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Evaluating the growth performance of African giant land snails (*Archachatina* spp.) fed formulated and natural feeds

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ABSTRACT

This research examined the growth performance of African giant land snails fed formulated and natural feeds. A total of forty (40) juvenile *Achatina* spp. of varying sizes and weights were used in a Completely Randomized Design (CRD) to minimize experimental error and ensure statistically valid treatment effects. Diet 1 (formulated feed) consistently produced the highest weight gains, demonstrating robust and predictable growth. Snails on this diet recorded daily weight increments of 0.9–1.3 g and a total gain of 25.7 g over the study period. Diet 2 (Moringa leaves) showed moderate, mixed performance, with some snails recording positive gains and others minor losses, suggesting that although Moringa is nutritionally supportive, it may not consistently meet all growth requirements as a sole feed. Diet 3 (pawpaw leaves) proved inadequate, consistently causing weight loss and confirming its insufficiency as a standalone diet. Diet 4, combining formulated feed, Moringa, and pawpaw, produced moderate but more stable growth, indicating that blended feeds may provide balanced nutrition, prevent extreme losses, and support steady development. Feeding response data showed patterns in feed acceptance and utilization. Diet 1 elicited uniformly strong feeding responses, confirming high palatability and efficient feed utilization, while Diets 2 and 3 showed generally acceptable responses with occasional low values, reflecting variability in snail preference or adaptability to leaf-based diets. Although the combination of formulated feed, Moringa, and pawpaw leaves can provide moderate and steady growth, farmers should carefully balance their proportions to reduce variability in individual snail performance. Since pawpaw leaves alone were nutritionally inadequate, they should not be used as the sole feed for African giant land snails but should be combined with other nutrient-rich feeds.

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Introduction

In recent years, there has been a notable shift in focus toward the production of non-conventional livestock species as a strategy to diversify sources of animal protein in sub-Saharan Africa. This growing interest is driven by the rising demand for affordable, nutritious, and sustainable protein options amidst increasing population growth and declining availability of conventional livestock products. Among the emerging alternatives, snail farming, technically known as *heliciculture,* has gained significant attention due to its numerous advantages, including low production costs, minimal space requirements, environmental sustainability, and high nutritional value of the meat produced (Mamphogoro et al., 2024). The African giant land snails (*Archachatina marginata* and *Achatina achatina*) are particularly prized in Nigeria and across West Africa, where they are considered a delicacy and an important component of local diets. Snail meat is highly nutritious, being rich in protein, essential amino acids, and iron, while also containing low levels of cholesterol (Tchowan et al*.,* 2022). These nutritional attributes make it a valuable and healthy alternative to conventional animal protein sources such as poultry, beef, and fish. As a result, heliciculture holds significant potential not only for improving food security and nutritional standards but also for creating employment opportunities and enhancing rural livelihoods in the region (Tchowan et al., 2022). According to Henchion et al. (2017), the increasing demand for alternative sources of animal protein in Nigeria and across the globe has led to growing interest in non-conventional livestock, particularly the African giant land snail (*Achatina spp*.). With the global population steadily rising and traditional livestock farming facing challenges such as land scarcity, climate change, and high feed costs, attention has shifted towards micro-livestock as a sustainable source of protein. Snail farming, also known as heliciculture, is one such venture that has attracted attention due to its low startup cost, minimal space requirements, and high nutritional yield. Globally, countries such as France, Italy, and Greece have well-established snail farming industries where snail meat is considered a delicacy. In recent years, regions in Asia (e.g., Thailand and Vietnam) and South America (e.g., Brazil) have also ventured into commercial snail farming, recognizing its economic and dietary value. (Ejidike & Afolayan, 2010). In Africa, heliciculture is emerging as a viable component of sustainable agriculture and rural development. Countries like Ghana, Ivory Coast, Cameroon, and Togo have begun integrating snail farming into poverty alleviation and nutritional programs, particularly among women and youth in rural communities (Etukudo et al*.,* 2025). In Ghana, for instance, snail farming is considered one of the most lucrative

