INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print); 2222-5234 (Online)
Website: https://www.innspub.net
Email contact: info@innspub.net
Vol. 28, Issue: 2, p. 7-16, 2026

RESEARCH PAPER OPEN ACCESS

Sensory evaluation of horn snail (*Telescopium telescopium*) patty

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Key words: Horn snail, *Telescopium telescopium*, Marine gastropod, Edible mollusk, Seafood utilization

Received Date: January 19, 2026 **Published Date:** February 02, 2026

DOI: https://dx.doi.org/10.12692/ijb/28.2.7-16

ABSTRACT

The researchers utilize horn snail (*Telescopium telescopium*) or bagongon as the main ingredient in making patty which has not been actively consumed because of the relatively low popularity despite its abundance. Bagongon is a type of sea snail commonly found in coastal areas and muddy estuaries. The abundance of the horn snail and its nutritional value allows the researcher to produce horn snail meat patty for hamburgers containing a high content of horn snail that can maximize the taste and aroma of horn snail which would help prevent diseases. The main thrust of this study is to determine the acceptability of horn snail patty in terms of appearance, aroma, taste, texture, flavor, and general acceptability. The researchers used the experimental design and descriptive survey methods as a tool in gathering the data with the three treatments consisting of 125 g, 150 g, 175 g of horn snail meat. The gathered data were tabulated using the weighted mean and the One-way ANOVA. Results show that T1 had the best result among the 3 treatments in terms of color, texture, and flavor while T3 had the best results among the 3 treatments in terms of taste, aroma, and overall acceptability. Results show that the three treatments do not differ from each other in overall acceptability and the null hypothesis is accepted. Furthermore, the three treatments were generally acceptable thus suggested that horn snail could be a good substitute for making a patty and can be produced as a new food product.

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INTRODUCTION

In this study, the researchers are able to produce a rare and savory horn snail meat patty a food product that is not just acceptable to the masses but also nutritious through the utilization of Horn snail (*Telescopium telescopium*). Hence, this study was pursued to evaluate the sensory aspects of patty prepared from various proportions of Horn snail (*Telescopium telescopium*).

Bagongon, is a type of snail commonly found in coastal areas and muddy estuaries. Apart from its scientific name, this fascinating creature goes by various other names including the telescope snail, horn shell, or tower shell. In terms of description and appearance, Bagongon sports a spiral-shaped shell that resembles a miniature tower or telescope. Its unique design makes it stand out among other snail species.

The color of its shell can range from light brown to dark grayish-brown with distinctive vertical stripes running along its length. The telescope snail, also known as Bagongon, is a unique and nutritious delicacy that offers various health benefits. Packed with protein, vitamins, minerals, and omega-3 fatty acids, these snails are not only delicious but also provide essential nutrients for our overall well-being. As for taste, Bagongon offers a delicate and slightly briny flavor profile reminiscent of seafood. Many people find it enjoyable when incorporated into various dishes such as soups, stews, stir-fries, or even used as toppings for pizza (Lauro, 2024).

Compounds extracted from a species of horn snails, locally known as bagongon, were discovered to have properties that may be used for the development of cancer treatments.

Students from the University of the Philippines-Manila, in a study published in the journal Acta Medica Philippina last month, found that certain extracts from locally abundant horn snails (*Telescopium Telescopium*) may prevent angiogenesis or the formation of blood vessels from existing ones. The blood vessels, according to the authors, supply oxygen and nutrients for the growth of cancer cells, making angiogenesis a significant mechanism of growth and spread of cancer cells in the body (Mateo, 2019).

The burger patty is considered a processed meat product that is usually produced by using minced chicken, lamb, pork, turkey, and other palatable meats. Excess cholesterol, sodium, and flavoring agents in commercial burger patties led to an unhealthy diet pattern and an increased consumer craving for fast food. This, ideally, results in elevated cholesterol levels in the blood, obesity, high blood pressure, and even the possibility of cancer. This study was aimed at observing the unripe soursop's incorporation into the burger patty as the meat alternative and its effect on the physical and sensory properties. Therefore, this research study intended to formulate a vegetarian burger patty by using plant-based sources such as unripe jackfruit, unripe soursop, and oyster mushroom as meat alternatives which mimic the taste and texture of animal-based burger patties and as well as to reduce the reliance of red meat in processed (Rajaretnam *et al.*, 2023).

