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Health benefits of snail farming in Imo state, Nigeria: a life science and biomedical approach

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RESEARCH ARTICLE

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ABSTRACT: **Snail farming links food production, life sciences, and biomedicine, offering not only economic benefits but also vital health advantages. This study investigated the health benefits of snails, described the socioeconomic characteristics of snail farmers, compared the price elasticity of demand for snails with other animal proteins, and identified the key factors influencing profitability in snail farming within the study area. Data were collected through a well-structured questionnaire for 150 selected respondents using snowball sampling techniques. The data were analyzed using descriptive statistics, the elasticity model, the profit model, and ordinary least squares multiple regression. The results showed that 51.33% of respondents were male and 48.67% were female, with a mean age of 46 years, mean 6.8 persons per household, mean farming experience of 5.7 years, and 52.22% of respondents engaged in snail farming as their primary occupation. The price elasticity of demand for animal proteins was calculated, resulting in -0.24 for *Archantina archantina* and -1.10 for *Archantina marginata*. Snails were found to offer notable health benefits, including low cholesterol content, potential in asthma management, essential vitamins that aid in skincare and nutrients that support brain cell maintenance. The cost and return analysis revealed that a total of $235.67 was incurred, while $647.60 was realized from sales, resulting in a total profit of $411.92. Additionally, the factors affecting the profit of snail farmers were identified, including age, labour, stock size, and feed. The study recommended government intervention to scale up snail production and suggested that stakeholders in the snail industry adopt measures to promote both the production and consumption of snails.**

KEYWORDS: **Demand, health benefit, profit determinants, snail production.**

INTRODUCTION

Snails are invertebrates with soft, segmented exoskeletons in calcareous shells. They belong to the phylum Mollusca and some species, particularly *Archantina archantina* and *Archantina marginata*, are edible, especially in Imo State. Snail farming is becoming increasingly popular due to its numerous health benefits and economic viability for farmers. The business has good returns because the commercialization of the venture is on the rise [1]. Nutritionally, snail meat is a rich source of essential amino acids, unsaturated fatty acids, and vital minerals such as calcium and magnesium, contributing to its superior meat quality and potential as a health, promoting food component [2]. Snail mucin medically contains bioactive compounds like glycoproteins, glycolic acid, hyaluronic acid, and antimicrobial peptides, which contribute to regenerative and protective effects on human skin [3]. Recent studies showed that snail mucin is efficacy in promoting wound healing, reducing inflammation, and exhibiting antimicrobial properties, making it valuable in treating conditions such as burns, acne, and dermatitis [4].

In recent years, rural communities' practice of snail farming has gained prominence as households seek to diversify their income sources, reducing their reliance solely on crop cultivation for revenue. This shift is partly driven by the need to meet protein requirements, a gap that traditional crop production struggles to fill, necessitating the consumption of snail meat to bridge this nutritional divide [5]. The Food and Agriculture Organization (FAO) recommends a minimum daily animal protein intake of 35g per capita [6], highlighting the importance of addressing protein deficiencies in Nigeria through collaborative efforts [5].

The growing demand for snails, attributed to increased awareness of health risks associated with cholesterol and the nutritional benefits of snail meat, indicates a thriving market both locally and globally [7]. Snail meat's low-fat content serves as a preventive measure against fat-related diseases like hypertension and provides essential nutrients such as iron, calcium, and various vitamins crucial for brain and skin health [8]. Additionally, the selenium content in snails offers anti-inflammatory, antioxidant, and anti-cancer properties, boosting the immune system and aiding in combating various ailments [6].

While snail farming exhibits significant profitability potential due to its low input requirements, maximizing productivity hinges on adopting modern techniques for breeding, feeding, housing, and marketing snail products [9]. Despite its promising prospects, the full development of snail farming in Nigeria, particularly in Imo State, remains hindered by factors like unsustainable harvesting practices, environmental degradation, and insufficient farmer participation [10]. There have been several studies on profitability analysis of snail farming, cost and return in Owerri agricultural zone and other states in Nigeria, but empirical evidence shows that no such studies considered the health benefits of consuming snails in Imo State, hence necessitated this study. However, there is a need to close this gap by providing information on how snail farming links with key areas of life science, such as nutrition, biomedicine, and disease prevention to add to the existing body of knowledge on snail production in Imo State.

To address existing research gaps, this study aimed to analyze the health benefit of snails among the farmers, describe the socio-economic characteristics of snail farmers, compare the price elasticity of demand for snails and other animal proteins, and determine the factors influencing the profit of snail farmers in the study area.