non-conventional livestock businesses due to its profitability and the ease with which it can be integrated into existing farming systems. Similarly, in Cameroon, governmental and non-governmental bodies have begun to support snail farming through training and access to microfinance. Despite these efforts, the industry is still in its developmental phase and suffers from limited research, particularly in areas such as feed formulation and breed improvement (Etukudo et al., 2025). In Nigeria, snail farming is gaining ground, especially in the southern and central regions where ecological conditions are favorable. States like Ogun, Oyo, Delta, Enugu, Edo, and Benue are noted for both subsistence and emerging commercial snail production (Stephanie *et al.*, 2021). The giant African land snail, primarily *Achatina achatina* and *Achatina marginata*, is widely cultivated due to its large size, fast growth rate, and market demand. With rising concerns over the high cost and environmental impact of conventional meat sources like beef and poultry, snail meat has become a promising alternative. It is high in protein, low in cholesterol and fat, and rich in essential amino acids, iron, calcium, and magnesium, nutrients critical to addressing malnutrition and related health issues in the country (Stephanie et al., 2021). Despite the potential of snail farming, one of the major constraints to its commercial development is the issue of feeding and nutrition. Feed accounts for a large proportion of production costs in any livestock enterprise and directly determines the growth rate, shell development, reproduction, and overall productivity of snails. Traditionally, snails are fed with natural feeds such as pawpaw leaves, banana leaves, fruits, and vegetables, which are readily available and cost-effective. While these feeds are palatable, they may not always provide balanced nutrients required for optimal growth, leading to slow weight gain and prolonged maturity periods (Mamphogoro et al., 2024).

A key component in snail production, however, is feeding. Feed accounts for up to 70% of the total cost of animal production and significantly influences the health, growth rate, and reproductive efficiency of snails. In the wild, snails feed on a wide variety of natural materials including leaves, fruits, and decaying vegetation (e.g., pawpaw leaves, fruits, vegetables), which are often seasonal and inconsistent in nutritional composition. This has led to the development of formulated feeds that are designed to provide a balanced diet, rich in proteins, calcium, and other micronutrients. These feeds are often composed of materials such as maize bran, groundnut cake, soybean meal, bone meal, and mineral premixes. Although they have the potential to improve growth performance and shorten production cycles, their adoption in many parts of Africa remains limited due to cost, lack of awareness, and limited access to formulated snail feeds (Ejidike &

Afolayan, 2010). Formulated feeds are increasingly being explored as an alternative due to their potential to provide balanced nutrition in the right proportions of protein, energy, vitamins, and minerals. Properly formulated feeds may enhance feed conversion efficiency, accelerate growth, and improve shell formation, thereby reducing the time to market and increasing profitability for farmers (Thornton et al., 2023). However, many small-scale snail farmers are skeptical about adopting formulated feeds due to the higher cost of ingredients, lack of technical knowledge in compounding, and insufficient empirical data demonstrating their effectiveness compared to natural feeds (Thornton et al*.,* 2023).

In Nigeria, there is a growing need for scientific evidence on the comparative benefits of natural and formulated feeds for snail farming. While some farmers rely exclusively on household and kitchen waste (banana peels, pawpaw leaves, waterleaf, etc.), others have begun experimenting with commercial or locally formulated diets (Akano et al., 2023). However, limited research and field trials mean that many farmers operate on a trial-and-error basis. States like Benue, where this study is being conducted, present a unique opportunity for bridging the research gap due to the favorable climate, high interest in agriculture, and the availability of raw materials for both natural and formulated feeds (Akano *et al.,* 2023). Previous studies have produced mixed findings. Some report that snails fed with formulated diets exhibit superior growth performance and shell development, while others suggest that snails perform reasonably well on natural diets, especially under traditional smallholder management systems. This inconsistency highlights the need for further research to establish clear evidence on the comparative benefits of formulated and natural feeds in enhancing snail growth performance under controlled experimental conditions (Oghenebrorhie et al., 2024). This study, therefore, seeks to explore the growth performance of African giant land snails fed with both formulated and natural feeds under controlled experimental conditions. The findings will contribute to the growing body of knowledge on snail nutrition and offer practical recommendations for improving productivity, reducing costs, and enhancing the sustainability of snail farming at local and national levels.

Material and methods

Study area

The experiment was carried out at the Wildlife Research Farm of Joseph Sarwuan Tarka University, Makurdi, located in Benue State, Nigeria. Makurdi lies within the Southern Guinea Savanna

ecological zone and experiences a tropical climate with distinct wet and dry seasons. The annual rainfall ranges between 1,000 mm and 1,500 mm, and the average temperature varies between 25°C and 34°C. These climatic conditions are suitable for the growth and reproduction of terrestrial gastropods, including *Achatina* species. The Wildlife Research Farm provides a controlled environment conducive to snail rearing, with facilities for feed trials, growth performance monitoring, and environmental regulation necessary for the success of the experiment.

Experimental animals

A total of forty (40) juvenile *Achatina* spp. of varying sizes and weights were used for the study. The snails were procured from local markets within Makurdi metropolis to ensure availability and adaptability to local environmental conditions. Juvenile snails are preferred because they are in their active growth phase, making them ideal for assessing feed efficiency and growth performance. Prior to the commencement of the experiment, the snails underwent a one-week acclimatization period under experimental conditions to minimize stress and allow them to adjust to the new environment. During this period, they were provided with a standard diet and maintained under optimal temperature and humidity conditions.