In connection with this, the researchers also wanted to convince other people to utilize the horn snail's meat in making a patty upon knowing its nutritional value and to consume meat products that has low amounts of fats as it fosters sustainable utilization of natural resources, expands dietary options, and enhances food security, particularly in coastal regions where awareness of its nutritional benefits and culinary potential may be limited.

Statement of the problem

The main purpose of this study was to determine the acceptability of Horn snail meat patty as a substitute for meat in the three treatments in terms of color, aroma, taste, texture, and general acceptability.

Specifically, this study aimed to answer the following questions:

1. What is the sensory description of horn snail patty in terms of;
   1.1 color;
   1.2 aroma;

1.3 texture,
1.4 taste;
1.5 flavor?

2. What is the acceptability level of the three treatments in terms of the mentioned sensory attributes and their overall acceptability?
3. Is there a significant difference in the acceptability level of the horn snail meat patty on the three treatments in terms of color, aroma, texture, taste, flavor, and general acceptability?
4. What is the cost of the horn snail meat patty in the three different treatments?
5. What extension program can be proposed based on the findings?

Statement of hypothesis

There is no significant difference in the acceptability level of horn snail meat patty using different treatments in terms of color, aroma, texture, taste, flavor, and general acceptability.

MATERIALS AND METHODS

Design

To achieve the purpose of the study, the researchers used descriptive survey and experimental design in conducting it. Descriptive design used rating sheets in gathering data and describing the acceptability of Horn snail meat patty. The rating sheet included the following concepts such as appearance, aroma, taste, texture, color, and general acceptability. Experimental design was applied in this study where different treatments were manipulated such as treatment 1–125 grams Horn snail meat with 50 grams all-purpose flour, treatment 2–150 grams Horn Snail meat with 50 grams all-purpose flour, treatment 3–175 grams Horn snail meat with 50 grams all-purpose flour.

Environment and participants

This study was conducted at the Bohol Island State University- Calape Campus. The researchers chose the CTAS Instructors, On-The-job trainees of Food Technology Students, the second-year FPST Students at Bohol Island State University, and the Service crew of different burger stands in Calape and Tubigon as the respondents of the study. The researchers used purposive sampling in selecting the respondents preferably to access the product for their specialized training and experience. Five CTAS Instructors, five OJT Food Technology students, ten second year FPST students in Bohol Island State University – Calape Campus, and 10 service crew of different burger stand which is the Nicey Burger Junction and Angel's Burger in Calape and Tubigon were to examine the product of the study.

Research instrument

To ascertain the respondents' opinions, the researchers employed an observation guide that was developed using the Nine Point Hedonic Scale. The questionnaires' content focuses on the Horn snail meat Patty's acceptability level by employing the three treatments by its characteristics, including its look, color, taste, texture, and general acceptability.

Research procedure

Approval of the study and preparation of the questionnaire

The researchers asked a written permission to conduct the study from the Dean of the College of Technology and Allied Sciences. Before data gathering, preparations for the sample product were made by the researchers after the rating sheet was formulated. The self-made rating sheets were submitted to the adviser first for corrections.

Preparations for making horn snail patty

The researchers prepared Horn Snail meat patty in three different the treatments, specifically, Treatment 1 - 125 grams of Horn snail meat with 50 grams of all-purpose flour and 1 egg, Treatment 2 - 150 grams of Horn snail meat with 50 grams of all-purpose flour and 1 egg, Treatment 3 - 175 grams Horn snail meat with 50 grams all-purpose flour and 1 egg. In addition, the researchers strictly observed proper hygiene protocols like washing their hands, cleaning the tools and equipment, and ensuring fresh ingredients used in making the Horn Snail patty.

The Horn snail meat is the main ingredient in making the patty, together with all-purpose flour, egg, oil, and black pepper. All these ingredients were used in three treatments and it was carefully demonstrated by the researchers. The tools and equipment used for the preparation of the product were the following: casserole pot, frying pan, digital weighing scale, food processor, mixing bowl, knife, plates, chopping board, measuring spoon, spoon, fork, strainer, and gas stove.

