

Journal of Coastal Life Medicine

journal homepage: www.jclmm.com



Original article

doi: 10.12980/jclm.4.2016J5-199

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Comparative studies on biochemical analysis of some economically important marine gastropods along Gulf of Mannar region, southeast coast of India

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ARTICLE INFO

Article history:

Received 12 Oct 2015

Received in revised form 26 Oct, 2nd revised form 5 Nov, 3rd revised form 7 Nov 2015

Accepted 5 Apr 2016

Available online 15 Jun 2016

Keywords:

Biochemical composition
Nine gastropods
Bycatch
Trawl net
Gulf of Mannar

ABSTRACT

Objective: To signify the economic importance of molluscan-gastropod food by estimating its biochemical composition.

Methods: Samples were collected from the trawl net bycatch at the fish landing center of Mandapam coast of the Gulf of Mannar region. The total protein, carbohydrate, lipid, ash and moisture contents were estimated from nine gastropods i.e. *Phalium glaucum*, *Tonna dolium*, *Hemifusus pugilinus*, *Babylonia spirata*, *Xancus pyrum*, *Chicoreus ramosus*, *Harpa articularis*, *Ficus ficus* and *Babylonia zeylanica*.

Results: The percentages of protein (41.2%), carbohydrate (17.5%) and lipid (6.6%) contents were found highest in *Babylonia spirata*, followed by other gastropods. The maximum ash content was observed in *Chicoreus ramosus* (1.21%) and the maximum moisture content was observed in *Phalium glaucum* (83.71%).

Conclusions: The results show that all the nine gastropods contain good sources of protein and other biochemical constituents and can be used for edible purposes to prevent starvation.

1. Introduction

Molluscs are the second largest invertebrate group which represents about 12% of the world's production and it is only next to insects which comprise about 3340 species out of which gastropods consist of 2449 species[1]. There are about 484 species of molluscs recorded from the Gulf of Mannar region and out of these 260 are gastropods. The gastropods are the largest class of the phylum Mollusk[2]. They comprise a major fishery resource and are commercially important around the world. The

awareness on the biochemical composition of edible organisms is important[3]. Any species is recommended for consumption only by assessing nutrient values[4]. The protein-rich food is indispensable for people today. Seafoods are rich in proteins and are used dramatically. In developing countries, the demand for protein-rich food is dramatically increasing and it arouses the searching of unexploited resources. Marine molluscs are such food important for marine ecology and human diet since it possesses important nutrients[5]. The protein is a vital substance and is considered as the largest quantity of all nutrients as a component of the livingbeing. Generally in animal tissues, the ratio of carbohydrate was less as compared with other nutrients like protein and lipid, particularly in aquatic organisms[6]. Lipids are the main source of metabolic energy and it plays a vital role in the formation of cell and tissue membranes[7]. Some gastropods like whelk's meats are exported to Europe, Japan, China and Korea, as they are considered as delicacy[8]. However,

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Foundation Project: Supported by UGC for BSR fellowship (Grant No. 02.09.2013/4-1/2008 (BSR)/Dt 24.11.2009).

The journal implements double-blind peer review practiced by specially invited international editorial board members.

some are not utilized even though they have high proteins. Since in the past whelks such as *Babylonia spirata* (*B. spirata*), sacred chank, *i.e.* *Xancus pyrum* (*X. pyrum*), limpets and trochids were used for edible purposes by poor people in the coastal areas of Gulf of Mannar region when fish is not available. Though some species of gastropods are consumed throughout the Mandapam coast as food by local fishermen, many species are remaining unexploited and the resources of gastropods should be utilized to prevent the global communities from malnutrition. So the present study intends to analyze the biochemical content of nine gastropods from the Gulf of Mannar region, southeast coast of India.

2. Materials and methods

2.1. Sampling and preprocessing

Gastropods were collected from trawl net bycatch at the fish landing center of Mandapam coast of the Gulf of Mannar region. The organisms were identified by standard keys provided by Adoni[9] and were washed to remove impurities and dusts by using distilled water and the outer shells were carefully removed and dissected out and dried in hot air oven at 40 °C for 48 h. The dried material was powdered, sieved and used for further analysis in triplicate to analyze the total protein, carbohydrate, lipid, ash and moisture contents.