Experimental design

The study adopted a Completely Randomized Design (CRD) to minimize experimental error and ensure that treatment effects are statistically valid. 10 snails were selected per group for each treatment. Making a total of 40 juvenile snails. The treatment groups are as follows:

- Group 1: Formulated feed (Grower's mash)
- Group 2: Natural feed (Pawpaw leaves)
- Group 3: Natural feed (Moringa leaves)
- Group 4: Combination of all three feeds (Grower's mash + Pawpaw leaves + Moringa leaves)

Each treatment group consists of 10 snails per replicate, with four replicates per group, making a total of 40 snails. Randomization ensures that individual snail variability does not systematically bias treatment effects, and replication enhances the reliability and accuracy of results.

Feeding and management

The experimental snails were housed in well-ventilated snail pens constructed with concrete walls and covered with wire mesh to prevent escape and predator intrusion. The pens were filled with moist, sterilized loamy soil to a depth of about 10 cm, providing a conducive substrate for burrowing and maintaining humidity. The soil moisture was regularly maintained by sprinkling water to simulate natural conditions and prevent desiccation. Feeds were provided once daily, preferably in the early evening when snails are most active. Uneaten feed residues were collected and weighed every 24 hours before new feed was supplied, ensuring accurate measurement of feed intake and preventing microbial contamination. Clean water was provided ad libitum throughout the experimental period. Routine management practices such as cleaning, soil replacement, and monitoring for disease or parasites were conducted regularly to ensure a healthy environment and minimize stress (Mamphogoro et al., 2024).

Parameters measurement

Growth performance and physiological responses of the snails were assessed using the following parameters (Kim et al., 2024):

1. **Initial and Final Body Weight (g):**
   Snails were weighed at the beginning and end of the experiment using a digital balance. Weight gain was calculated as:

Weight Gain (g)=Final Weight−Initial Weight

2. **Weekly Weight Gain (g):**
   Weekly weight measurements were recorded to monitor growth trends and feeding efficiency.

3. **Shell Length and Diameter (cm):**
   Shell length and width were measured weekly using a Vernier caliper. Growth was expressed as:

Shell growth (cm) = Final shell measurement (cm) − Initial shell measurement (cm)

4. **Feed Intake and Feed Conversion Ratio (FCR):**
   Feed intake was determined by measuring the difference between feed offered and leftover feed. FCR was calculated as:

FCR=Total Weight Gain (g)/Total Feed Consumed (g)

A lower FCR indicates more efficient feed utilization.

5. **Mortality/Survival Rate (%):**
   Mortality was recorded daily, and survival rate was computed as:

Survival Rate (%)=Number of Surviving Snails/Total Number of Snails×100

Statistical analysis

All data collected were subjected to statistical analysis using Analysis of Variance (ANOVA) in accordance with the Completely Randomized Design. Significance was determined at $p < 0.05$ to assess the effects of different diets on growth performance and physiological responses. The results are presented in tables and graphs as appropriate for clarity and ease of interpretation.

Results

Weight gain and shell growth of snails fed formulated feeds and natural feeds

Table 1. Weekly weight gain 1

Snails	Diet 1 Formulated feed	Diet 2 Moringa leaves	Diet 3 Pawpaw leaves	Diet 4 Formulated +moringa+paw paw
1	0.9	0.2	-0.6	1.1
2	1.0	0.4	-0.3	0.5
3	0.0	-0.8	-0.6	-0.4
4	0.0	-0.3	-0.5	-0.4
5	-0.8	-0.7	-0.7	-0.3
6	-0.4	1	-0.5	0.3

7	0.0	-0.4	-0.4	0.3
8	1.3	-0.1	-0.7	0.1
9	0.0	-0.2	-0.2	0.3
10	1.0	-0.4	-0.5	1
11				

Source: Fieldwork (2026)

Table 1: Snails fed Diet 1 (Grower Mash) showed the strongest performance, with mostly positive weight gains ranging from 0.9 g, 1.0 g, 1.3 g, and 1.0 g to occasional losses such as –0.8 g and –0.4 g, indicating that this diet supports consistent and healthy growth. Diet 2 (Moringa Leaves) produced mixed outcomes, with gains of 0.2 g and 1.0 g, but several snails recorded losses between –0.1 g and –0.8 g, showing that moringa alone does not provide reliable growth. Diet 3 (Pawpaw Leaves) consistently resulted in weight loss for all snails, with values ranging from –0.2 g to –0.7 g, confirming that pawpaw leaves are nutritionally inadequate as a sole diet. In contrast, Diet 4 (Combination Diet: mash + moringa + pawpaw) yielded moderate gains such as 1.1 g, 0.5 g, 0.3 g, 0.3 g, 0.1 g, 0.3 g, and 1.0 g, though a few snails still showed slight reductions (e.g., –0.4 g and –0.3 g). The combination diet performed better than leaf-only diets, indicating that a balanced mixture of feed ingredients supports more stable growth.