MATERIALS AND METHODS

The study will be conducted in Imo State, Nigeria. The state is made up of 27 local government areas and is divided into three agricultural zones: Owerri, Orlu, and Okigwe. The state is located within latitudes $4^{0}45^{1}$ N and $7^{0}15^{1}$ N and longitudes $6^{0}50^{1}$ E and $7^{0}25^{1}$E with an area of around 5100 km^{2} [11]. The state shares a border with Anambra State and Abia State to the north, Abia State to the east, and Rivers State to the south and west. The population of Imo State stood at about 5,408,300 in 2016 and is estimated to grow at a rate of 3.8% per annum [12].

Imo State is in the rainforest vegetative region with average rainfall, temperature, and relative humidity of 1500 mm, 27 °C, and 80%, respectively. The vegetation is mainly characterized by tall trees with different layers of canopies and shrubs at the base. Agriculture is the predominant occupation of the people, for almost all farm families either as a primary or secondary occupation. The state agricultural production is characterized by large arable and tree crops with moderate livestock production spread across the three zones. The crops grown are grains like maize and rice, with other tuber crops like yam, cassava, and cocoyam. The state is also known for its involvement in forest products such as timber and non-timber production. Off-farm production activities going on in the state, which include processing and food preservation that are primarily done to prolong the shelf-life of the harvested arable and fruit crops, are important food commodity marketing activities.

The emerging snail farming in Imo State was at an early stage, the enterprise had not fully developed, and the snail farmers had no properly organized association. The snail farmers across these three zones of the state devise different ways to bring their mature snails into the markets to increase their customers' preferences and interest in the snail. Since the market does not have a well-defined and suitable arrangement, the study adopted a snowball sampling technique. The technique enabled the researcher to reach as many snail farmers as possible who have snail farms at different locations in the three agricultural zones of the state. To have wider coverage, different snail farmers engaged in different scales of operation in snail farming were identified using snowball sampling until 150 respondents across the three zones of Imo State were gathered for the study. Repeated visits and referrals to the different respondents identified using the snowball sampling method; as soon as one snail farmer is identified in any community in an area, others within the same area who are referred by the respondents will also be visited to get more respondents into the study.

Primary data was obtained using a well-structured pretested questionnaire. Information on respondents' socio-economic characteristics of the farmers, quantities, and prices of snails and other related animal proteins was obtained. Data was analyzed using descriptive statistics, profit analysis model, and ordinary least squares regression analysis.

Model specifications

Profit analysis model is given as;

$$\pi = TR - TC \quad \text{- - - (1)}$$

Where π = Net profit.

TR= Total Revenue (Price x Quantity)
TC= Total Cost (TFC+TVC) - - - (2)
TFC = Total Fixed Cost ($); TVC = Total Variable Cost ($)
The price elasticity of demand model is specified as follows;

$$E_p = \frac{\text{percentage change in amount of ith demanded}}{\text{percentage change in ith prices}} \quad - - - (3)$$

The multiple regression model used for the factors affecting the profit of snail farming was specified implicitly as: $Y = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, e_i)$ - - - (4)

Y= Profit ($); X_1 = Age (years); X_2 = Marital status (Dummy: married =1; single=0); X_3 = Household size (number of persons); X_4 = Educational attainment (years); X_5 = Scale of operation (Large scale =1; otherwise = 0); X_6 = Cost of feed ($); X_7 = Stock size (kg); X_8 = Experience (years); X_9 = Labour cost ($); ei= error term.

RESULTS AND DISCUSSION

Identified health benefits

The result of the analysis of the health benefits of snails is presented in Table 1. Table 1 showed that the first three highest-ranked health benefits of snails indicated by the respondents were low cholesterol and cure for asthma, essential vitamins and skin care, and brain cell maintenance, respectively. According to Cilia and Fratini [13] snails are used for medicinal value in the production of lectin, slime, allantonin, collagen and elastin for skin maintenance, and it is also believed that the meat is ideal for the treatment of asthma and ulcers. Research has shown that key ethnomedicinal uses of snails (and or their extracts) are used for the healing of wounds, smooth soothing, and relief of stomach cramps, inflammation, smallpox and chronic bronchitis [14]. Further findings also showed that the mucus of snails is used for the removal of wrinkles on the skin. Liu et al. [15] reported that mucus secretion extracted from snails is used in the cosmetic industry to produce creams that remove pigmentation, wrinkles and black spots on the skin. Traditionally, the mucus secretion of snails is mixed with honey as a syrup for both adults and children for the treatment of chronic asthma. Furthermore, Traditional medicine has it that the shell of the snail can be crushed into fine powder and mixed with the food of a baby to provide calcium deficiency in the bones.