2.2. Estimation of biochemical parameters

The protein contents in the body tissues of gastropods were estimated by the Folin-Ciocalteu phenol method[10]. The carbohydrate content was estimated using the procedure of phenol-sulfuric acid method[11]. The lipid was estimated using chloroform-methanol mixture[12]. The water content was estimated by subtracting the dry weight from the known wet weight of the sample[13]. Ash content was estimated by powdering 1 g of tissue in porcelain crucible and kept in a muffle furnace at 60 °C for 4 h and weighed[14].

3. Results

The studies about biochemical composition of the seafood organisms are necessary to prevent malnutrition problems. In the present study, nine economically important marine gastropods, namely, *Phalium glaucum* (*P. glaucum*), *Tonna dolium* (*T. dolium*), *Hemifusus pugilinus* (*H. pugilinus*), *B. spirata*, *X. pyrum*, *Chicoreus ramosus* (*C. ramosus*), *Harpa articularis* (*H. articularis*), *Ficus ficus* (*F. ficus*) and *Babylonia zeylonica* (*B. zeylanica*), were used for the estimation of protein, carbohydrate,

lipid, ash and moisture contents. They were commonly found in the Mandapam coast of Gulf of Mannar region.

3.1. Percentage of total protein

Protein is the indispensable component of life desired for the existence and it was expressed in percentage from the following organisms *B. spirata* (41.2%), *B. zeylanica* (40.8%), *H. pugilinus* (38.9%), *C. ramosus* (37.3%), *X. pyrum* (37.2%), *H. articularis* (35.2%), *P. glaucum* (35.1%), *T. dolium* (33.6%), *F. ficus* (31.2%). Maximum protein content was observed in *B. spirata* and the minimum was observed in *F. ficus*.

3.2. Percentage of total carbohydrate

The carbohydrate contents were estimated for the nine gastropods and the values were found as *B. spirata* (17.5%), *H. pugilinus* (16.9%), *B. zeylanica* (16.6%), *C. ramosus* (15.2%), *X. pyrum* (14.5%), *H. articularis* (14.3%), *P. glaucum* (14.2%), *F. ficus* (13.5%) and *T. dolium* (12.3%). The maximum carbohydrate content was observed in *B. spirata* and the minimum was observed in *T. dolium*.

3.3. Percentage of total lipid

Lipids are major sources of metabolic energy and essential compounds for the formation of cell and tissue membranes. The lipid contents were estimated and the values were found as *B. spirata* (6.6%), *B. zeylanica* (6.1%), *H. articularis* (4.7%), *X. pyrum* (4.3%), *P. glaucum* (3.9%), *F. ficus* (2.2%), *C. ramosus* (2.0%), *T. dolium* (1.9%) and *H. pugilinus* (1.1%). The maximum lipid content was observed in *B. spirata* and the minimum was observed in *H. pugilinus*.

3.4. Percentage of total ash

The ash content was estimated and expressed in percentage and the values were found as *C. ramosus* (1.20%), *B. zeylanica* (1.19%), *H. pugilinus* (1.10%), *P. glaucum* (0.98%), *F. ficus* (0.93%), *X. pyrum* (0.88%), *B. spirata* (0.85%), *T. dolium* (0.82%) and *H. articularis* (0.81%). The maximum ash content was observed in *C. ramosus* and the minimum amount was observed in *H. articularis*.

3.5. Percentage of total moisture

The moisture content was observed in the nine gastropods and the obtained values were *P. glaucum* (83.7%), *X. pyrum* (81.2%), *B. spirata* (80.0%), *B. zeylanica* (78.1%), *H. articularis* (72.0%),

H. pugilinus (71.3%), *F. ficus* (67.1%), *C. ramosus* (65.4%) and *T. dolium* (60.15%). The maximum moisture content was observed in *P. glaucum* and the minimum was observed in *T. dolium*.