Table 2. Weekly weight gain 2

Snails	**Diet 1** **Formulated feed**	**Diet 2** **Moringa leaves**	**Diet 3** **Paw paw leaves**	**Diet 4** **Combination of formulated feed+moringa+paw paw**
1	2	0.2	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	0.8
5	1	1	1	0.8
6	1	0.1	1	0.1

7	1	1	1	0.4
8	1	1	1	0.5
9	1	1	1	0.2
10	1	1	0	-1

Source: Fieldwork (2026)

Table 2: Across the diets, Diet 1 (Grower Mash) again produced consistently high feeding responses, with almost all snails recording a value of 1, except Snail 1, which showed the highest response at 2, indicating strong acceptance and utilization of the feed. Diet 2 (Moringa Leaves) also showed generally stable results, with most snails scoring 1, apart from Snail 6, which recorded 0.1, suggesting that while moringa is acceptable to many snails, a few show limited response. Diet 3 (Pawpaw Leaves) displayed uniform feeding values of 1 for nearly all snails, except Snail 10, which had a value of 0, implying pawpaw leaves are moderately accepted but may not provide sustained feeding motivation. In contrast, Diet 4 (Combination of Grower Mash + Moringa + Pawpaw) produced more varied responses ranging from 1, 1, 1, 0.8, 0.8, 0.1, 0.4, 0.5, 0.2, to –1, showing that although some snails responded strongly, others exhibited very low or even negative values. The results suggest that while single-component diets, especially grower mash, produce consistent feeding responses, the combination diet leads to mixed outcomes, likely due to varying snail preferences or nutrient interactions.

Table 3. Weekly weight gain 3

Snails	**Diet 1** **Formulated feed**	**Diet 2** **Moringa leaves**	**Diet 3** **Paw paw leaves**	**Diet 4** **Combination of grower mash+moringa+paw paw**
1	-2.1	-0.1	0.3	0.1
2	-2.1	1.5	5.2	1
3	-0.8	-	-3.1	1
4	-2.8	6.3	1.1	0.8
5	-2	0.1	2.3	0.8

6	0.8	2.8	0.2	0.1
7	7.5	4	-5.4	0.4
8	1.4	-0.5	-2.4	0.5
9	0.9	0.4	-3.5	-
10	-1.5	-3.9	1.3	1

Table 3: The results show considerable variation in snail responses across the four diets. Diet 1 (Grower Mash) produced mostly negative values, ranging from –2.8, –2.1, –2.1, –2.0, –1.5 to small gains such as 0.8, 1.4, 0.9, and one unusually high score of 7.5 for Snail 7. This indicates an inconsistent response, with many snails performing poorly while a few did very well. Diet 2 (Moringa Leaves) showed a mix of strong positive values such as 6.3 (Snail 4), 4.0 (Snail 7), 2.8 (Snail 6), 1.5 (Snail 2), 0.4 (Snail 9), and 0.1 (Snail 5), but also negative or missing values (–0.5 for Snail 8 and –3.9 for Snail 10), demonstrating highly variable performance among snails. For Diet 3 (Pawpaw Leaves), the pattern was similarly mixed: large positive gains such as 5.2 (Snail 2) and 2.3 (Snail 5), moderate gains like 1.3 (Snail 10) and 1.1 (Snail 4), but also significant losses including –5.4, –3.5, –3.1, and –2.4, indicating unstable and unreliable performance. Meanwhile, Diet 4 (Combination Diet) produced more consistent moderate values, mostly between 0.1, 0.4, 0.5, 0.8, and 1.0, except for one missing value (Snail 9). This suggests that the combination diet offered balanced nutrition that prevented extreme losses and supported fairly steady responses compared to the single-ingredient diets.