Table 1. Health benefits of snail

Health benefits *	Frequency	Rank
Prevent hypertension	88	7 (5^{th})
Provide essential vitamins	108	3.5 (2^{nd})
Maintain brain cells	93	5 (3^{rd})
Boost immune system	56	8 (6^{th})
Anti-cancer	89	6 (4^{th})
Low cholesterol	148	1.5 (1^{st})
Cure for asthma	148	1.5 (1^{st})
Maintain skin	108	3.5 (2^{nd})

Source: Field Survey Data, 2024 *Multiple Responses

Socio-economic characteristics of snail farmers

The result of the socioeconomic characteristics of the respondents that is presented in Table 2 showed that 51.33% of respondents were male, while 48.67% of them were female. This shows that males are more dominant in snail production than their female counterparts. This result is justified by the findings of Anochili and Aneke, [16]; Ahmadu and Ojogho [17] that heliciculture activities are mostly dominated by men who fall within the age bracket of 36-45 years. The result shows that the mean age of the respondents was approximately 46 years. This implies that the respondents were young and active in the production of snails in the study area. This result is in line with the findings of Adewale and Belewu [5] that the mean age of snail farmers was 41.58 years. Table 2 further shows that 53.33% of the respondents were married, 18.67% were widowed and 17.33% were single. This shows that married farmers get involved more in the snail production enterprise because of the family's responsibility of providing for the family and to support in the farm work through their human power in labour. The result also shows that 48% of the respondents have a secondary level of education, 22% have a tertiary level of education, 16% have a primary level of education and 14% have no formal education. This implies that most of the respondents possessed secondary school education an indication that snail farming in Imo State is not an

enterprise of those that possess indigenous knowledge who may not know the techniques involved in the production of snails. This is so because snail farming requires a lot of technical and scientific knowledge to be successfully undertaken. The finding agreed with Aguaguiyi et al. [18] that education provides a favourable atmosphere for awareness, adoption and utilization of information.

Table 2 shows that the mean household size was found to be 6.8 persons per household. This shows that the respondents have adequate family labour to engage in the production of snails, hence reducing the cost of hired labour. This finding is consistent with the findings of Adewale and Belewu [5].

The result also showed that the mean farming experience of the respondents was 5.7 years. This shows that the enterprise has not gained much prominence like other livestock production and crop production in the study area. The result of Table 2 showed that 51.33% of the respondents engaged in snail farming as their major occupation while 48.67% used snail farming as a secondary occupation to support household income. Furthermore, 20% of the respondents reared *A. archantina,* 58.67% of the respondents reared *A. marginata,* and 21.33% of the respondents reared both species of snails in the study area. This implies that *A. marginata* was the most reared species in the study area. Finally, the result showed that the mean stock size of snails stocked by the respondent was 2604.17 numbers of snails in their farms. This implies that the snail farmers are still operating in a small-scale commercial system of snail farming. This result was not in agreement with the findings of Agbugba *et al.* [19] that snail farmers operate in a subsistence farming operation.

Table 2. Socioeconomic characteristics of the respondents

Variable		Frequency	%
Gender	Male	77	51.33
	Female	73	48.67
Age	25 - 35	51	34.00
	36 – 45	57	38.00
	46 – 55	20	13.33
	>56	28	14.67
Mean	43.6 years		
Marital Status	Single	26	17.33
	Married	80	53.33
	Divorced	16	10.67
	Widowed	28	18.67
Educational level	No formal education	21	14.00
	Primary	24	16.00
	Secondary	72	48.00
	Tertiary	33	22.00
Household size	0 – 4	30	20.00
	5 – 9	95	63.33
	10 – 14	25	16.67
Mean		6.8 persons	
Farming experience	0 – 5	92	61.33
	6 –11	32	21.33
	12 – 17	26	17.34
Mean		5.7 years	
Production system	Intensive	85	56.67
	Extensive	65	43.33
Major occupation	Yes	77	51.33
	No	73	48.67
Species of snail-reared	*Archantina archantina*	30	20.00
	Archantina marginata	88	58.67
	Both	32	21.33
Stock size	500 – 1599	23	15.33
	1600 - 2699	59	39.33
	2700 – 3799	51	34.00
	3800 – 4899	17	11.34
Mean		2604.17 No of snails	

