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BIOCHEMICAL COMPOSITION OF *PILA GLOBOSA* (SWAINSON: GASTROPOD) IN ACTIVE AND AESTIVATION PERIODS

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ABSTRACT: This research looks at the biochemical makeup of the edible gastropod *Pila globosa*, which is found in freshwater. One of Bangladesh's largest beels, Chalan Beel, is where this investigation was conducted for analyze the nutritional value of this snail. In freshwater snails, seasonal variations in biochemical composition, including protein, fat, and ash, have been observed during two distinct periods: the Active period and the Aestivation period. On body meat, this analysis was conducted. The Micro-Kjeldahl distillation method was used to evaluate the protein content. There were no seasonal variations in the body's edible water content. Significant seasonal fluctuations were seen in other edible portion components, though. It was discovered that throughout both the active and aestivation periods, the edible portions had a high protein proportion. The range of the calorific value (including ash) was 7.83 to 11.98%. Seasonal variations were seen in the edible body part's fat and carbohydrate composition. It was discovered that throughout both the active and aestivation periods, the edible portions had a high protein proportion which can help to alleviate nutrient deficiencies.

Key words: Aestivation, Bio-chemical, Mineral, Nutrition, *Pila globosa*

INTRODUCTION

In the modern era, the rural hinterland and big metropolises are "bridging" due to the population growth of small- to medium-sized cities and rural towns (FAO, 2017). Along this rural-urban continuum, changing demographic agglomeration patterns are causing agri-food systems to change (Cattaneo *et a*l., 2022). To ensure that everyone has access to reasonably priced, wholesome food, this offers both opportunities and obstacles. Asia's population is projected to fall by 540 million from 2.3 billion to 1.8 billion in rural areas and increase by 83% from 1.9 billion to 3.5 billion in urban areas (UN DESA 2022). To get low feed conversion ratios and intensify farming systems without employing fewer farm

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workers, we must boost the production of nutrient-rich food without endangering the environment, escalating greenhouse gas emissions, or requiring more water.

Meyer-Rochow (1975) was the first to propose using non-conventional (alternative) foods, such as edible insects, to alleviate the world's food shortages and to include both the FAO and WHO (Meyer-Rochow 1975). The current interest in entomophagy results from the idea's gradual acceptance. Although algae have garnered some interest as a food source in recent decades (Hashemian *et al.*, 2019), the agriculture sector has paid very little attention to snails as a potential means of expanding the range of food items accessible. Mollusks are classified as gastropods, found in both water and land. Naturally, not every wild species is edible. *Helix aspersa* and *Helix pomatia* are the land snail species that are most commonly consumed. Eaten in many Asian countries, Ampullariidae is a family of freshwater snails widely known as apple snails (*Pila globosa*). Most 85% of snails are taken from nature, with snail-breeding units accounting for 15% of the total (Van Huis, 2013).

Snails are significant, flavorful, and nutritionally beneficial as human food. They have a solid nutritional value, with a high calcium and protein contents. This paper's primary goal is to calculate the pace at which nutritional values fluctuate in response to seasonal variations.

MATERIAL AND METHODS

Samples were taken from the Natore district in Bangladesh's Rajshahi division's Chalan Beel. The sample of active period was collected in the month of September, 2022 and the sample of aestivation period was collected in the month of April,2023 after a heavy rain. The gathered samples were brought to the Institute of Environmental Science laboratory of University of Rajshahi.

Processing of samples: Samples of collected snails were cleaned of grit and other surface debris using potable water. The shell was taken out and thoroughly cleaned under running water to avoid microbial contamination. The samples were pulverised into powder using a domestic blender after being dried for 75 hours at 70 degree in an air dryer oven. We evaluated the amounts of moisture, protein, ash, and lipids using the AOAC techniques.

Estimation of proximate Composition: Established protocols determined the approximate composition of snail powder, including its protein, fat, moisture, ash, and carbohydrate content. The micro-Kjeldahl distillation method evaluated the protein content of goods manufactured from snail powder. Following petroleum ether extraction, the lipid content of powdered goods was determined using Soxhlet equipment. A moisture analyzer (MAC 50/NH) was used to

determine the moisture content, whereas the following method was used to compute the ash content. This method was applied to calculate the proportion of carbs.

Fig.1. Sample collected area

Estimation of Minerals: The mineral content of powdered goods such as calcium, potassium, and sodium was determined using recognized methods. APHA utilized atomic absorption spectrometers (ELICO, SL 194 Model) to measure potassium and sodium concentrations. Calcium was measured using a flame technique.

RESULT AND DISCUSSION

There is a 65.8 to 89.2% range in the moisture content and fresh weight basis of edible snail species. Snails' meat is generally more susceptible to microbial infection due to its high moisture content (Meyer-Rochow 2019). Consequently, drying snails before further processing may help extend their shelf life. *P.globosa's* g/100g biochemical composition—which includes ash, moisture, fat, and carbs—is evaluated. The nutritional values for moisture, protein, fat, ash, and carbohydrates were obtained via proximate compositional analysis of dried snail powder with seasonal change, as shown in Fig. 2.

