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Biochemical and nutritional evaluation of mangrove clam *Anadontia edentula* from Pattuvam and Kattampally, Kerala, India

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Abstract

Nutritional evaluation of the mangrove clam *Anadontia edentula* collected from Kattampally, Valapattan River, Pattuvam, Kuppam River, in Kannur, Kerala is presented in the paper. Average length of mangrove clam ranged from 5-10 cm and an average weight ranged from 34-250g. The wet weight of the meat content ranged from 10.8 g to 53.5g. Proximate composition study revealed that moisture content of mangrove clam was 85%; Protein content was 11.16%; Fat content was 8.01%; ash content was 5.09%. Fatty acid profiling revealed 17 amino acids. Total amino acid content was 8.71g/100g in raw mangrove clam. Meat of mangrove clam is very hard and pressure cooking is tried by locals to consume the meat. Battered and breaded products like nuggets were prepared using clam meat and sensory evaluation revealed that all attributes were acceptable. Considerable amount of protein, fat and amino acids in the meat and better sensory attributes revealed that mangrove clam can be a source of raw material for value addition.

Keywords: Biochemical, *Anadontia edentula*, Pattuvam, Kattampally, Kerala, India, nutritional

Introduction

Clams and other bivalves are good source of protein among the riparian communities, especially in the South-East Asian countries. Their collection, marketing and utilisation is a source of livelihood and a considerable number of women are engaged in the collection, processing and marketing. Man-made issues like sand mining, pollution and conversion of beaches and mangrove areas are threats reported for destruction of clam beds. Difficulty in cleaning and processing due to smaller size is a reason for less consumer preference compared to other seafoods.

Mangrove clam, *Anadontia edentula* is a bivalve distributed in Indo-Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia and Hawaii, and from southern Australia to northern Japan (Palomares and Pauly, 2025) ^[4]. The mangrove clam *A. edentula* is highly prized in the Philippines for its flavour and large size (Primavera *et al*, 2002) ^[5].

Mangrove clams are collected and consumed after boiling, removing the shell, and preparing curry. Meat is very hard and it needs to be pressure-cooked, unlike other clams, for the preparation of the curry and that may be the reason for the lack of interest in the collection and utilization of the species. There is limited literature available on occurrence, collection and utilization of this species (Rathul *et al*, 2023) ^[7]. Furthermore, proximate composition, storage and utilization in India are entirely absent (Rathul, 2022) ^[6]. Hence, the present study assumes considerable significance for the species.

Materials and Methods

The study on mangrove clam *A. edentula* was conducted from mangrove forests of Kannur, extending from Kattampally to Pattuvam of Kerala with the help of local fisherfolk during low tide in the post-monsoon season during the year 2021-2022.

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To compare and evaluate the nutritional and organoleptic characters of mangrove clam, samples of black clam (*Villorita cyprinoides*) was collected from local markets and selected as the control. Then the shells were open, meat was scooped out using a small shucking knife. The weight of the meat content was also measured to know the wet weight and yield in the field. The moisture content was determined by the oven drying method and the fat content of the moisture-free sample is determined by extracting the fat with a suitable solvent (AOAC, 2012) [2]. Ash content, total nitrogen and amino acid was analyzed according to the standard method described by AOAC (2005) [1]. Organoleptic evaluation of sausage was done by a group of panellists' who were asked to evaluate the

product by giving scores for appearance, colour, taste, texture, odour, and overall acceptability of the samples fried in refined vegetable oil based on 9-point descriptive scale (ranges from 1 for low to 9 for high).

Results and Discussion

Proximate composition of mangrove clam is given in Table 1, which shows that the moisture content is 85%, followed by protein content of 10%, Fat at 5%, and Ash at 5%. A recent report on food composition per 100g edible portion of mangrove clam was estimated as Water (g) 82.3, Protein (g) 6.8, Fat (g) 0.8, and Ash (g) 2.8.



Fig 1: Opened clam shell of *A. edentula* (Mangrove clam)

Table 1: Proximate composition of the mangrove clam

No	Composition	%
1	Moisture\%	85.28
2	Fat\%	8.01
3	Ash\%	5.09
4	Protein\%	11.16

The proximate composition of products displays slight variations across their compositions depending on species. The ash and moisture content after deep and flash frying of common clam nuggets was comparatively higher than

mangrove clam nuggets, whereas the protein content was higher in mangrove clam's nugget than in the control product. Similarly, the fat content was significantly higher in the control product.