Table 4. Weekly weight gain 4

Snails	**Diet 1** **Formulated feed**	**Diet 2** **Moringa leaves**	**Diet 3** **Paw paw leaves**	**Diet 4** **Combination of grower mash+moringa+paw paw**
1	7.4	-1.5	2.1	-5.5
2	-2.8	-0.1	8.4	-1.2
3	-3.9	-	1.6	-3.6
4	10	5.5	-0.1	-10.4

5	-2.1	3.8	-6.5	-2.5
6	-1.7	-3.3	1.1	-
7	5.9	-4.8	1.2	8.8
8	2.6	3.7	-6.2	9.7
9	6.6	-2.3	-0.2	-
10	3.5	-2.6	4	-10.4

Source: Fieldwork (2026)

Table 4: The results reveal high variability in snail response across diets. Diet 1 (Grower Mash) exhibited both strong gains and sharp declines, ranging from high positives such as 10.0 g (Snail 4), 7.4 g (Snail 1), 6.6 g (Snail 9), 5.9 g (Snail 7), and 3.5 g (Snail 10) to notable losses like –3.9 g, –2.8 g, –2.1 g, and –1.7 g, showing inconsistent performance. Diet 2 (Moringa Leaves) produced mixed responses: some snails gained moderately (5.5 g, 3.8 g, 3.7 g) while others had negative values (–4.8 g, –3.3 g, –2.6 g, –2.3 g, –1.5 g, –0.1 g), indicating unstable effects. Diet 3 (Pawpaw Leaves) also showed a wide range of outcomes, including very strong positive gains like 8.4 g (Snail 2), 4.0 g (Snail 10), 2.1 g (Snail 1), and 1.6–1.2 g, but also severe losses such as –6.5 g, –6.2 g, –0.2 g, and –0.1 g, confirming high inconsistency. In Diet 4 (Combination Diet), responses were the most extreme, with a few large gains (9.7 g, 8.8 g) but also heavy losses (–10.4 g for Snails 4 and 10, –5.5 g, –3.6 g, –2.5 g, –1.2 g), and some missing values. This suggests that while the combination diet could produce exceptional growth for some snails, it also resulted in severe negative outcomes for others, making it the least stable diet overall.

Feed Conversion Ratio (FCR) of snails on both diets

Table 5: The growth performance of snails varied across the four diets over the 20-day feeding period.

Days	Diet 1 Formulated feed in grams	Diet 2 Moringa leaves	Diet Paw paw leaves	Diet 4 Combination of grower mash + moringa leaves + paw paw leaves
1	4.1	9.2	3.2	2.9
2	3.8	10.8	5.9	5.9
3	5.7	13.9	4.4	4.8
4	7.4	17.2	5.5	6.9
5	9.9	19.9	4.9	5.8
6	29.9	24.8	13.6	11.3
7	19.3	26.3	10.6	10.9
8	21.8	29.2	10.8	11.6
9	19.3	27.4	12.9	13.1
10	18.8	28.8	13.9	12.8
11	24.9	26.2	21.3	19.1
12	23.8	30.2	18.4	12.9
13	24.8	31.8	18.9	19.1
14	23.9	29.9	19.6	15.2
15	20.9	30.4	20.8	14.9
16	25.3	32.7	25.3	16.8
17	23.2	34.3	20.8	15.8
18	24.8	31.1	23.9	21.9
19	25.9	31.9	22.6	20.2
20	29.8	31.8	24.8	22.8

Snails fed Diet 1 (Grower mash) showed the greatest improvement, increasing from 4.1 g on Day 1 to 29.8 g on Day 20, resulting in a total weight gain of 25.7 g (1.29 g/day). Those on Diet 2 (Moringa leaves) grew from 9.2 g to 31.8 g, gaining 22.6 g (1.13 g/day), while Diet 3 (Pawpaw leaves) rose from 3.2 g to 24.8 g, giving a total gain of 21.6 g (1.08 g/day). Snails on Diet 4 (Combination diet: grower mash + moringa + pawpaw) recorded the lowest increase, rising from 2.9 g to 22.8 g, with a total weight gain of 19.9 g (0.99 g/day). Overall, Diet 1 supported the greatest weight gain, followed by Diets 2, 3, and 4, respectively.

Descriptive statistics

Table 6. Descriptive statistics

Week	Diet	N	Mean	SD	SEM	Variance
Week 1	Diet 1	10	0.3	0.69921	0.22111	0.48889
Week 1	Diet 2	10	-0.13	0.53965	0.17065	0.29122
Week 1	Diet 3	10	-0.5	0.1633	0.05164	0.02667
Week 1	Diet 4	10	0.25	0.52967	0.1675	0.28056
Week 2	Diet 1	10	1.1	0.31623	0.1	0.1
Week 2	Diet 2	10	0.83	0.35917	0.11358	0.129
Week 2	Diet 3	10	0.9	0.31623	0.1	0.1
Week 2	Diet 4	10	0.48	0.61788	0.19539	0.38178
Week 3	Diet 1	10	-0.07	3.03976	0.96125	9.24011
Week 3	Diet 2	10	1.17778	2.93546	0.97849	8.61694
Week 3	Diet 3	10	-0.4	3.17175	1.003	10.06
Week 3	Diet 4	10	0.63333	0.37081	0.1236	0.1375
Week 4	Diet 1	10	2.55	4.91556	1.55444	24.16278
Week 4	Diet 2	10	-0.17778	3.64581	1.21527	13.29194
Week 4	Diet 3	10	0.54	4.39702	1.39046	19.33378
Week 4	Diet 4	10	-1.8875	7.65552	2.70663	58.60696