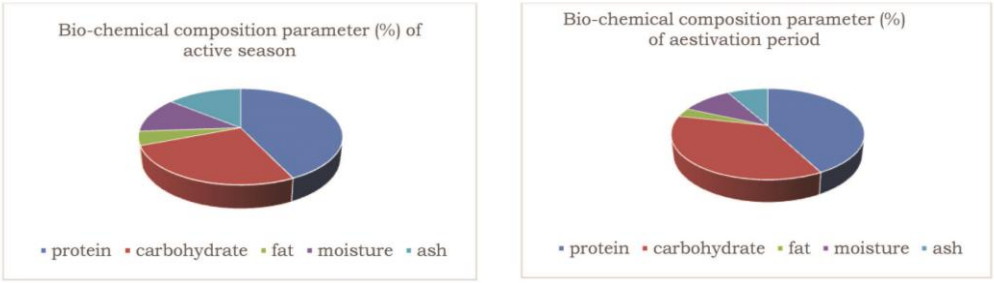

Fig. 2. Nutritional composition of *P. globosa* meat powder.

Protein content: According to our dry-weight protein analysis, the protein content of the snail meat was found to be 40.87% for the estimation phase and 42.88% for the active time (Figure 2). The building blocks of life are proteins. The human body is made up of protein in every cell. An amino acid chain makes up the basic building blocks of proteins. Proteins aid in both cell division and repair. Protein is also crucial to a child's, adolescent's, and pregnant woman's growth and development. The Food and Drug Administration's Dietary Guidelines for Americans notes that Healthy adults' daily recommended protein intake is between 10% and 35% of their total caloric demands (Knobel, 2020). A gram of protein has four calories in it. Thus, consuming 100 grams of protein, or 400 calories, would provide 20% of an individual's daily caloric intake on a 2000-calorie diet. The protein content of snail flesh is substantial during both stages of their life cycle.

Carbohydrate: Our examination of carbohydrates revealed 26.27% and 35.03% (Figure 2). Energy production is one of the primary uses of carbohydrates. When no carbs are available, the body can use the amino acids in muscle to make glucose, which powers the brain during a starving episode. In this case, consuming some carbohydrates can stop the breakdown of muscle. This explains why snail flesh during the aestivation period has fewer carbohydrates than during the active period.

Lipid: Dietary fats are necessary for cell function and energy production in the body. They also aid in maintaining body temperature and organ protection. The body produces vital hormones and absorbs certain nutrients from fats. In this present study, fat research revealed 4.70% and 3.10% fat, likewise less than the active time.

Moisture: Moisture is equally essential to all living systems' basic components of life. It is, therefore, a vital bodily part of aquatic creatures. It prolongs the shelf life of dried goods by lowering water activity, which prevents bacteria from accessing the water (Nowsad, 2007)). In the current investigation,

the moisture content of dry snail flesh was found to be 11.98% and 9.80%, respectively (Fig. 2).

Ash: Ash content represents the inorganic residue after completely burning and oxidizing organic matter. Because they consume a wide range of foods, including dirt, snails may cause the study's comparatively high ash value. The results of this work were 14.17% and 7.83%, respectively. Ash, determining food samples is one of the proximate analyses required for nutritional evaluation, and ensuring that no hazardous minerals are present guarantees food safety.

Mineral composition in dried snail meat: Snails are meat with excellent nutritional content, and they are eaten all around the world. Their antioxidant and anti-inflammatory properties make them anti-cancer and immune-boosting. Mineral ratios are often more critical in identifying nutritional excesses and deficiencies because they can indicate hidden or future metabolic dysfunction (Nargis *et al.*,1970).

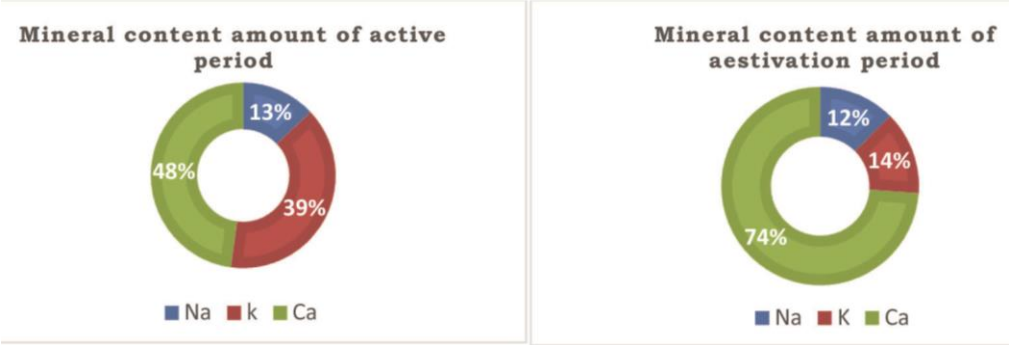

Fig. 3. Mineral composition of *P. globosa* meat powder (mg/100g).