4. Discussion

Seafoods are important constituents of the human diet. Nowadays, the protein deficiency increases in developing countries. It has stimulated the exploration of non-traditional resources[15]. The utilisation of edible gastropods is limited and restricted to poor coastal people, though snail meat is delicious and nutrient. The limited utilization is mainly due to the conservative food habits of mankind and the lack of knowledge about the nutritive value of the mollusks, particularly gastropods[16]. The analysis of biochemical constituents in organisms was useful in grading their consumption as food. It could be told from this study that all the nine gastropods possessed good quantity of protein, carbohydrate, lipid, ash and moisture. Among the constituents, protein was found to be highest followed by carbohydrate and lipid. The values of protein of the present study ranged from 31.2% to 41.2%. Giese[17] found that mollusks' protein was the dominant organic constituent in the whole body composition and it was evidently consistent with the present study. According to Kunusaki[18], the protein content varies from animal to animal and in our present study all the nine gastropods show variations in the protein contents and other biochemical constituents. Nirmal[19] observed the highest value of protein content (68.31%) in body tissue of male *B. zeylonica* whereas in female samples (69.75%). According to Kamalkanth *et al.*[20], the percentage of protein in the tissue of *Thais mutabilis* was 53.86% and its meat was valuable food with high quality of protein. Sekar[21] studied the proximate composition of *H. pugilinus* and revealed that protein and lipid contents were high. Hence, *H. pugilinus* was the potential source for nutritive value and it is strongly recommended for human consumption.

The carbohydrate of the present study ranged from 12.3% to 17.5%. The result was high when compared with the previous study reported by Suryanarayanan and Nair[22] analyzed in *Turbo bruneus* (1.1%–9.2% in males and 1.5%–9.2% in females). Babu *et al.*[6] reported that the carbohydrate level was 3.4%–7.7% in *Bursa spinosa*. Geise[17] observed that lipid acts as a reserve material and is utilized during stress situation. Ansari[23] reported that the lipids have little role throughout the seasonal cycle. In *Turbo brunneus*, the lipid value is higher in ovary with a maximum value of 4.85% and in testis 4.20%. According to McLachlan and Lombard[24], the lipid values ranged from 3.90% to 7.40% in various size groups of *Turbo sarmaticus*. In the present study, the lipid values ranged from 1.1% to 6.6%. The gastropods had higher water content than the bivalves and the variation was not significant between the

species of the same genus or between sexes[25]. Giese observed that the moisture content of *Unio terminalis* was 80.36% and *Patomida littoralis* was 81.69%[17]. In the present study, the maximum moisture content was observed in *P. glaucum* (83.7%) followed by other gastropods. Margret *et al.*[14] observed that the ash content of gastropods was very less which is about 1.18% in *B. zeylonica* followed by other gastropods. In our present study, the maximum ash content was observed in *C. ramosus* (1.20%). From the result, *B. spirata* showed the maximum values of protein, carbohydrate and lipid when compared with other gastropods, which differed from the previous study by Margret[14] who showed that the nutritive value of *B. zeylonica* was more when compared with other gastropods. According to Khalua *et al.*[26], protein, carbohydrate and lipid were the maximum during pre-monsoon period than monsoon and post-monsoon periods. So, further studies are needed to know the variation during monsoon period. Many mollusks have been considered as edible food according to Srilatha *et al.*[27], and the study clearly indicates that *Meretrix casta* is an important part of a balanced diet and contributes to a good nutritional status. Subavathy *et al.*[28] reported the preparation of soup, curry and cutlet from the foot and mantle of *Fusinus nicobaricus* provides the way to use marine resources. According to Anand *et al.*[29], *P. trapezium* meat acts as the food source that can be utilized like other seafoods. Several studies reported that marine mollusks reserve biochemical energy in the reproductive or somatic tissue for use when needed[30]. The malnutrition problem in our country can be overcome by effective utilization of nutrient-rich mollusc seafoods. In India, 20%–30% of the population does not get adequate nutrition. Proper exploitation of aquatic through capture and culture fisheries will supply the balanced nutritious food and malnutrition can be controlled. A balanced diet should provide around 60%–70% of total calories from carbohydrates, preferable starch, about 10%–12% from protein and 20%–25% from fat.

Since ancient times, the finfish and shellfish have been important sources of animal proteins for mankind all over the world. So the food source should be properly used for the well being of people. In the present study, all the nine gastropods possess high values of protein and other biochemical constituents and hence they are recommended for human consumption to prevent starvation.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

We thank UGC for BSR fellowship for financial support (Grant No. 02.09.2013/4-1/2008 (BSR)/Dt 24.11.2009) and DST PURSE for the consumable support for completing the study.

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