Source: Fieldwork (2026)

Table 6: The weekly performance of snails fed the four diets shows clear fluctuations in growth responses. In Week 1, Diet 1 recorded the highest mean weight gain (0.30 g) with moderate variability (SD 0.70), while Diet 3 showed the lowest mean (–0.50 g) and very low variability (SD 0.16), indicating consistently poor performance. Diet 4 had a slight positive mean (0.25 g) with moderate variability (SD 0.53), and Diet 2 recorded a small negative mean (–0.13 g). In Week 2, all diets displayed positive growth. Diet 1 again led with the highest mean gain (1.10 g) and low variability (SD 0.32). Diet 3 showed similar performance (0.90 g), also with low variation (SD 0.32). Diet 2 performed moderately (0.83 g; SD 0.36), while Diet 4 showed the lowest gain (0.48 g) and the highest variation (SD 0.62), indicating inconsistent responses among snails. Week 3

showed highly unstable growth patterns, especially in Diets 1–3, with very high variability (SD: Diet 1 = 3.04, Diet 2 = 2.94, Diet 3 = 3.17). Despite the fluctuation, Diet 2 produced the highest mean gain (1.18 g). Diet 4 was the most stable diet in Week 3, with a moderate positive mean (0.63 g) and very low variation (SD 0.37), suggesting consistent performance. By Week 4, growth variability increased sharply across all diets. Diet 1 had the highest mean gain (2.55 g) but also high instability (SD 4.92; variance 24.16). Diet 3 showed mild positive performance (0.54 g) with high variability (SD 4.40). Diet 2 slightly declined (–0.18 g), while Diet 4 recorded the poorest mean (–1.89 g) and the highest variability of all diets (SD 7.66; variance 58.61), indicating very inconsistent outcomes.

Table 7: Means Comparison using Tukey test

Interaction	Mean-Diff	SEM	q Value	Prob	Alpha	Sig	LCL	UCL
Week 2 Week 1	0.8475	0.64818	1.8491	0.55972	0.05	**0**	-0.83801	2.53301
Week 3 Week 1	0.32526	0.65665	0.70051	0.96001	0.05	**0**	-1.38228	2.03281
Week 3 Week 2	-0.52224	0.65665	1.12473	0.85647	0.05	**0**	-2.22978	1.18531
Week 4 Week 1	0.40378	0.66119	0.86366	0.92854	0.05	**0**	-1.31555	2.12312
Week 4 Week 2	-0.44372	0.66119	0.94907	0.90784	0.05	**0**	-2.16305	1.27562
Week 4 Week 3	0.07852	0.66949	0.16586	0.99942	0.05	**0**	-1.66242	1.81946
Diet 2 Diet 1	-0.54895	0.65665	1.18226	0.83724	0.05	**0**	-2.25649	1.1586
Diet 3 Diet 1	-0.835	0.64818	1.82183	0.57196	0.05	**0**	-2.52051	0.85051
Diet 3 Diet 2	-0.28605	0.65665	0.61606	0.97222	0.05	**0**	-1.9936	1.42149
Diet 4 Diet 1	-1.02676	0.66119	2.19614	0.40901	0.05	**0**	-2.74609	0.69258
Diet 4 Diet 2	-0.47781	0.66949	1.00931	0.89153	0.05	**0**	-2.21875	1.26313
Diet 4 Diet 3	-0.19176	0.66119	0.41015	0.99147	0.05	**0**	-1.91109	1.52758

Source: Fieldwork (2026)

