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The Use of Natural Growth Promoters in Snails Diet for Improved Productivities

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Abstract: This study was conducted to evaluate the effects of a natural growth promoter consisting of a mixture of Neem leaf, Bitter leaf, and Moringa leaf meal (NBM) on the weight gain, feed efficiency, reproductive performance, and carcass quality of snails. Four dietary treatments—NBM1, NBM2, NBM3, and NBM4—contained 0%, 1%, 2%, and 3% inclusion levels of the NBM mixture, respectively. The leaves were air-dried before incorporation into the feed. A completely randomized design was used, with four replicates per treatment and ten snails per replicate. Data were collected on growth performance, reproductive indices, carcass yield, and cost implications. Significant differences were observed in feed intake among treatments. The highest feed intake (971.2g) was recorded in snails fed 3% NBM, although it was not significantly different from those fed 2% NBM (969.1g). Dressing percentage and egg production were significantly influenced ($p<0.05$) by dietary inclusion levels. Snails fed 3% NBM recorded the highest egg production, while incubation period was not affected by treatment. Cost per weight gain was lowest in the 3% NBM group. The study concluded that NBM can effectively be used as a natural growth promoter at 2–3% inclusion in snail diets.

Keywords: *Snails, Natural Growth Promoter, Feed Efficiency, Productivity.*

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I. INTRODUCTION

Snail meat contains higher levels of essential amino acids such as lysine and arginine compared to whole eggs, which contributes to its increasing demand and economic potential in livestock production. However, several factors—including slow growth rate, poor-quality feed, and environmental conditions—limit optimal snail production.

Feed represents a major component of livestock production costs, accounting for approximately 70% of total expenses. While feeds for other livestock species are readily available, commercially formulated snail feed is scarce. Properly formulated diets that meet the specific nutritional requirements of snails can significantly improve their growth and productivity.

Growth promoters are substances added to animal diets to enhance growth rate and feed utilization efficiency. These may be natural or synthetic. Although synthetic growth promoters have shown positive effects, concerns over their potential negative impacts on animal health, human health, and the environment have led to restrictions in many parts of the world.

Plant-derived additives such as *Moringa oleifera*, Neem (*Azadirachta indica*), and Bitter leaf (*Vernonia amygdalina*) contain bioactive compounds known to improve nutrient utilization and animal performance. These phytogenic materials offer a safer and more sustainable alternative to synthetic additives. Given the inherently slow growth of snails, incorporating such plant materials into their diets may enhance productivity. Therefore, this study aimed to assess the effects of a combined Neem–Bitter leaf–

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Moringa mixture on growth performance, feed efficiency, carcass characteristics, and reproductive indices of snails.

II. METHODOLOGY

The experiment was conducted at the Snailery Unit of the Institute of Agricultural Research and Training (IAR&T), Moor Plantation, located at Longitude 03°51′E and Latitude 07°23′N within the humid rainforest zone of southwestern Nigeria. The area has a mean annual rainfall of approximately 1220 mm and an average temperature of 26°C.

Four dietary treatments (NBM1–NBM4) were formulated to contain 0%, 1%, 2%, and 3% inclusion levels of the NBM mixture. The leaves were air-dried and incorporated into the feed during formulation.

A completely randomized design was adopted. Each treatment was replicated four times, with ten snails per replicate. The snails were housed in cages divided into twelve compartments measuring 0.5 × 0.5 m² each.

Feed intake was recorded daily, while body weight was measured weekly using a sensitive weighing balance. Feed intake was calculated as the difference between feed offered and leftovers, while weight gain was determined by subtracting initial weight from final weight. Shell length and width were measured weekly using a vernier caliper, and shell thickness was measured using a micrometer screw gauge. Feed conversion ratio was calculated as feed intake divided by weight gain.

Reproductive parameters including number of eggs laid, egg weight, shell dimensions, incubation period, and hatchling measurements were recorded. The feeding trial lasted 12 weeks.

At the end of the trial, four snails per replicate were randomly selected for carcass evaluation. The snails were weighed, processed, and separated into shell, foot, and visceral components for measurement.

Cooked samples were evaluated by thirty panelists using a 9-point hedonic scale to assess colour, flavour, texture, taste, appearance, and overall acceptability following standard sensory evaluation procedures.

All data collected were subjected to Analysis of Variance (ANOVA), and treatment means were separated using Duncan Multiple Range Test (SAS, 2000).