Source: Field Survey Data, 2024

Price elasticity of the demand for snail and other animal protein

The result of the price elasticity of demand for snails is presented in Table 3. Table 3 shows the result of price elasticities of the different animal proteins demanded by the respondents in the study area. The results showed that the price elasticity of the products was less than one. This implies that the demand for animal proteins is inelastic. For different species of snail, the price elasticity of *Archantina archantina* was -0.11, which implies that the quantity demanded decreases by 0.11% as the price increased, while *Archantina marginata* was -0.33, which implies that the quantity of *Archantina marginata* of the specie of snail demanded decreased by 0.33% as the price increased. Despite the low-fat content of snail meat and its health benefits, the demand is increasingly reducing as the prices of the snails increase. Table 1 also showed that the pooled price elasticity of demand for animal proteins was -1.39 showing an inelastic demand. This implies that as the demand for animal proteins declined by 1.39%, the price also increased to the extent that the consumers could not afford more. This result affirmed the statement that it is more expensive to maintain a healthy living.

Table 3. Demand for snails and another animal protein per month

Description (Animal Protein)	Mean old quantity (No. of snail/kg)	Mean new quantity (No. of snail/kg)	Mean unit old price ($)	Mean unit new price ($)	Price elasticity of demand (E_p)
Archantina archantina	100	45	0.1324	0.7924	-0.11
Archantina marginata	80	25	0.3301	0.9902	-0.34
Fish	16	8	0.3963	0.9901	-0.33
Beef meat	10	8	1.3199	5.2799	-0.07
Chicken	15	10	0.9901	2.3104	-0.25
Egg	60.22	32.98	0.9899	2.5084	-0.29
Pooled Value	281.22	123.98	4.1587	12.8714	-1.39

Source: Field Survey Data, 2024

Cost and return to snail farming

The result of the cost and return of snail farming is presented in Table 4. The costs and return analysis were used to determine the profit of snail production enterprises in the study area. Table 4 shows that the total production cost per 259.7 kg of Snail in the study area was $236.24, while the total revenue per 259.7 kg was $652.14. The analysis showed that snail producers realized $415.92 per 259.7 kg as Net profit. The return per Naira on investment was $1.76. This indicates that for every $1 invested, an additional $1.76 is gained by the snail farmers in the study area and shows that snail farming in the study area was profitable. This is in line with the findings of Ahmadu *et al.* [20] who stated that snail farmers had $2.04 return on investment. The breeding stock cost was the largest component of the total cost ($62.33) and disagrees with the other types of livestock such as poultry where feed is the most expensive input [21].

Factors affecting snail farmers' profit

The result of the factors affecting the profit of snail farming is presented in Table 5 shows that the multiple correlation coefficient (R^2) was 0.691. This is high and indicates a strong positive correlation between the independent and dependent variables. This implies that age, labour, stock size, and feed in snail production account for 69.1% of the variation in snail production. The remaining variation can be attributed to other factors not included in the model. The calculated value 19.891 had a corresponding significant F value of 0.01 < 0.05 significance level; therefore, the researcher concludes that the model is good. The result further showed that the coefficient of stocking size and labour were positively significant at 1% respectively indicating that a unit increase in them will lead to an increase in snail profit. This is in line with Aminu *et al.* [22] where stock size was positively significant at a 1% level of significance. The coefficient of feed cost was negatively significant at 1% indicating that any increase in feed cost will lead to a decrease in snail profit. This aligns with the "a priori" expectation that cost has an inverse relationship with profit. The coefficient of age was significant at 1% for the snail farmers implying that older farmers have higher farm productivity than young farmers due to their more farming experience than the younger farmers. This result agrees with Agbugba et al. [21], who found that an increase in age would lead to an increase in productivity leading to higher profit.

