e-ISSN 2795-4362
p-ISSN 2795-4340

GPH-INTERNATIONAL JOURNAL OF AGRICULTURE & RESEARCH
GPH - JOURNAL OF AGRICULTURE & RESEARCH

10.5281/zenodo.8228906 Vol. 06 Issue 08 August - 2023 Manuscript ID: #0968

PHYTOCHEMICALSANALYSIS OF FRESH AND BOILED GOLDEN APPLESNAIL (*POMACEACANALICULATA*)

Rusky I. Pratama & Yuli Andriani
Depart of Fisheries, Faculty of Fisheries and Marine Science, Univ. Padjadjaran, West Java, Indonesia.

Corresponding Author: rusky@unpad.ac.id

ABSTRACT

The golden apple snail, Pomaceacanaliculata, has a complex history in Indonesia, where it was originally introduced as an aquarium fauna in 1981 but later became a pest in rice fields. As a result, there is a need for better understanding of the biological aspects of this species to develop efficient control measures. Phytochemical compounds found in plants, such as phenolic components, glucosinolates, and carotenoids, have various biological activities and potential health benefits. However, the phytochemical properties of the golden snail have not been extensively studied. In this research, samples of raw and boiled golden snail meat were analyzed for alkaloids, steroids, flavonoids, saponins, phenol hydroquinone, and carbohydrates using various methods.The results showed that both raw and boiled golden snail meat tested negative for alkaloids, steroids, flavonoids, saponins, and phenol hydroquinone. However, the Molisch test for carbohydrates gave positive results, indicating the presence of carbohydrates in both samples.

These findings contribute to a better understanding of the phytochemical properties of the golden snail and highlight the potential biological activities of these compounds. Further research in this area may lead to the development of more targeted and sustainable control measures for the golden snail as a rice pest. Additionally, the presence of carbohydrates in the snail meat may have implications for its nutritional value and potential uses in the food industry.

KEYWORDS

Biological activities, golden apple snail, Pomaceacanaliculata, phytochemicals analysis, phytochemicals compounds.

INTRODUCTION

The golden apple snail's history as a rice pest in Indonesia is similar to that of other countries. Originally introduced as aquarium fauna in Yogyakarta in 1981, it wasn't until roughly 1985-1987 that this species quickly expanded and acquired popularity throughout Indonesia (Sulistiono, 2007). By 1990, two opposing viewpoints on the significance of the golden snail had arisen. One viewpoint saw it as a rice pest, while the other saw it as a desirable export commodity. Nonetheless, observations of golden snails remained prevalent on the Java and Sumatra islands (Suharto, 2003).

When the golden snail becomes a problem, information on its ecological traits, biology, and control techniques is frequently sparse. This leads to arbitrary pesticide selection and application, resulting in environmental degradation and public health dangers, particularly for farmers who confront a variety of health issues. Multiple control measures, including biological, cultural, and chemical approaches, have been developed to address this issue. However, knowledge regarding the biological and ecological aspects of the golden snail, particularly *P. canaliculata*, is scarce. Developing an efficient control approach requires a thorough study of the biological properties of this species (Teo, 2004).

Phytochemical compounds are biologically active substances and secondary metabolites found in plants that do not serve as nutrients but fulfill various roles such as providing color, and flavor, and acting as means of self-defense (poisons). These compounds can be classified into three main groups: phenolic components, glucosinolates, and carotenoids. Additionally, phytochemicals encompass other components like plant sterol derivatives (phytosterols) and sulphur-containing compounds found in onions.In the past, phytochemical compounds, particularly flavonoids, were primarily used for plant taxonomic identification. However, current knowledge reveals that many phenolic compounds, including lignans, tannins, isoflavonoids, flavonoids, vitamin E, and curcumin, exhibit significant biological activities with potential antiviral, antitumor, and anticancer properties (Lien and Ren, 2000). These findings demonstrate the diverse and valuable contributions of phytochemicals to human health and well-being.