Table 2: Proximate composition of nuggets of two species of clams

	Common clam		Mangrove clam	
Moisture\%	Deep fry	Flash fry	Deep fry	Flash fry
Protein\%	25.4346	41.6848	16.4159	39.2438
Fat\%	17.875	8.125	20.637	15.037
Ash\%	64.6926	44.8057	29.2872	41.4231
	2.0519	2.0843	1.4576	1.1235

The amino acid total is 8.71 in raw mangrove clam. The total amino acid present in products A and B is almost similar with

a minute change that product A is 15.27 and product, B is 15.76.

Table 3: Amino acid per 100g sample of raw mangrove clam as well as product A (Black clam) and product B (Mangrove clam).

Amino acid	Clam Raw	Product A	Product B
Aspartic acid	0.85	1.48	1.50
Glutamic acid	1.71	3.26	3.71
Serine	0.42	0.76	0.78
Histidine	0.16	0.39	0.35
Glycine	0.53	0.77	0.87
Threonine	0.37	0.69	0.60

Arginine	0.73	1.11	1.34
Alanine	1.05	0.84	0.98
Tyrosine	0.27	0.52	0.53
Cystine	0.02	0.06	0.05
Valine	0.51	0.94	0.90
Methionine	0.04	0.17	0.13
Phenylalanine	0.24	0.58	0.50
Isoleucine	0.43	0.78	0.76
Leucine	0.70	1.34	1.37
Lysine	0.66	0.84	0.80
Proline	0.04	0.72	0.60
Total	8.71	15.27	15.76

Table 4: Fatty acids of raw clam, along with product A (Black clam) and product B (Mangrove clam).

Fatty Acid	Beaker	Beaker + Fat	Fat	Milligram
Clam raw	7.2087	7.2159	0.0072	7.2
Fried product A	7.0421	7.2415	0.1998	199.8
Fried product B	7.7291	7.9304	0.2013	201.3

Table 5: Percentage of fatty acid to total fatty acid of sample and products.

SL	Fatty Acid		Raw clam	Clam A	Clam B
1	C4:0		0.129	0.169	-
2	C6:0	Caproic	0.078	-	-
3	C8:0	Caprylic	0.218	-	-
4	C10:0	Capric	-	-	-
5	C11:0	Undecanoic	-	-	-
6	C12:0	Lauric	-	-	-
7	C13:0	Tridecanoic	-	-	-
8	C14:0	Myristic	2.476	0.182	-
9	C14:1	Myristoleic	-	-	-
10	C15:0	Pentadecanoic	0.475	-	-
11	C15:1	Cis-10-Pentadecanoic	0.585	-	-
12	C16:0	Palmitic	20.191	8.007	7.397
13	C16:1	Palmitoleic	5.093	0.251	-
14	C17:0	Heptadecanoic	2.215	-	-
15	C17:1	cis-10-Heptadecanoic	1.057	-	-
16	C18:0	Stearic	4.709	3.479	3.402
17	C18:1 trans 9	Elaidic	0.091	-	-
18	C18:1 cis 9	Oleic	10.156	27.991	28.352
19	C18:2 trans 9,12	Linolelaidic	-	-	-
20	C18:2 cis 9,12	Linoleic	2.742	55.836	57.331
21	C20:0	Arachidic	0.917	-	-
22	C18:3 cis 6,9,12 gamma	Linolenic	0.109	-	-
23	C20:1 cis 11	cis-11-Eicosenoic	3.737	0.136	0.179
24	C18:3 cis 6,9,12,15 alpha	Linolenic	0.121	-	-
25	C21:0	Henicosanoic	-	-	-
26	C20:2 cis 11,14	cis-11,14-Eicosadienoic	0.723	0.386	-
27	C22:0	Behenic	0.242	0.713	0.801
28	C20:3 cis 8,11,14	Eicosatrienoic	0.182	-	-
29	C22:1 cis 13	Erucic	0.175	0.091	-
30	C20:3 cis 11,14,17	Eicosatrienoic	-	-	-
31	C20:4 cis 5,8,11,14	Arachidonic	2.376	-	-
32	C23:0	Tricosanoic	-	-	-
33	C22:2 cis 13,16	Docosadienoic	-	-	-
34	C24:0	Lignoceric	0.068	-	-
35	C20:5 cis 5,8,11,14,17 EPA	Eicosapentanoic	2.455	0.158	0.27
36	C24:1 cis 15	Nervonic	-	-	-
37	C22:6 cis 4,7,10,13,16,19 DHA	Docosahexanoic	6.876	0.358	0.163

Sensory evaluation of Clam products: Sensory assessment is one of the best methods for quality control which does not require any expensive chemicals and testing equipment, more over the sense of sight, smell, touch, and taste can be used for

analysis. The result will be a combination of multiple unbiased opinions from a trained panel of individuals who critically analyzed the product using their senses.