Table 4. Average monthly cost and returns of snail production in the study area

Item	Unit	Average Quantity	Cost ($)	Amount ($)
Variable cost				
a) Breeding Stock	Number of snails	259.71	0.24	62.33
b) Labour	Man-day		39.44	39.44
c) Feed	Kg	6.83	7.92	54.09
d) Fumigation	Grams		3.26	3.26
e) Transportation			2.02	2.02
f) Utilities (Eg Water, Sanitation etc.)			10.01	10.01
Total Variable Cost				171.15
Fixed cost				
Snail housing			45.76	45.76
Depreciation on fixed assets			1.52	1.52
Land rent or lease			17.81	17.81
Total fixed cost				65.09
Revenue				
Medium jumbo (A.A)		75.18	0.61	45.86
Breeding stock (A.A)		496.86	0.16	79.50
Large jumbo (A.M)		236.49	0.81	191.56
Breeding stock (A.M)		1396.76	0.24	335.22
Total Revenue				$652.14
Total cost				$236.24
Net Profit				$415.92
Returns on Investment				1.76

Source: Field survey data, 2024 Archantina *Archantina* (A.A), *Archantina marginata* (A.M) Variable Cost (Breeding stock, Labour, Feed, Fumigation, Transportation, Utilities), Fixed Cost (Snail housing, Depreciation, Land rent),

Table 5. Multiple linear regression on factors affecting the profit of snail farmers

Variables	Coefficient	Standard Error (S.E)	T. value
Constant	6.607	0.989	6.681***
Age	0.064	0.184	3.330***
Education	-0.023	0.030	-0.761
Household size	0.006	0.063	0.103
Marital status	-0.074	0.090	-0.818
Experience	0.078	0.115	0.675
Labour	0.032	0.010	3.330***
Stock size	0.503	0.970	5.176***
Feed	-0.540	0.850	-6.378***
Credit	0.041	0.088	0.469
R^2	0.691		
Adjusted R^2	0.656		
Df	9		
Observation	90		
F-statistic	19.891**		

Source: Field survey Data, 2024 *** significant at 1%, ** significant at 5%

CONCLUSION AND RECOMMENDATIONS

The findings of this study underscore the dual benefits of snail farming, which not only offers a profitable avenue for farmers but also provides significant health benefits to consumers. Snail meat, as highlighted, is rich in essential nutrients such as low cholesterol, essential vitamins, and protein, making it a valuable component of a balanced diet. Additionally, snail mucin is increasingly recognized for its dermatological benefits, including its ability to improve skin elasticity and reduce signs of ageing. The neuroprotective properties of snail mucin also suggest that snail farming has a potential role in brain health, further emphasizing the relationship between life sciences and snail farming.

However, the findings also revealed that while snail farming has clear health benefits and is a profitable venture, the cost of snails limits its accessibility to a wide consumer base. This cost barrier has a direct impact on demand, reducing the overall potential for snail farming to make a significant impact on public health and nutrition. Furthermore, while gender was found to play a positive role in ensuring snail production in the study area, factors such as age, labour, stock size, and feed significantly influenced the profitability of the sector.

The study recommends that the government should implement policies and programs that support the growth of snail farming as a health-oriented agricultural practice, Research should focus on validating the therapeutic potential of snail products in areas such as cardiovascular health, skin care, and neurodegenerative diseases, and Public health campaigns should be launched to educate consumers about the nutritional and medicinal benefits of snail meat.

DECLARATIONS

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Authors' contribution

Anyiam, K.H, Nwaiwu, I.U.O, Kadiri, F.A, Osuji, M.N. = Conceptualization, methodology design, models design, data analysis, section writing and proofreading.

Anyanwu, U.G, Nwosu, F.O, Obinna-Nwandikom, C.O. = Questionnaire design, data collection, section writing and grammar check.

Enoch, O.C., Isaiah, I.G., Bala, M.B., Obasi, A.C. = Data collection, data sorting, and data entering

Madu, J.A., Nnorom, E.I = Data coding, data curation, data processing.

Ethical consideration

There is no direct contact with the snail, but there was direct contact with the farmers.

Consent to publish

All the authors consented to publish the article.

Competing interests

There is no existence of conflict of interest among the authors.

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REFERENCES

[1] Munywoki GN. Snail farming (*Heliciculture*): Benefits, economic viability, challenges and prospects. International Journal of Research in Agronomy. 2022; 5(1):9-11. https://doi.org/10.33545/2618060X.2022.v5.i2a.102

[2] Gupta A, Khanal P. The potential of snails as a source of food and feed. Journal of Agriculture and Food Research. 2024 Jul 29:101330. https://doi.org/10.1016/j.jafr.2024.101330

[3] Maddi Hebebrand, MC. Current Clinical and Aesthetic Applications of Snail Mucin. Dermatology Times, 2025. https://www.dermatologytimes.com/view/current-clinical-and-aesthetic-applications-of-snail-mucin