In this study, two treatments were selected: raw snail meat and boiled snail meat. Boiling the golden snail is a common method used by people in Indonesia, particularly in West Java and Central Java, before consumption. The processing of fresh raw materials at high temperatures can significantly impact the physical and chemical changes in the meat, consequently influencing the characteristics of the final product. High-temperature processing methods have the potential to enhance product quality and prolong its shelf life. The various physical changes and chemical reactions induced by the heating process can also significantly affect sensory attributes, including color, texture, and flavor (Lewis & Jun, 2011). However, their specific effect on the physicochemical characteristics of the golden snail requires further research and investigation.The main objective of this study was to investigate the characteristics of *Pomaceacanaliculata* by conducting a series of phytochemical analysis on samples of both raw (fresh) golden snails and golden snails that underwent boiling. The purpose of this analysis is to identify and comprehend the diverse phytochemical properties present in the golden snail samples, as these components are associated with numerous potential biological activities.

MATERIALS AND METHOD

This study was carried out in Cikarawang, Bogor, where samples of golden snails were collected. The research employed various materials and equipment, such as adult-sized golden apple snails, plastic bags, aquariums, buckets, cutting boards, knives, pots, stoves, ovens, ceramic cups, test tubes, glass funnels, desiccators, mortars, pipettes, and digital scales, along with various chemicals essential for conducting the analysis.

Fresh golden snail samples were collected by extracting live snails from their natural habitat, followed by thorough rinsing under running water. The next step involved separating the snail meat from the shell, which was facilitated by breaking the tip of the shell to extract the meat and feces more easily. Subsequently, the weight of the golden snail meat was measured for further analysis. In contrast, boiled golden snail samples were obtained from live snails as well. These snails were rinsed under running water and then boiled until fully cooked. After boiling, the golden snail meat was extracted using a wire to ensure the separation of meat from shells, while preventing any shell fragments or debris from being carried along. The meat was then washed and weighed to be used in the subsequent analysis.Phytochemicals analysis was conducted on the two samples to investigate their alkaloid content, steroid content, Flavonoid content,phenol hydroquinone content, saponin content, and carbohydrates by Molisch test (Sudarmadji*et al.*, 2006; Widjanarko, 2008)

RESULTS AND DISCUSSION

The golden snail treatment comprised two categories: fresh snail meat and boiled meat. Both treatments underwent a series of phytochemicals analysis, and the findings for each analysis are presented in Tables 1.

Table 1. Phytochemicals analysis results for fresh and boiled golden apple snail

Analysis	Fresh Meat	Boiled Meat
Alkaloids	negative	negative
Steroids	negative	negative
Flavonoids	negative	negative
Saponins	negative	negative
Phenol hydroquinone	negative	negative
Molisch test	positive	positive

Alkaloids

The test results for the alkaloid content in both raw and boiled golden snail meat yielded negative results, as indicated by the absence of a precipitate after the addition of Dragendorff reagent. This implies that alkaloid compounds, such as coniine, strychnine, atropine, solanian, and others, are not present in the snail.Alkaloids constitute the largest group of secondary plant substances and are often known for their toxicity to humans. Many alkaloids possess significant physiological activities, making them valuable in medicine. Their exact function in plants remains largely unclear, although they have been implicated as growth regulators, insect repellants, and attractants. These compounds are mostly in crystalline form, with only a small fraction being liquid at room temperature. Identifying an alkaloid from a new source is challenging, as the type of alkaloid in a specific source cannot be easily predicted. Additionally, due to the wide variation in solubility and other properties of alkaloids, general screening methods for alkaloids in plant samples may not always detect specific compounds (Harborne, 1987).Furthermore, some alkaloids exhibit antimicrobial properties. For instance, alkaloids extracted from *Prosopis juliflora* were tested for their antimicrobial activity against 40 different microorganisms, including 31 bacteria types, 2 Candida types, 5 skin fungi types, and 2 viruses. Their activity was compared with benzyl penicillin, gentamicin, and trimethoprim (Naidu, 2000).

Steroids

The phytochemical testing results of both raw and boiled golden snail meat for steroid content turned out negative. In the presence of steroids, the red solution would change to blue and green upon the addition of an acid solution. However, this color change did not occur with the golden snail meat, indicating the absence of steroids in the sample.Steroids are classified under the triterpenoid group, with a carbon skeleton derived from six isoprene units. Some compounds in this group, like limonin found in citrus fruits, are known for their bitter taste. Steroids are triterpenes characterized by a cyclopentane perhydro phenanthrene ring system. Initially, sterols/steroids were thought to be exclusive to animal compounds, functioning as sex hormones and bile acids. However, it has been discovered that many of these compounds also exist in plant tissues and are referred to as phytosterols. Phytosterols have a different chemical structure compared to animal sterols, but interestingly, animal sterols have also been found in plant tissues, as seen in the insect moulting hormone, ecdysone, which is abundant in ferns (Harborne, 1987).