III. RESULTS

Table 1 Gross Composition of the Experimental Diets,

Percentage inclusion of NBM leaf meal				
Ingredient (%)	**NBM_1 (0%)**	**NBM_2 (1%)**	**NBM_3 (2%)**	**NBM_4 (3%)**
Maize	44.0	44.0	44.0	44.0
NBM	0.0	1.0	2.0	3.0
GNC	10.5	10.5	10.5	10.5
Fish meal	2.5	2.5	2.5	2.5
Brewer Dry Grains	15.5	14.5	13.5	12.5
*Other fixed ingredients	27.5	27.5	27.5	27.5
Total	100.0	100.0	100.0	100.0
Cost/kg (N)	151.34	149.34	137.2	134.32
Calculated Nutrients				
Crude protein (%)	24.22	24.21	24.13	24.08
ME (kcal/Kg)	2605.2	2599.3	2589.45	2572.12

ME= Metabolisable energy; NBM = Neem, Bitter and Moringa leaf, GNC= Groundnut cake *Other fixed ingredients: Bone meal

Table 1 showing the graded inclusion level of NBM at 0%, 1%, 2%, and 3%.

Table 2 Performance of Snail-Fed Diets Containing NBM Leaf Meal

Percentage inclusion of NBM leaf meal					
Parameters	**NBM_1 (0%)**	**NBM_2 (1%)**	**NBM_3 (2%)**	**NBM_4 (3%)**	**SEM**
Initial weight (g)	83.14	83.09	83.59	83.45	1.96
Final weight (g)	349.86^{c}	352.74^{b}	368.62^{a}	369.94^{a}	13.90
Total weight gain (g)	266.72^{c}	269.65^{b}	285.03^{a}	286.49^{a}	17.12
Total feed intake (g)	944.19^{a}	951.87^{a}	969.10^{a}	971.2^{b}	12.88
Feed conversion ratio (g)	3.54^{b}	3.53^{b}	3.40^{b}	3.39^{a}	0.24
Shell length increment (g)	13.34	13.37	13.38	13.42	0.32
Shell width increment	11.48	11.48	11.50	11.51	0.24
Shell thickness increment	0.17	0.17	0.18	0.18	0.03

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Cost/kg feed (N)	410.34	410.21	410.01	399.23	
Total feed cost (N/Kg)	387.43	390.47	396.46	387.73	
Cost/weight gain (N/Kg)	1452.57 [a]	1448.06 [a]	1391.08 [b]	1355.38 [c]	

Means along rows with different superscripts are significantly different from each other (P<0.05)

Performance results in Table 2 indicate that dietary inclusion of NBM significantly influenced feed intake and weight gain. The highest feed intake (971.2 g) was recorded in snails fed 3% NBM, while the lowest intake occurred in the control group. Total weight gain increased progressively with higher inclusion levels of NBM. However, shell length, width, and thickness were not significantly affected by dietary treatments.

Table 3 Carcass Evaluation of Snails Fed Diets Containing NBM Leaf Meal

Percentage inclusion of NBM leaf meal					
Parameters	**NBM_1 (0%)**	**NBM_2 (1%)**	**NBM_3 (2%)**	**NBM_4 (3%)**	**SEM**
Live weight (g)	347.86	350.34	346.71	348.67.	23.45
Foot weight (g)	147.29[b]	152.43[ab]	156.05 [a]	158.85[a]	2.97
Dressing percentage (%)	42.34[b]	43.51[ab]	45.01[a]	45.56[a]	23.45
Offal to live-weight (%)	23.34	23.36	23.41	23.56	0.32
Shell to Live-weight (%)	22.43	22.45	22.68	22.89	0.34

Means along rows with different superscripts are significantly different from each other (P<0.05)

Carcass evaluation (Table 3) showed that dressing percentage improved significantly with NBM supplementation, with the highest values observed in snails fed 2% and 3% inclusion levels.