Steps in making the hornsnail patty

1. Place the collected Horn snail in a basin with running water and wash until the Horn snail is clean.
2. Transfer the cleaned Horn snail to the stock pot and boil the Horn snail for about 20 minutes on medium heat.
3. Once cooked, put the closed cooking pot in a bucket full of clear water and let it cool for about 15 seconds. This process helps to facilitate the removal of the horn snail from inside the shell.
4. After cooling, transfer the horn snail to a basin. Pick out the horn snail meat and put it on a separate plate. Remove the black part of the tail.
5. Wash the Horn snail meat in a minute using the strainer. Transfer the horn snail meat to plates.
6. Grind horn snail meat gradually using a food processor for about 2 minutes or until it is minced.
7. Weigh the Horn snail meat (125 grams, 150 grams, and 175 grams) using a digital weighing scale.
8. Combine the ground Horn Snail meat with the all-purpose flour, egg, salt, and pepper. Mix well.
9. Form the Horn Snail mixture into a flattened circle using the patty molder.
10. In a frying pan, heat 2 ml of oil in a low medium heat.
11. Fry the horn snail patty until cooked and serve.

Statistical treatment

To be able to attain scientific evidence and answers to the research problems, the following statistical tools were used.

Frequency (*f*) and percent (%) are used to determine the sensorial description of the Horn Snail meat patty such as color, aroma, texture, and taste.

Mean (*M*) was used to ascertain the describe the acceptability of Horn Snail Patty in terms of color, taste, texture, aroma, flavor, and general acceptability. It is interpreted as follows: 1.00–1.88 (Extremely Inacceptable), 1.89–2.77(Very Much Inacceptable), 2.78–3.66 (Moderately Inacceptable), 3.67–4.55 (Slightly Inacceptable), 4.56–5.44 (Neither Like nor Dislike), 5.45–6.33 (Slightly Acceptable), 6.34–7.22 (Moderately Acceptable), 7.23–8.11 (Very Much Acceptable), and 8.12–9.00 (Extremely Acceptable).

One-way analysis of variance applying bootstrapping with 95% Bias corrected accelerated was used to test if there is a significant difference in the acceptability of the three treatments of Horn snail Patty in terms of color, taste, texture, aroma, flavor, and general acceptability.

Bootstrapping is a robust estimation method for reducing bias associated with normality, homogeneity of variance, and sampling. Explicitly, the *F*-statistic with corresponding between and within group degrees of freedom was determined which is defined as the ratio of the between-group variability to the within-group variability. Moreover, Duncan new multiple range test was used as a post-hoc analysis for significant ANOVA results to test where specifically the difference lies. Probability values (*p)* were compared at a .05 level of significance. The IBM SPSS Statistics Trial Version was used in data analysis (Duncan, 1955; Bower, 2013; Field, 2020; Tabachnick and Fidell, 2018; IBM Corp, 2022).

RESULTS AND DISCUSSION

Sensory description of the horn snail meat patty

Sensory description plays a crucial role in the food industry, helping manufacturers ensure consistency in product quality and meet consumer expectations. Table 1 shows a sensory description of the three

treatments of horn snail meat patty evaluated in terms of appearance, taste, texture, aroma, and flavor. The goal is to provide a detailed and objective description of the sensory characteristics of the horn snail patty.

The color of the food surface is the first quality parameter evaluated by consumers, and it is critical for product acceptance. Food appearance determined mostly by surface color is the first sensation that the consumer perceives and uses as a tool to either accept or reject food (Leon *et al.*, 2006) Table shows that the 125 grams of Horn snail patty (*f* = 12, % = 40.0), the 150 grams of Horn snail patty (*f* = 18, % = 60.0), and the 175 grams of Horn snail patty (*f* = 17, % = 56.7) have *a* dark brown color. This implied that the different levels of Horn Snail added in every treatment have no difference in terms of color. The change in color of horn snails when cooked is due to the heat treatments altering their structure and appearance leading to a brown coloration.