Table 6: Results of sensory evaluation (scale of 1 to 9; 1 for bad and 9 for good) of nuggets (A-Appearance, C-Colour, O-Odour, T-Taste, F-Flavour, Te-Texture, OA-Overall acceptability)

Person	Clam A (Black clam)							Clam B (Mangrove clam)						
	A	C	O	T	F	Te	OA	A	C	O	T	F	Te	OA
1	8	8	8	8	8	8	7	8	8	8	9	8	7	8
2	7	7	7	7	6	7	7	7	8	7	8	8	7	7
3	8	8	8	7	6	7	7	8	8	8	7	7	7	7
4	7.5	7	8	7	7	7.5	7.5	8	7.5	8	8.5	8	7	8
5	8	8.5	8	7.5	8	8	7.5	8	8.5	8	8.5	8.5	7.5	8
6	9	8	8	8	8	8	8	9	8	8	8	8	7	7.5
7	9	8.5	8	8.5	8.5	8.5	8.5	8	8.5	8	8	8	8	8
8	8.5	8.5	8	8	8.5	8.5	8.5	8.5	8.5	8	8	8	8	8.2

The present study provides the detailed biochemical and nutritional evaluation of the mangrove clam *Anadontia edentula* collected from selected mangrove ecosystems of Kerala, India. The study reveals that the species contains appreciable levels of protein (11.16%), fat (8.01%), essential amino acids, when processed into value-added products. These results highlight the nutritional potential of *A. edentula* as a seafood resource that remained unknown due to its tough texture and limited consumer familiarity. Though having high potential many clams such as the Asian hard clam is not popular for consumption in Thailand, owing to a high amount of mucus and a tough texture (Karnjanapratum, *et al*, 2013) [3].

Biochemical composition and nutritional evaluation of common clams are reported but similar data with respect to *A. edentula* is not available as the availability of the latter is restricted to certain pockets. The results of proximate composition, amino acid profile, fatty acid content, and sensory quality shows scope for future investigations for value addition and product development. Mangrove clam meat can be successfully incorporated into battered and breaded products with high consumer acceptability; this study shows its relevance in the seafood industry as per the present study.

Relevance transcends nutrition since clam fisheries contribute significantly to food security and livelihood, particularly in riparian and coastal communities in Southeast Asia, Africa, and the Pacific. Most women and poor groups are directly involved in the collection and processing of clams, and encouraging the utilization of *A. edentula* can boost income opportunities. In addition, sustainable use of mangrove clams is consistent with world priorities for diversification of protein sources, minimizing reliance on overfished finfish stocks, and supporting ecosystem-based fisheries management.

The geographical scope of this study is global. *A. edentula* occurs naturally in the Indo-Pacific region, ranging from East Africa and the Red Sea to Polynesia, Australia, and Japan. This global distribution, coupled with rising global demand for nutritious, affordable, and sustainable seafood, makes the mangrove clam a resource with extensive global potential. Outside of food uses, marine bivalves are increasingly being seen as sources of bioactive substances with antioxidant, antimicrobial, and anti-inflammatory activity. These compounds are of interest for use in nutraceuticals,

pharmaceuticals, and cosmetics (e.g., skin well-being, aging, cardiovascular supplements). While this paper did not directly evaluate these activities in *A. edentula*, the biochemical diversity documented here identifies promising directions for further studies on its medical and cosmetic uses.

Conclusion

Overall, this study confirms *A. edentula* as not merely a healthy and palatable food source but also an ecologically and biotechnologically significant species with vast socio-economic implications. Its importance in nutrition, livelihoods, and sustainable fisheries underscores its value in securing global food supplies, while its untapped potential for use in health and beauty industries enhances the opportunities for scientific and commercial ingenuity. Extended research and development of this clam can go a long way in ensuring food security, nutritional diversification, and sustainable resource use globally.

Conflict of Interest

There is no conflict of interest

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