Table 4 Reproductive Performance of Growing Snails Fed Diets Containing NBM Leaf Meal

Percentage inclusion of NBM leaf meal					
Parameters	**NBM_1 (0%)**	**NBM_2 (1%)**	**NBM_3 (2%)**	**NBM_4 (3%)**	**SEM**
Total egg laid (Number)	16.67[b]	18.75 [ab]	19.93 [a]	19.98 [a]	1.02
Weight of the eggs(g)	5.57 [c]	5.68 [b]	5.91[b]	5.93 [a]	0.32
Egg shell length (mm)	4.50 [b]	4.62 [a]	4.63[a]	4.63 [a]	0.32
Egg shell width (mm)	3.45 [a]	3.49 [a]	3.52 [a]	3.53 [a]	0.35
Incubation period (days)	31.67	31.66	31.67	31.66	1.72
Weight of hatchling at day old (g)	5.72 [c]	6.24 [b]	6.59 [ab]	6.70 [a]	0.11
Shell length hatchling (mm)	3.65	3.65	3.66	3.67	0.03
Shell width hatchling (mm)	2.84	2.85	2.87	2.87	0.04

Means along rows with different superscripts are significantly different from each other (P<0.05)

Reproductive performance (Table 4**)** was positively influenced by NBM inclusion. Snails fed 3% NBM laid the highest number of eggs and produced heavier hatchlings, although incubation period remained unchanged across treatments.

Table 5 Sensory Evaluation of Snails Fed Diets Containing Neem, Bitter Leaf and Moringa

Percentage inclusion of NBM leaf meal					
Parameters	**NBM_1 (0%)**	**NBM_2 (1%)**	**NBM_3 (2%)**	**NBM_4 (3%)**	**SEM**
Colour	86.5	86.01	86.14	86.34	0.33
Taste	84.34	84.36	84.4	84.14	0.34
Flavour	85.1	85.51	86.49	87.41	0.31
Texture	84.45	84.12	84.30	84.16	0.31
General Acceptability	84.58	84.67	84.69	84.79	0.32

Means along rows with different superscripts are significantly different from each other (P<0.05)

Sensory evaluation results (Table 5) revealed no significant differences in taste, flavour, texture, or overall acceptability among treatments, indicating that NBM supplementation did not adversely affect meat quality.

IV. DISCUSSION AND CONCLUSION

The protein and energy levels of the control diet (NBM1) were consistent with the recommended nutritional requirements for growing *Archachatina marginata*, as reported by Omole (2018). This confirms that the basal diet was adequate to support normal growth, thereby allowing a

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clear evaluation of the effects of Neem, Bitter leaf, and Moringa (NBM) supplementation.

The results clearly demonstrate that dietary inclusion of NBM positively influenced growth performance. Feed conversion ratio (FCR) differed significantly among treatments, with the best performance observed in NBM4, although it was statistically similar to NBM3. Improvements in feed intake, weight gain, and feed efficiency suggest that NBM enhanced nutrient utilization and metabolic efficiency. The rich nutritional and bioactive composition of Neem, Moringa oleifera, and Bitter leaf—particularly their proteins, vitamins, minerals (such as iron), and phytochemicals—likely contributed to improved digestion, physiological performance, and overall growth. These findings indicate that NBM can effectively serve as a natural growth promoter when included at 2–3% of the diet.

Economic evaluation further strengthened these findings. The lowest cost per unit weight gain was recorded in NBM3 (3% inclusion), which aligns with its favorable feed conversion ratio. This demonstrates that NBM supplementation is not only biologically effective but also economically viable, making it a practical feeding strategy for snail farmers seeking to maximize returns.

Reproductive performance was also positively influenced by NBM supplementation. The mean weight of eggs laid was significantly affected by dietary treatments ($P<0.05$) and was higher than values previously reported by Omole *et al*. (2013) and Fayenuwo et al. (2019). The highest mean hatchling weight was observed in NBM4, while the lowest occurred in the control group. However, shell length, shell width, and incubation period were not significantly affected, consistent with findings by Ajasin *et al*. (2015) and Oluokun *et al*. (2013). These results suggest that while NBM enhances growth and reproductive output, it does not negatively alter normal physiological development.

Importantly, sensory evaluation revealed no significant differences in meat quality or general acceptability across treatments. This confirms that inclusion of NBM does not adversely affect consumer perception, reinforcing its suitability as an alternative to synthetic growth promoters.

Overall, the findings of this study demonstrate that incorporating a natural growth promoter composed of Neem, Bitter leaf, and Moringa into the diets of *Archachatina marginata* significantly improves growth rate, feed utilization, carcass yield, reproductive indices, and economic returns without compromising meat quality.

It can therefore be concluded that NBM may be safely included at levels of up to 3% of the total diet. Its adoption represents a sustainable, eco-friendly, cost-effective, and consumer-acceptable feeding strategy capable of enhancing snail production, strengthening food security, and increasing income generation for farmers.

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