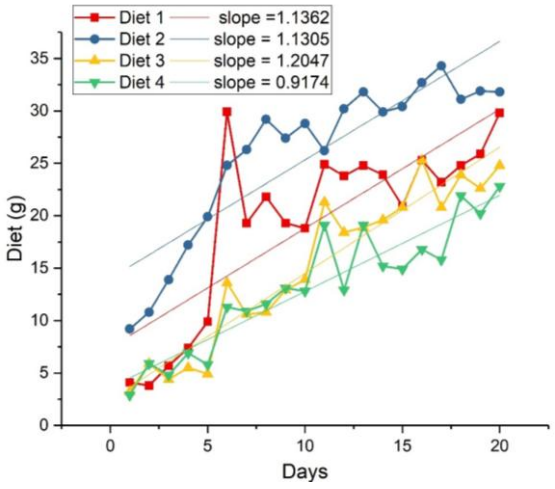

Figure 1. Graph of Diet versus Days with slope unit in g/day

Table 7 shows the analysis of the weekly comparisons which revealed no statistically significant differences in the measured variable across the four weeks. Specifically, the comparison between Week 2 and Week 1 showed a mean difference of 0.8475 with a p-value of 0.55972 and a 95% confidence interval ranging from -0.83801 to 2.53301, indicating slightly higher values in Week 2 but not a significant effect. Week 3 compared to Week 1 had a mean difference of 0.32526 ($p = 0.96001$, CI: -1.38228 to 2.03281), showing negligible and non-significant increases. The comparison of Week 3 to Week 2 yielded a mean difference of -0.52224 ($p = 0.85647$, CI: -2.22978 to 1.18531), suggesting slightly lower values in Week 3, yet again not significant. Finally, all comparisons involving Week 4 versus Weeks 1, 2, and 3 produced p-values greater than 0.9 with confidence intervals spanning zero, confirming that Week 4 did not differ significantly from the earlier weeks. These findings suggest a stable growth performance of African giant land snails over the experimental period, regardless of whether they were fed formulated or natural feeds. The absence of significant weekly variation implies that the snails maintained consistent growth patterns across the four weeks, indicating that both diet types provided adequate nutrition to support steady development. This stability is crucial for practical snail farming, as it suggests that either formulated or natural feed can sustain reliable growth rates without abrupt fluctuations, thereby enhancing predictability in production outcomes.

Table 8. ANOVA

	DF	Sum of Squares	Mean Square	F Value	P Value
Week	3	14.92681	4.9756	0.59214	0.62116
Diet	3	25.91521	8.6384	1.02805	0.38226
Interaction	9	88.1678	9.79642	1.16587	0.32159
Model	15	126.279	8.4186	1.00189	0.45681
Error	139	1167.973	8.40268	--	--
Corrected Total	154	1294.252	--	--	--

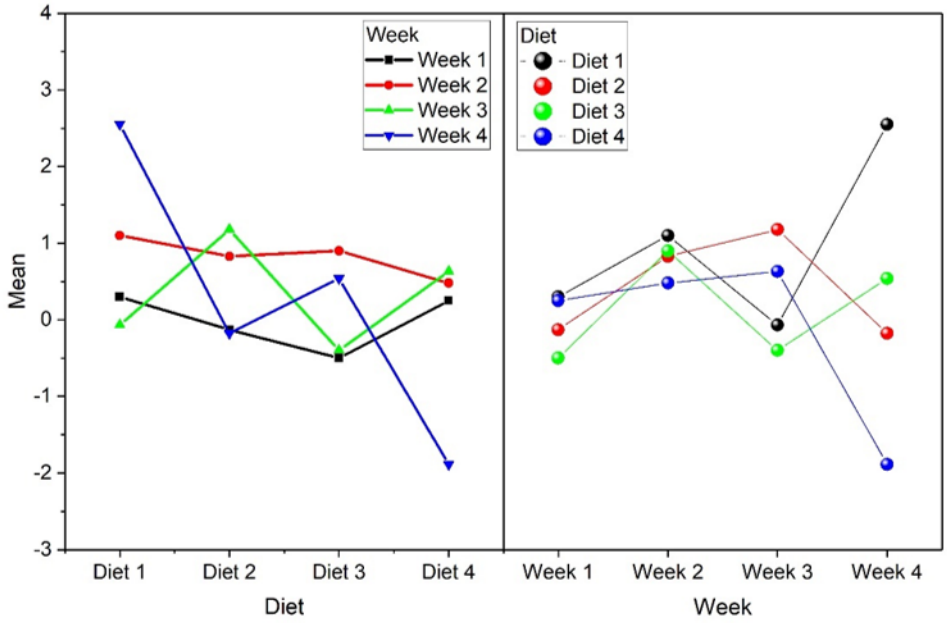

Figure 2. Interaction between week and diet

The ANOVA results indicate that neither week, diet, nor their interaction had a statistically significant effect on the measured variable. Specifically, the effect of week had an F-value of 0.59214 and a p-value of 0.62116, showing no significant variation in snail growth across the four weeks. Similarly, the effect of diet had an F-value of 1.02805 and a p-value of 0.38226, indicating that the different feed types (formulated and natural) did not significantly influence growth. The interaction between week and diet, with an F-value of 1.16587 and a p-value of 0.32159, also did not reach statistical significance, suggesting that the combination of diet type and week did not produce differential growth patterns. The overall model yielded an F-value of 1.00189 with a p-value of 0.45681, confirming that the factors included in the model collectively did not explain a significant proportion of the variability in growth. The error variance (Mean Square = 8.40268) indicates the natural variation in growth among individual snails not accounted for by the model.