Table 1. Sensory description of horn snail meat patty (n = 30)

Attributes	Descriptions	Treatments					
		Patty with 125 grams of horn snail		Patty with 150 grams of horn snail		Patty with 175 grams of horn snail	
		f	%	*f*	%	*f*	%
Color	Brown	7	23.3	5	16.7	6	20.0
	Golden brown	11	36.7	6	20.0	7	23.3
	Dark brown	12	40.0*	18	60.0*	17	56.7*
Taste	Bland	4	13.3	4	13.3	4	13.3
	Slightly sweet	7	23.3	7	23.3	6	20.0
	Well-blended flavor	16	53.3*	14	46.7*	12	40.0*
	Slightly salty	3	10.0	5	16.7	8	26.7
Texture	Hard	4	13.3	2	6.7	2	6.7
	Firm	20	66.7*	23	76.7*	22	73.3*
	Crunchy	6	20.0	5	16.7	6	20.0
Aroma	Slightly perceptible aroma of horn snail	9	30.0	1	3.3	6	20.0
	Moderately perceptible aroma of horn snail	12	40.0*	8	26.7	14	46.7*
	The well-blended aroma of horn snail	9	30.0	10	33.3*	10	33.3
	No distinct aroma of horn snail	0	0.0	1	3.3	0	0.0
Flavor	No distinct horn snail flavor	0	0.0	1	3.3	1	3.3
	Slightly perceptible horn snail flavor	10	33.3	9	30.0	5	16.7
	Moderately perceptible horn snail flavor	10	33.3*	10	33.3*	15	50.0*
	Very perceptible horn snail flavor	10	33.3	10	33.3	9	30.0

Description with the highest f and % is used as a descriptor for the treatment.

In term of tasta, the horn snail patty with 125 grams (*f* = 16, % = 53.3), the horn snail patty with 150 grams (*f* = 14, % = 46.7), and the horn snail patty with 175 grams (*f* = 12, % = 40.0) all have well-blended flavor. Bioactive compounds found in the horn snail (*Telescopium telescopium*) can influence its taste due to the presence of chitosan, a biopolymer with unique properties derived from the snail. These compounds and enzymes present in *T. telescopium* highlight its potential to influence the taste profile of the horn snail, showcasing the diverse bioactive properties of this marine mollusc (Rajathy, 2020). The superior taste blending observed in Treatment 1 implies that this treatment has achieved optimal ingredient proportions, seasoning, and cooking techniques compared to the other treatments. This likely results from a more effective combination of higher-quality ingredients, and a refined preparation process, which together contribute to a more harmonious and well-integrated flavor in the patty.

In texture, the Horn Snail patty with 125 grams of horn snail (*f* = 20, % = 66.7), the horn snail patty with 150 grams of horn snail (*f* = 23, % = 76.7), and the horn snail patty with 175 grams of horn snail (*f* = 22, % = 73.3) all have firm texture. Chitosan derived from Telescopium telescopium has been shown to have bactericidal effects and prevent biofilm formation,

indicating its potential influence on the snail's texture (Rajathy, 2020). It showed that Treatment 2 got the highest frequency and percentage rating of the three (3) treatments while Treatment 1 got the lowest. The firmness of the patty in Treatment 2, relative to the other treatments, suggests that this treatment employs an optimal combination of ingredient proportions, binder usage, or processing techniques. This indicates that Treatment 2's formulation or preparation method effectively enhances the cohesion and structural integrity of the patty, likely due to factors such as the type and amount of binder used, the mixing process, or the specific cooking method employed.

For aroma, the horn snail patty with 125 grams of horn snail (f = 12, % = 40.0) have moderately perceptible aroma of horn snail, the horn snail patty with 150 grams of horn snail (f = 10, % = 33.3), and the horn snail patty with 175 grams of horn snail (f = 10, % = 33.3) have well-blended aroma of horn snail. It showed that Treatment 1 has the highest frequency and percentage among the three (3) treatments while Treatment 2 and Treatment 3 are the lowest. This implied that the less use of horn snail, the less the aroma of Horn Snail Patty will be affected. The complex bond between these heat-generated odorants and proteins is responsible for the peculiar scent notes detected during the frying of horn snails, offering a sensory experience that is exclusive to this cooking method. Bioactive compounds like alkaloids, steroids, and flavonoids found in Telescopium telescopium can influence its aroma profile, impacting its sensory characteristics (Hafiluddin, 2012).

In flavor, the Horn Snail patty with 125 grams of horn snail (f = 10, % = 33.3), the horn snail patty with 150 grams of horn snail (f = 10, % = 33.3), and the horn snail patty with 175 grams of horn snail (f = 15, % = 50.0) have moderately perceptible horn snail flavor. Due to the presence of chitosan, a biopolymer with unique properties derived from the snail (Rajathy, 2020), it contributes to the flavor by the amount of Horn Snail added. The more horn snail is used, the higher it can influence to the flavor of Horn Snail Patty.

