatina snails are the largest land snails in the world and are widely sought after species, due to their size, distinct markings and lack of availability. They are sometimes more difficult to breed than other African snails. They are believed to have three year breeding cycle which is longer than other snails. Average adult shell length is 18cm within an average diameter of 9cm. In exceptional cases the shell can grow to be 30cm long but this is very unlikely, especially in captivity. Large ones may achieve a shell lengthy of 22cm.

Lights duration and intensity play an important part in the regulation and control of production, reproduction, behavior and welfare of animals' example poultry (Schewean *et al.*, 2013). Photo-periodism is the ability of plants and animals to measure environmental day length to ascertain time of the year (Deep et al., 2010). The ability to accurately predict future events requires endogenous mechanisms to permit

physiological anticipation of annual conditions (Okafor 2009). Day length provides a virtually noise free environmental signal to monitor and accurately predicts time of the year. For individuals of many species, the annual cycle of changing photoperiod provides the environmental switch between seasonal phenotypes. Many behavioral pattern are controlled by the nervous system and are modified from learning. The present study was therefore designed is to evaluate the effect of photoperiod on the growth rate and behavioural pattern of *Achatina achatiana*, a species of snail called Giant African Land Snail.

Materials and method

Location of study

The experiment was carried out at Umuriam village, Nawfia in Njikoka Local government area. It is located near the capital city of Anambra state, Awka. Awka lies within the coordinates 6°12N and 7°0E in the tropical zone of Nigeria. It experiences two seasons brought about by the two predominant winds, the south western monsoon wind from the Atlantic Ocean and the North Eastern dry wind from across the Sahara desert. The temperature is generally hot and humid within the range 27-28°c during July through December but rises to 35°c between February and April (Ezenwaji et al., 2013).

Experimental animals

Ninety grower snails (*Achatina achatina*) of average weight were got from a local snail trader at Ochanja market, Onitsha, Anambra state. They were transported in well aerated jute bag containing loamy soil. They were protected from a direct rays of sunlight during transportation. The jute bag was placed in a bowl to reduce heat from the vehicle.

On arrival, the snails were placed in their improvised housing which is a basket. The snails were covered very well to prevent them from escaping. After two days, they were placed in the plastic bowl which was covered with a mosquito net and tied with a twine rope to prevent the snails from escaping and also prevent pests and predators from attacking the snails. The bowl were filled with one third of sterilized top soil (loamy soil) got from the farm. The snails were fed with paw-paw leaves and plantain leaves during the one week of acclimatization.

Experimental design

The experimental design was Completely Randomized Design (CRD). There were three treatments and each treatment was replicated three times. The treatment 1, was subjected to 12 hours of daylight and 12 hours of night which equally served as the control, treatment 2 (T2), was subjected to 18 hours of light and 6 hours of darkness while treatment 3 (T3) was subjected to 24 hours of light.

Management of the experimental animals

The snails are fed using a plastic saucer having different weights of 13g, 14g, 18g and 19g. The snails were fed commercial poultry feed once in a day in the evening but later in the morning. The leftover feed are weighed in the following morning before putting a fresh feed for the snails and also discarded after taking the weight. The feed is weighed using a sensitive weighing balance. Paw-paw leaves was also fed to the snails when they weren't able to feed on the compounded feed and even when the feed became too powdery. The experiment lasted for 9 weeks including the one week of acclimatization (63 days).

Data collection

Data on feed intake was collected using the sensitive weighing balance (electronic kitchen scale) as well as data on the weight gain which was done weekly. Data on the behavioral pattern was collected everyday by closely observing them every 30 minutes and stay with the snails 2 hours in the morning, afternoon and night to note their various behavior in the hot weather and rainy weather. The data on behavioral pattern are collected daily.

Statistical analysis

The data collected were subjected to Analysis of variance (ANOVA) using SPSS analytical package and differences between means were separated using Duncan Multiple Range test (Duncan 1955) at 5% probability level.

Results and Discussion

The result on the effect of photoperiod on the growth parameters of *Achatina achatina* snail is presented in Table 1. The findings showed that there was no significant difference (P> 0.05) in the initial weight, final body weight, total body weight, average daily weight gain, total feed intake, average daily feed intake and feed conversion ratio. This result may be attributable to the fact that one diet was used for the experiment but the different photoperiods did not affect their weight gain and feed intake. It was observed that treatment 1 compared favourably with treatment 3 in the total feed intake. This also agrees to what was reported by Hodasi (1984) that exposure of snails to continuous light at night increases their activity and rate of feed consumption and promote rapid growth.

There was no significant difference (P> 0.05) in the average daily feed intake of the three treatments with treatment 2 as the highest (0.97±0.05) and treatment 1 the lowest daily feed intake (0.93±0.06). It was noted that what was reported by Hodasi (1984) that exposure of snails to continuous light at night increases their activity and rate of feed consumption and promote rapid growth.

There was no significant difference between treatments in feed conversion ratio. Treatment 1 had the highest feed conversion ratio (3.94±3.08) and treatment 3 having the lowest feed conversion ratio (3.10±0.76).