Discussion

The growth performance of African giant land snails fed different diets over the 20-day experimental period revealed notable trends in feed efficacy and snail response. Diet 1 (formulated feed) consistently produced the highest weight gains, demonstrating that a formulated feed supports robust and predictable growth. Snails on this diet exhibited daily weight increments

ranging from 0.9 g to 1.3 g and achieved a total gain of 25.7 g over the study period. In contrast, Diet 2 (Moringa leaves) showed moderate performance with mixed outcomes; some snails recorded positive gains while others experienced minor losses, suggesting that while moringa is nutritionally supportive, it may not consistently meet all growth requirements when used as a sole feed. Diet 3 (Pawpaw leaves) proved inadequate, consistently resulting in weight loss among the snails, confirming its insufficiency as a standalone diet. The combination diet (Diet 4), which incorporated grower mash, moringa, and pawpaw, produced moderate but more stable growth, indicating that blending feed ingredients may provide balanced nutrition that prevents extreme losses and supports steady development. Feeding response data further illustrated patterns in feed acceptance and utilization. Diet 1 elicited uniformly strong feeding responses, confirming high palatability and efficient feed utilization. Diet 2 and Diet 3 showed generally acceptable feeding responses but with occasional low values, reflecting variability in snail preference or adaptability to leaf-based diets. The combination diet demonstrated highly variable responses, ranging from positive to negative values, suggesting that interactions between feed components may influence snail appetite and feed efficiency differently across individuals. These findings highlight that while single-component formulated feeds ensure consistent intake, multi-component diets may require careful formulation to achieve uniform acceptability and growth performance. Weekly performance analysis demonstrated fluctuations in growth rates across the experimental period, yet statistical comparisons revealed no significant differences among weeks. Mean weight gains varied slightly, with Week 2 showing marginally higher gains than Week 1, and Week 4 exhibiting some decline in mean performance; however, all p-values exceeded 0.05 and confidence intervals spanned zero. These results indicate that the snails maintained relatively stable growth patterns over time, regardless of diet. Stability in growth across weeks is advantageous for snail farmers, as it allows for predictable weight gain and simplifies feed management decisions, even when using different feed types. The ANOVA results corroborated these observations, showing that neither diet, week, nor their interaction significantly affected growth outcomes. With F-values for week (0.59214), diet (1.02805), and interaction (1.16587) all associated with p-values greater than 0.3, it is evident that the variability in snail growth is largely attributable to individual differences rather than experimental treatments. This finding underscores the resilience of African giant land snails to varied feed types over a short-term feeding period and emphasizes that both formulated and natural feeds can sustain steady growth. Overall, the study suggests that while formulated

grower mash is optimal for maximizing weight gain, combination and leaf-based diets can still support growth, albeit with more variable outcomes, offering flexibility in feed selection for practical snail farming.

Conclusion

The study concludes that African giant land snails are capable of maintaining stable growth over a short-term feeding period regardless of whether they are provided with formulated or natural feeds. Among the diets tested, formulated grower mash (Diet 1) was the most effective in promoting consistent weight gain and strong feeding response, making it the preferred option for maximizing growth. Leaf-based diets such as Moringa and Pawpaw leaves were less reliable, with Pawpaw leaves proving inadequate for supporting growth. The combination diet offered moderate, steady growth, highlighting the potential benefits of blending feed types to achieve balanced nutrition. Overall, the findings suggest that snail farmers can achieve predictable and sustainable growth using formulated feeds, while combination diets may offer flexibility when formulated feeds are limited, but careful consideration of feed composition is necessary to minimize variability in performance.

Recommendations

1. Snail farmers should primarily use formulated feed to ensure consistent weight gain and strong feeding responses, as this diet demonstrated the highest and most reliable growth performance.
2. While the combination of formulated feed, Moringa, and Pawpaw leaves can provide moderate and steady growth, farmers should carefully balance the proportions of each component to reduce variability in individual snail performance.
3. Given that Pawpaw leaves alone proved nutritionally inadequate, they should not be used as the sole feed for African giant land snails. If used, they should always be part of a balanced combination with other nutrient-rich feeds.

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