Large in size, calcium is difficult for the stomach to break down. The amount of calcium indicated on a food product's Nutrition Facts label is the amount in the food, not always the amount the body will absorb. "Calcium bioavailability" refers to the amount the body absorbs and uses. The bioavailability of calcium varies among foods. It is essential for blood coagulation, excretion, neuromuscular functioning, and several enzyme-mediated processes. Inadequate calcium consumption might impede healthy growth and cause osteoporosis symptoms in older people, particularly in postmenopausal women (Liu *et al.*, 2020). The mineral assay of dried *Pila globosa* snail meat revealed a calcium content of 48% and 74%, respectively. It is reasonable to anticipate physiological benefits from edible snails' high potassium and low salt contents. Low potassium intake is frequently linked to several physiological conditions,

such as hypertension, renal, and respiratory issues. 13% and 12% sodium and 39% and 14% potassium were identified in our investigation (Fig. 3). Compared to the active phase, the amount of potassium, sodium is lower, and calcium is higher during the aestivation period.

Comparing Nutrition of snail meat Fresh weight basis and Dry weight basis: Even now, many species of snails are regularly eaten by people in many different communities worldwide. Snails are typically prepared by boiling, smoking, or incorporating them into curries. A well-known snail dish in France is escargots in butter with garlic and parsley; other snail dishes that are worth trying are the freshwater snails from Gaeng-Kui-Hoi-Khom in red curry from Thailand; the river snail curry from Tharoi Thongba in Manipur, India; the stir-fried snails and BúnỐc from Vietnam; the Lumachealla Romana from Rome, Italy; Cargols from Spain; the stewed snail from Portugal; and the pan-fried snail dish called Kohlibourbouristi from Greece (Baghele *et al.*, 2022). Fresh meat weight was collected from another research work (Baby *et al.*, 2010).

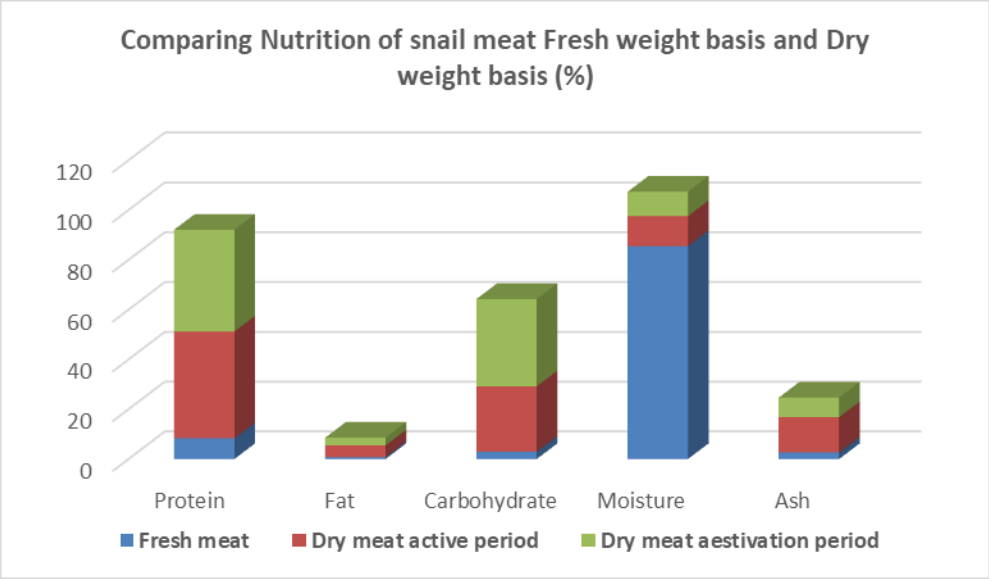

Fig. 4. Comparing Nutrition value of snail meat Fresh weight basis and Dry weight basis.

Concerns about safety: While there is little doubt that eating edible snails is nutritionally better than traditional diets derived from animals, safety concerns must be carefully considered before using snails. One significant concern is the buildup of heavy metals in freshwater snails. We tested heavy metals in our investigation. Manganese 25.65 mg/kg and chromium 6.26 mg/kg were found.

CONCLUSION

The results of this study indicate that dried snail meat has more nutritional value than fresh meat. Dry snail flesh powder is rich in calcium, necessary for human survival, and has a low fat and high protein content. Powdered snail meat may be a vital supply of protein and minerals for nutritional security. Consuming more snail meat can help alleviate nutrient deficiencies and improve the economic standing of some localities where suitable snails can be raised and traded.

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