Table 1: Effect of Photoperiod on the Growth Parameters

Parameters	T1	T2	T3
Initial body weight(g)	49.03±2.82	38.06±2.22	46.23±1.35
Final body weight(g)	67.53±7.71	55.66±7.95	64.20±3.70
Total body weight gain (g)	18.50±10.31	17.60±5.74	17.96±1.30
Average daily weight gain(g)	0.33±0.18	0.31±0.10	0.32±0.90
Total feed intake (g)	52.5±4.00	54.23±3.13	53.23±2.23
Average daily feed intake (g)	0.93±0.06	0.97±0.05	0.95±0.04
Feed conversion ratio	3.94±±3.08	3.30±±1.00	3.10±±0.76

Mean with different superscript are statistically different (P<0.05).

Effect of Photoperiod on the reproductive behaviour

The result of effect of photoperiod is presented in Table 2. The results showed no significant difference (P<0.05) in all treatments in the duration of courtship. Treatment 3 had the highest (88.00±23.06) duration of courtship and treatment 1 had the lowest (52.00±44.53). The snails used their tentacles in finding a mate. If the tentacle is withdrawn during this process, it means that that particular one already had a mate. The ones courting, feed or eat from the side of the feeding trough. Their tentacles will stand still during courtship if they like each other but sometimes it is crossed. I observed that *Achatina achatina* expands their posterior and exterior invagination during courtship display and also when they are excited. When one of the courting mate is on heat, it will start bringing out it's love dart to notify the other one that's it's on heat (sex drive).

There was no significant difference in the duration of mating between the three treatments as treatment 3 had the highest (192.33±24.17) while treatment 1 had the lowest (125.66±4.04). This may be due to the regular exposure to light making the ones in T3 not knowing the difference between night and day.

The one on top during mating produces or releases mucus first which lubricants the love dart and keeps their body moist when it is becoming dry followed by the one under. During mating, the one beneath crosses the love dart first having its head inside the shell while the other twists its head to the position that will be comfortable for the mating. The love dart is situated on the right hand side of the snails. After mating, the one that have the love dart under separates first followed by the one on top. The material exchanged during mating passes from the one on top to the one under and it goes on till the end of the mating.

There is significant difference (p<0.05) in the reproduction rate (number of eggs laid) during the experiment. Treatment 3 had the highest number of eggs (233.00±73.91) and treatment 1 had the lowest (89.00±32.74). This rhymes with what was reported in the work of Hodasi (1982) which said that natural photoperiod favours maximum egg production output in giant snails.

Table 2: Effect of Photoperiod on the reproductive behaviors

Parameters	T1	T2	T3
Duration of courtship(minutes)	52.00±44.53	67.66±22.07	88.00±23.06
Duration of mating (minutes	125.66±4.04[b]	176.00±28.21[a]	192.33±24.17[a]
Duration of feeding (minutes)	93.33±30.23	57.00±17.69	83.00±22.64
Rate of reproduction (no of eggs laid)	89.00±32.74[b]	102.00±36.59[b]	233.00±73.91[a]

Means with different superscript are statistically different (P<0.05).

Conclusion and Recommendation

The findings from this study showed that the various photoperiod the snails were exposed to had an effect on their feed intake, duration of feeding, cost of feed per kg weight gain and egg production. The result showed that the diet was utilized efficiently. Treatment 3 had the best feed conversion ratio and the lowest cost of feed per kg weight gain which will lead to less or cheapest in raising the animals. Therefore treatment 3 is recommended to farmers

References

Agbogidi, O.M, Okonta, B.C and Ezeana, E.L (2008). Effects of two edible fruits on the growth of African Giant Land Snails Archachatina marginata (Swaison); ARPN Journal of Agricultural and biology science 3(3) : 26-29.

Akinnusi, O., (2004). Introduction to snails and snail farming, 2nd edition Triolar Exquisite ventures. P.90.

Ayodele, J.A and Asimalowo, A.A (1999). Essentials of snail Farming. Agape printing, Ibadan Pp 7-37.

Chinwuko, B.A., (2003). Tropical approach to snail farming on land, Joanee educational publishers Ltd, Awka, Nigeria.

Deep, A; Schwean- Lardner, K.Crowe,T.G; Francher B.I and Classen, H.L.2010. Effect of light density on broiler production processing characteristics and welfare. Poultry Science 89.2326-2333.

Duncan, D. B. (1955). Multiple range and multiple F. test biometrics, 11: 1-42.

Ezenwaji E.E., Okoye, A.C. and Awopeju A.K. (2013). The Relative contributions of climatic elements and environmental factors to flooding in Awka urban area. African Journal of Environmental Science and Technology. Vol.7(8) pp:804-814. Retrieved from Doi: 10.5897/AJEST2013.1519. 1SSn: 1996-0786.

Hodasi, J.K., (1982). The Effects of different light regimes on the behavior and biology of *Achatina (Achatina) achatina (Linne). Journal Molluscan studies* 48: 283-293.

Hodasi, J. K., (1984). Some observation on edible land snail of West African world Animal review, 52:198-217.

Okafor, F.C., (2009). Snail farming hand book. Oktek Publisher 4/8 Osadebe Street Ogui New layout, Enugu.

Omole, A.J., Osunkeye, O.J, Odijide, J.O, Sodamola, M.O and Popoola, Y.A (2006). The african Giant Land Snails published by greenhouse choice Agric.

Schwean-Lardner. K, Francher, B. I., Classen H. L (2013). Minimum light intensity threshold to prevent negative effects on broiler production and welfare. Br. Poult. Sci. 2013; 54: 686-694.