Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Spl Issue [3] 2022: 350-353

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

REVIEW ARTICLE **OPEN ACCESS**

Impact of Freezing on the Nutritive Content of *Penaeus indicus*in Thoothukudi Coastal Region of Tamil Nadu, India

P.Subavathy[1*] and A.Arockia Jenecius Alphonse[2]
[1*] PG and Research Department of Zoology, St.Mary's College (Autonomous), Thoothukudi– 628001, Tamilnadu, India
[2] PG and Research Department of Botany, St.Mary's College (Autonomous), Thoothukudi– 628001, Tamilnadu, India
Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli – 627012, Tamilnadu, India
Corresponding Author Email: subavathy.p89@gmail.com

ABSTRACT
Shrimps are an extremely good source of protein, making them a healthy choice of food. They are low in fat and calories. Minerals are an important part of shrimp nutrition. Freezing is a phase transition where a liquid turns into a solid. The present study was carried out to investigate the impact of the freezing process on the nutritive content of the flesh of white shrimp (Penaeus indicus) in the Thoothukudi coastal region of Tanil Nadu. The biochemical analysis of the flesh was done periodically (7, 14, 21,28 and 35 days) according to the standard procedures of Association of Official Analytical Chemists (AOAC) methods. In the fresh shrimp, calcium (121.3 mg/100g), potassium (45.7 mg/100g), magnesium (10.11 mg/100g), sodium (55.3 mg/100g) and iron (3.42 mg/100g) contents were recorded. Changes in moisture, ash, protein, carbohydrate, lipid and minerals values were decreased as the storage days increased. The level of ash, moisture, protein, carbohydrate and lipid was found to be 0.5%, 29.8%, 13.9%, 8.2% and 2% after 35 days of frozen shrimp. The nutritional values exhibited a low variation in the flesh content on continuous freezing of even 35 days. Thus, indeed, consumption of fresh shrimp should be preferred compared to frozen shrimp on the basis of biochemical components.
Keywords: Biochemical Composition, Carbohydrate, Lipid, Minerals, Protein, White Shrimp

Received 11.08.2022 Revised 21.09.2022 Accepted 03.12.2022

INTRODUCTION

Shrimps are one of the most important types of *seafood* that are consumed worldwide. There are many inorganic elements in the body of shrimp associated with vital physiological functions. It also provides good quality proteins, vitamins A and D for humans and animals. It also contains various dietary minerals such as Ca, Fe, and others [1]. It is also believed that the freezing process plays a key role in causing functional and vital changes in the protein. The change in some properties of the meat upon freezing depends on the events of changes in the susceptibility of the protein. The changes in the specific qualities of the meat was observed that the freeze has a direct effect on the enzymes and protein degradation [2].

Freezing is a prevalent procedure in the meat, fish, and other animal protein-based industries. It preserves quality for a more extended period and provides various benefits such as minimal changes in product dimensions and colour, flavour, and texture [3]. Beroumand and Jooyandeh [4] reported that the types of packaging, maintenance of proper storage temperature and freezing properties of different species are important on the quality of fish. This means that fish should be stored for a short period to retain the taste and to maintain both the protein and fat at the optimal level.

The highest shrimp quality is maintained by freezing immediately after being harvested. There are many commercial methods for freezing shrimp. Although freezing is an effective method of preserving foods, some deterioration in frozen food quality occurs during storage. Nakazawa and Okazaki [5] have reported that the meat of fish and shellfish exhibits a higher moisture content than livestock meat, and the proteins, lipids, and tissue structures are highly unstable, leading to substantial-quality changes during freezing and thawing.

The present work was undertaken to determine the variation in the biochemical components like moisture, ash, protein, carbohydrate, lipid and mineral contents based on freezing in commercially important species of white shrimp *Penaeus indicus*.

MATERIAL AND METHODS

Collection of samples:

The white shrimps *P. indicus* were collected from the Thoothukudi coast, Gulf of Mannar (lat 8°35' - 9°25' N and long 78°08' - 79°30'E) coastal region. The flesh of the shrimp was washed with deionized water to remove any adhering contamination, drained under folds of filter paper and then brought to the laboratory. A few samples were used for biochemical analysis of moisture, ash, protein, carbohydrate, lipid and mineral contents. The remaining washed shrimps were wrapped in aluminum foil and frozen at -4°C for 7 days. The analysis was done periodically at an interval of 7, 14, 21,28 and 35 days as per the standard procedures.

Preparation of samples:

The edible part flesh, which represented the parts consumed by the local population, was cut into small pieces and minced. For lipids analyses, fresh edible part was used immediately. For proteins, ash and mineral analyses, the samples (edible part) were dried in an oven (Blinder, 14D-78532) at 45°C for 48 h. They were homogenized thoroughly in a food blender with stainless steels cutters.