Table 2. Sensory acceptability and test of hypothesis of horn snail meat patty (n = 30)

Attributes	Treatments	Mean (M)	Interpretation	F	p	Result
Color	125 grams of horn snail	7.07	Like Moderately			
	150 grams of horn snail	6.77	Like Moderately	.324	.724	ns
	175 grams of horn snail	6.97	Like Moderately			
Taste	125 grams of horn snail	6.67	Like Moderately			
	150 grams of horn snail	6.63	Like Moderately	.067	.935	ns
	175 grams of horn snail	6.77	Like Moderately			
Texture	125 grams of horn snail	6.63	Like Moderately			
	150 grams of horn snail	6.33	Like Slightly	.293	.747	ns
	175 grams of horn snail	6.60	Like Moderately			
Aroma	125 grams of horn snail	6.80	Like Moderately			
	150 grams of horn snail	6.77	Like Moderately	.131	.878	ns
	175 grams of horn snail	6.97	Like Moderately			
Flavor	125 grams of horn snail	6.97	Like Moderately			
	150 grams of horn snail	6.93	Like Moderately	.066	.936	ns
	175 grams of horn snail	6.83	Like Moderately			
Overall	125 grams of horn snail	7.23	Like Very Much			
	150 grams of horn snail	7.17	Like Moderately	.445	.642	ns
	175 grams of horn snail	7.43	Like Very Much			

Note: F values were determined with 2 degrees of freedom between groups and 87 degrees of freedom within groups. F values are based on bias-corrected and accelerated (BCa) bootstrap 95% confidence intervals, unless otherwise noted. Bootstrap results are based on 1,000 resamples. ns indicates a non-significant result (p > .05); * indicates significance (p ≤ .05); ** indicates high significance (p ≤ .01).

Acceptability of horn snail patty

Table 2 shows the results of acceptability and one-way analysis of variance test of significant differences in the acceptability of Horn Snail meat patty in terms of color, taste, texture, aroma, flavor, and general acceptability.

In terms of color, results showed that Treatment 1 with 125 grams of horn snail (M = 7.07), T2 with 150 grams of horn snail (M = 6.77), and T3 with 175 grams of horn snail (M = 6.97) are liked moderately by the respondents. Moreover, the three treatments have no statistically significant difference in terms of color, F(2,87) = .324, p = 724.

This implied that the different levels of horn snail added in every treatment have no difference in terms of color. The change in color of the Horn snails when cooked is due to the heat treatments altering their structure and appearance leading to a brown coloration (Sri *et al.*, 2019). According to (Leskow *et al.*, 2021) the Maillard reaction contributes to the browning and flavor development in various foods, affecting their color through the formation of melanoidins, production of pigments, and enhancement of color intensity. The Maillard reaction is essential for the color acceptability of patties, as it produces a desirable known color that signals proper cooking and flavor development. This browning enhances the visual appeal and perceived quality of the patty, influencing consumer satisfaction and expectations.

In terms of taste, results showed that horn snail patty with 125 grams of horn snail (M = 6.67), with 150 grams of horn snail (M = 6.63), and with 175 grams of horn snail (M = 6.77) are liked moderately by the respondents. Moreover, the three treatments have no statistically significant difference in terms of taste, F(2,87) = .067, p = .935. Based on the result, it indicated that the most preferred treatment is Treatment 3 which is 175 grams of horn snail.

This implied that increasing the amount of horn snail added, the higher it is acceptable in terms of taste. An excessive amount of horn snail can alter the taste, although it can also bring about health benefits, and enhance the sensory attributes of Horn Snail Patty. Studies have identified various compounds such as peptides, sterols, and polysaccharides. Peptides are short chains of amino acids and can significantly impact taste. Peptides are responsible for various flavor profiles, including umami, bitterness, and savory notes. While these compounds may not be the primary flavor agents, they contribute to the complexity, enhancement, and modification of flavors in various food products (Othman *et al.*, 2020).