Flavonoids

The phytochemical test for flavonoids in the golden snail meat yielded negative results, as no red, yellow, or orange colors formed when the sample and solution were shaken. Therefore, it can be concluded that the tested golden snail does not contain flavonoids.Flavonoids constitute the largest group within the phenol group. All flavonoids are derivatives of the main flavone compound, which is found in the form of white flour in the Primula plant, and they share several common properties. Flavonoids are primarily water-soluble compounds and are phenolic in nature, as they change color when exposed to a base. In plants, flavonoids are usually found as a mixture, and it is rare to find only a single flavonoid in plant tissue. Apart from the main flavonoid groups, there are also minor flavonoid groups such as isoflavones, chalcones, aurones, flavonones, and others. However, these groups have a limited distribution and are specific to certain plants (Harborne, 1987).Certain flavonoids possess antimicrobial activity. For instance, the flavonoid extract from *Uvariachamae* has been shown to inhibit the growth of *Staphylococcus aureus, Bacillus subtilis,* and *Mycobacterium smegmatis*, with its activity comparable to the synthetic antibiotic streptomycin sulphate. Honey also contains two significant antimicrobial phytochemical groups, namely flavonoids and phenolic acids (Naidu, 2000).

Saponins

The saponin test conducted on both raw and boiled golden snail meat yielded negative results, as no foam was formed for 30 minutes after the addition of 1 drop of 2 N HCl, indicating the absence of saponins in the golden snail.Saponins are part of the triterpenoid group, and they are triterpene and sterol glycosides that have been identified in more than 90 plant families. These surface-active compounds function similarly to soap and can be detected based on their ability to form foam and haemolyze blood. In the laboratory, saponins can be converted to animal sterols with significant properties, such as cortisone and contraceptive estrogens. Additionally, saponins have the potential to cause poisoning in livestock (Harborne, 1987).

Saponin extracts from several plants have exhibited antimicrobial activity. For instance, Camellia sinensis tea leaf extract is known to have inhibitory effects against the pathogenic skin fungus *Microsporumaudouinii* and can also play a role in inhibiting enzymes involved in inflammatory reactions (Naidu, 2000).Upon ingestion, saponins interact with the membrane of the digestive tract, especially with the small intestine wall, due to their ability to bind to sterol membranes. The aglycone hydrophobic group in the saponin molecule penetrates the lipid bilayer, causing the lipid membrane to leak and increase cell permeability, ultimately affecting absorption (Oleszek, 2000).

Phenol hydroquinone

The test results for phenol hydroquinone content in both raw and boiled golden snail meat were negative, as no color change was observed in the sample solution after the addition of ethanol and $FeCl_3$. The absence of a green or blue-green color indicates that the golden snail meat tested did not contain phenol hydroquinone.Phenol compounds encompass a wide variety of compounds derived from plants and share a common characteristic of having an aromatic ring with one or two hydroxyl substitutes. These compounds typically dissolve easily in water and are often bound to sugars as glycosides, present within cell vacuoles. The exception is hydroquinone, which is a water-free (relative) phenolic compound and is rarely found in plants.Phenols and their derivatives, such as benzoic acid, caffeic acid, catechins, catechols, rutin, vanillic acid, eugenol, and others, serve as natural antimicrobials, contribute to a distinctive taste, and have been utilized for centuries as natural food preservatives (Bidlack and Wang, 2000).

Molisch Test

The Molisch test is a qualitative method used to detect the presence of carbohydrates in various ingredients. In the case of golden snail meat, both treatments showed positive results, indicated by the formation of a purple complex between the two liquid layers. However, the purple ring appeared somewhat less distinct and seemed to merge with the acid layer on top, while the boundary with the bottom layer was very clear. Nevertheless, the presence of the purple ring was clearly visible. This slight discrepancy in the clarity of the ring might have resulted from a procedural error, such as improper dripping of the sulfuric acid, or it could be due to the relatively low carbohydrate content in the golden snail samples, which were found to be 2.876% and 4.43%.