[4] Rashad M, Sampò S, Cataldi A, Zara S. From Nature to Nurture: The Science and Applications of Snail Slime in Health and Beauty. Journal of Cosmet Dermatol. 2025 Feb 19;24(2):e70002. https://doi.org/10.1111/jocd.70002

[5] Adewale CI, Belewu KY. Economic analysis of snail production and its contribution to food security of farming households in Nigeria. Agricultura Tropica Et Subtropica. 2022;55(1):159-68. https://doi.org/10.2478/ats-2022-0017

[6] FAO (2022). The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable. Rome, FAO 2022. https://doi.org/10.4060/cc0639en

[7] Akifenwa G. Agribusiness with huge potential most farmers ignore. The Guardian. 2022; https://guardian.ng/features/agro-care/snail-farming-agribusiness-with-huge-potential-most-farmers-ignore/

[8] Onodugo VA, Nwonye NG, Anowor OF, Ofoegbu GN. Attaining inclusive growth in a developing economy on the wings of micro, small and medium scale enterprises. Amazonia Investiga. 2019 Nov 21;8(24):239-52. https://amazoniainvestiga.info/index.php/amazonia/article/view/977

[9] Jimoh OA, Akinola MO. Reproductive performance of laying snails (Archachatina marginata) fed on roughages and different concentrate mixes. Bulletin of the National Research Centre. 2020 Dec;44:1-6. https://doi.org/10.1186/s42269-020-00378-w

[10] Munonye JO, Moses P. Profitability analysis of snail farming in Owerri Agricultural Zone, Imo State. Contributed paper prepared for presentation at the 93rd Annual Conference of the Agricultural Economics Society, University of Warwick, England, 2019; 15-17. https://doi.org/10.22004/ag.econ.289661

[11] Southeast Region Economic Development Company, SEREDEC. (2023). Government of Imo State, Nigeria.

[12] National Population Commission, NPC. (2022). Report on population estimate, 2022.

[13] Cilia G, Fratini F. Antimicrobial properties of terrestrial snail and slug mucus. Journal of Complementary and integrative Medicine. 2018 Aug 28;15(3):20170168. https://doi.org/10.1515/jcim-2017-0168

[14] Dhiman V, Pant D. Human health and snails. Journal of Immunoassay and Immunochemistry. 2021 May 4;42(3):211-35. https://doi.org/10.1080/15321819.2020.1844751

[15] Liu L, Sood A, Steinweg S. Snails and skin care—an uncovered combination. JAMA dermatology. 2017 Jul 1;153(7):650. https://doi.org/10.1001/jamadermatol.2017.1383

[16] Anochili IC, and Aneke JA. Economic implications of snail production in Enugu State. Academic Journal of Agricultural and Horticultural Research, 2022; 2(3): 1-12.

[17] Ahmadu J, Ojogho O. Economics of snail production in Edo State, Nigeria. International Journal of Agriculture Sciences. 2012 Jan 1;4(5):233. http://dx.doi.org/10.9735/0975-3710.4.5.233-237

[18] Aguaguiyi FN, Emegha, K, & Umebali EE. Determinants of snail production in Delta State. GOUni Journal of Faculty of Management and Social Sciences, 2022 Dec 2;10(1):110-31.. ISSN: 2550-7265.

[19] Agbugba IK, Agbagwa KS, Kau JS, Ugwuegbulem JC. Cost and Returns Analysis of Snail Production in Obio-Akpor Local Government Area, Rivers State, Nigeria. South African Journal of Agricultural Extension. 2023;51(3):1-6. https://doi.org/10.17159/2413-3221/2023/v51n3a14826

[20] Ahmadu J, Ida-Ogbomo EO, Oyoboh DE. Contribution of snail production to income status of snail farmers in Edo South, Edo State, Nigeria. Agro-Science. 2021 Sep 29;20(3):49-52. https://doi.org/10.4314/as.v20i3.7

[21] Agbugba IK, Agbagwa KS, Kau JS, Ugwuegbulem JC. Cost and Returns Analysis of Snail Production in Obio-Akpor Local Government Area, Rivers State, Nigeria. South African Journal of Agricultural Extension. 2023;51(3):1-6. http://www.iiardpub.org/

[22] Aminu FO, Edun TA, Abiodun GT. Analysis of the determinants of technical efficiency of snail farmers in Ogun State, Nigeria. Nigerian Journal of Animal Science. 2020;22(1):233-40. https://asan.org.ng/vol-22-no-1-2020/