In terms of texture, results showed that Horn Snail meat patty with 125 grams (M= 6.63), 150 grams of horn snail (M =6.33), and 175 grams of horn snail (M= 6.60) are liked moderately by the respondents. Moreover, the three treatments have no statistically significant difference in terms of texture, F (2,87) = .293, p = .747. Therefore, the less amount of the horn snail meat, the more it is preferable by the respondents. Increasing the amount of Horn Snail in the treatment can affect the texture of the Horn Snail Patty. Bioactive compounds found in Horn Snails can influence the texture of the food products, primarily through their structural properties and interactions with other food components (Li Zhang, 2021).

In terms of aroma, results showed that Horn Snail patty with 125 grams of horn snail (M =6.80), with 150 grams of horn snail (M =6.77), and with 175 grams of horn snail (M = 6.97) are liked moderately by the respondents. Moreover, the three treatments have no statistically significant difference in terms of aroma, F(2,87) = .131, p = .878. Based on the result, it indicates that the most preferred treatment is Treatment 3 which is 175 grams of horn snail.

This implied that increasing the amount of horn snail added, the higher it can contribute to the aroma of horn snail in the Horn Snail Patty. Bioactive compounds affecting the horn snail (*Telescopium telescopium*) in terms of aroma include glycans, peptides, glycopeptides, chondroitin sulfate, and specific proteins with antimicrobial and immunostimulatory properties (Milany, 2018).

In terms of flavor, results showed that Horn Snail meat patty with 125 grams of horn snail (M = 6.97), with 150 grams of horn snail (M = 6.93), and with 175 grams of horn snail (M = 6.83) are liked moderately by the respondents. Moreover, the three treatments have no statistically significant flavor difference, F(2,87) = .066, p = .936. Based on the result, it indicated that the most preferred treatment is Treatment 1 with 125 grams of horn snail. This implied that the lesser amount of the Horn Snail added, the less perceptible of the Horn Snail flavor will result which is more preferable to the acceptability of the flavor in Horn Snail Patty.

However, Treatment 3 got the lowest rate. Peptides are responsible for various flavor profiles, including umami, bitterness, and savory notes. Sterols can contribute to a creamier or richer mouthfeel, which can enhance the perception of flavor (Othman *et al.*, 2020).

Moreover, in the general acceptability, results showed that Horn Snail meat patty in T1 with 125 grams of horn snail (M = 7.23), T2 with 150 grams of horn snail (M = 7.17), and T3 with 175 grams of horn snail (M = 7.43) are liked very much by the respondents. Moreover, the three treatments have no statistically significant difference in terms of general acceptability, F (2,87) = .445, p = .642. This implied that the highest result among three treatments was Treatment 3 with 175 grams of Horn Snail. The overall acceptability of Horn Snail (*Telescopium telescopium*) as food depends on several factors, including its texture and flavor, which vary in appeal based on cultural preferences. The general acceptability of a food product is determined by various factors such as sensory attributes, consumer preferences, and environmental influences. Sensory characteristics play a crucial role in determining the acceptability of food products, as they directly impact consumer liking and overall perceived quality (Arvanitoyannis, 2012). Based on the results of the study from different authors, it is believed that snail meat has a nutritional value equal to the value of conventional types of meat (Radoslav *et al.*, 2013).

CONCLUSION

Based on the findings presented, the researchers concluded that there is no significant difference among color, aroma, taste, texture, flavor, and general acceptability within the three treatments. Additionally, given that the three treatments are generally considered acceptable thus they can be manufactured as alternative products. In this context, the researchers believed that it can contribute to the utilization of horn snails in product development. An extension program could be done to inform its viability for home consumption as well as an additional source of income.

RECOMMENDATIONS

Based on the conclusions, the following recommendations are forwarded:

1. Any of the treatments can be used in making Horn Snail Patty since they are equally acceptable;
2. Future researchers may conduct related studies to create more recipes for horn snails;
3. Future researchers may improve the sensory aspects of the Horn Snail Patty by polishing the product's appearance, aroma, taste, and texture by adding more ingredients;
4. Future researchers may also conduct another study of Horn snail Patty by adding different flavors;
5. To become further determine the nutrient content composition of the horn snail, the researchers recommend to study about the nutritional analysis and benefits of the horn snail.

To give value and importance of the horn snail in the community and enhance its recognition as a critical component of the local ecosystem, it is essential to conduct further research on its ecological roles and contributions.

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