The underlying principle of the Molisch test lies in the hydrolysis of carbohydrates by concentrated acid into monosaccharides, which are subsequently dehydrated by sulfuric acid to form furfural or hydroxymethylfurfural. The latter compounds then condense with alpha-naphthol to produce a purple complex. When sulfuric acid is carefully added to a carbohydrate solution containing alpha-naphthol through the glass wall, a purple ring appears at the boundary between the carbohydrate solution and the sulfuric acid, confirming the presence of carbohydrates in the sample (Sudarmadji*et al*., 1996; Winarno, 2008).

Conclusion

In conclusion, this study investigated the phytochemical properties of *Pomaceacanaliculata* (golden apple snail) by analyzing samples of both raw and boiled snail meat. The results of the phytochemical analysis showed that both raw and boiled snail meat did not contain alkaloids, steroids, flavonoids, saponins, and phenol hydroquinone. However, the Molisch test revealed the presence of carbohydrates in both samples. These findings provide valuable insights into the chemical composition of golden snails and their potential biological activities.The absence of toxic alkaloids, steroids, saponins, and phenol hydroquinone in golden snail meat is reassuring, as these compounds can pose health risks and environmental concerns. Additionally, the detection of carbohydrates in both raw and boiled snail meat indicates their significance as a potential source of energy and nutrition.Further research can explore other aspects of the golden apple snail's biology and interactions with its environment. Investigating its impact on rice crops and its potential as a beneficial export commodity can provide a comprehensive understanding of this species' role in Indonesia's agricultural landscape.

References

Bidlack, W.R. and Wang, W. (2000). Designing Functional Foods to Enhance Health in Phytochemicals as Bioactive Agents (Eds. W.R. Bidlack, S.T. Omaye, M.S. Televisin and D.K.W. Topham). CRC Press LLC. Florida, p.241-270

Harborne, J.B. (1987). Phytochemical Methods, Guide to modern ways of analyzing plants (Translator: K. Padamawinata, I. Soediro, Ed. S. Niksolihin). ITB Publisher. Bandung. 354 pp.

Heldman, D.R. and Hartel, R.W. (1998). Principles of Food Processing. Aspen Publishers, Inc. Gaithersburg, Maryland. 285 pp

Lewis, M. J., and Jun, S. (2011). ThermalProcessing. *Food ProcessingHandbook: 2nd Edition*, *1*, 31–75

Lien, E.J. and Ren, S. (2000). QSAR and Molecular Modelling of Bioactive Phyto-phenolics *In: Phytochemicals as Bioactive Agents* (Eds. W.R. Bidlack, S.T. Omaye, M.S. Meskin dan D.K.W. Topham). CRC Press LLC. Florida, p.21-41.

Naidu, A.S. (2000). Phytoantimicrobial (PAM) Agents as Multifunctional Food Additives *di dalam Phytochemicals as Bioactive Agents* (Eds. W.R. Bidlack, S.T. Omaye, M.S. Meskin dan D.K.W. Topham). CRC Press LLC. Florida, p.105-130

Oleszek, W.A. (2000). Alfalfa Saponins: Chemistry and Application *In: Phytochemicals as Bioactive Agents* (Eds. W.R. Bidlack, S.T. Omaye, M.S. Meskinand D.K.W. Topham). CRC Press LLC. Florida, p.167-188.

Sudarmadji, S., Haryono, B. Suhardi. (1996). Analysis of Food and Agriculture. Liberty Publishers. Yogyakarta. 172 pp

Sulistiono. (2007). Golden Apple Snail "The Slow" Rice Destroyer. Nusaku.com articles downloaded from http://www.nusaku.com/forum/archive/index.php/t-5340.html

Suharto, H. (2003). Golden Apple Snail, *Pomaceacanaliculata*(Lamarck) in Indonesia. *Research Institute for Rice Report.*Sukamandi, Subang, Indonesia.

Teo, S.S. (2004). Biology of the golden apple snail, *Pomaceacanaliculata*(Lamarck, 1822), with emphasis on responses to certain environmental conditions in Sabah, Malaysia. *Malacological Society of Australasia, Molluscan Research*, 24, 139-148.

Widjanarko. (2008). Passion Fruit Herbs Phytochemistry, downloaded from http://simonbwidjanarko.files.wordpress.com/2008/07/fitokimia-herba-konyal.pdf, on January 20, 2018.

Winarno, F.G. (2008). Food Chemistry and Nutrition. M-Brio Press. Bogor. 286 pp.