Determination of biochemical composition:

The percentage of moisture content in the white shrimp was determined using the hot air oven by drying the sample at 105°C ± 2°C until a constant weight was obtained. Ash content was determined by muffle furnace at 550°C for 20 h.Crude protein content was determined by converting the nitrogen content obtained by Kjeldahl's method after acid digestion using a Kjeldahl system (Nx6.25) [6, 7 and 8]. 2 g (W) of the sample was taken into the digestion tube, 5 g catalyst (K_2SO_4: $CuSO_4.5H_2O$ = 9:1) was added and then 15 ml of concentrated sulfuric acid was added, and poured into the digester (380°C) until a clear solution was obtained. Carbohydrate was estimated following the slightly modified method of [9] using anthrone reagent. A known weight of the tissue was homogenized with 2ml of 10% Trichloroacetic acid (TCA) and 8ml of distilled water. The homogenate was centrifuged at 3000 rpm for 10min. The supernatant was collected and measured. One ml of the supernatant was taken in a clean test tube. To this 4ml of anthrone reagent was added and mixed well. The test tube containing the mixture was kept at room temperature. The developed colour was read at 620nm against a standard reagent blank in a UV-VIS Spectrophotometer-118 model.

Total lipid was determined by Bligh and Dyer method using chloroform/methanol (1/1, v/v) Bligh and Dyer [10]. Crude lipid content was measured by 3 g sample in 105°C oven for at least 6 hours and then extracted the lipid with ether in a Soxhlet extractor for 6 hours. After extraction, the fat cup was put into the 105°C oven until constant weight to remove moisture and then cooled down in the desiccator and recorded the extract weight. Some important minerals (Ca, K, Mg, Na) and trace mineral (Fe) were analyzed in the flesh part of white shrimp. For mineral analysis accurately weighted ash samples were treated with nitric acid (HNO_3), $HClO_4$ and deionized water [11]. The mineral content of the digested samples was determined by Flame atomic absorption spectrophotometry using a BUCK Scientific 200 A apparatus for Ca, K, Mg, Na and Fe as cited in Anderson and Ingram[6]; Benton [12].

RESULTS AND DISCUSSION

The proximate composition of the flesh of white shrimp *P. indicus* is presented in Fig 1. The results showed a continuous decrease in the level of ash, moisture, protein, carbohydrate and lipid in frozen shrimp for 7, 14, 21, 28 and 35 days. The level of ash, moisture, protein, carbohydrate and lipid was found to be 0.5%, 29.8%, 13.9%, 8.2% and 2% after 35 days of frozen shrimp.

Hazim Ali Hussein et al.[13] estimated the effect of freezing on chemical composition and nutritional value in meat and concluded that decrease in moisture continued from the continuous storage period in buffalo, cow, sheep, and chicken meat, respectively, reducing the level of fat by increasing the storage period even for 4 months. The low humidity in frozen meat can also be caused by the rupture of frozen meat cell tissue due to the formation of large ice crystals, leading to the release of a portion of the cytosol after dissolving.

In the current study, results showed the level of protein varied continuously after freezing. The protein value in frozen shrimp after 7, 14, 21, 28 and 35 days were 23, 20, 17, 15 and 13.9%, respectively, due to the fractionation of protein during the storage period. Flesh of the fresh shrimp showed the amount of 25%. Aberoumand [14] observed thatthe most susceptible fish to protein loss during frozen storage was fish Sparidae (13.02% - 12.74%) respectively, while the fish *Liza dussmieri* was the least susceptible (10.13% - 10.06 %). The present study correlates that in case of white shrimp (*Penaeus indicus*) also, loss of nutrient quality is susceptible during freezing.

The level of carbohydrate was observed to be 18% and it was minimized after 7,14,21,28,35 days of continuous freezing to 8.2%. The lipid content was found to be 3.74% in the flesh of fresh shrimp and after 7,14,21,28,35 days of freezing showed the decrease in the level of lipid. The Prawn has great

importance as food. It is valuable in the diet, because of good quality proteins and vitamins, it also contains several dietary minerals such as calcium, iron etc, which are beneficial to human and other organisms. The mineral composition of the flesh of white shrimp *P. indicus* is depicted in Fig 2.
Bereket Abraha et al.[15] explored the effect of processing methods on nutritional and physico-chemical composition of fish.The freshness largely determines consumer approval of fish products, and there is substantial evidence that freezing is the most effective approach for preserving fish quality. Furthermore, freezing temperatures can alter protein denaturation during long periods of storage, albeit initial freezing at -20°C did not affect the degree of denaturation of myofibrillar proteins in minced mackerel in studies related storage temperature [16, 17 and 18]. However, the decrease in ash, moisture, protein, carbohydrate, lipid and mineral levels (Ca, K, Mg, Na and Fe) of the shrimp changed due to freezing.

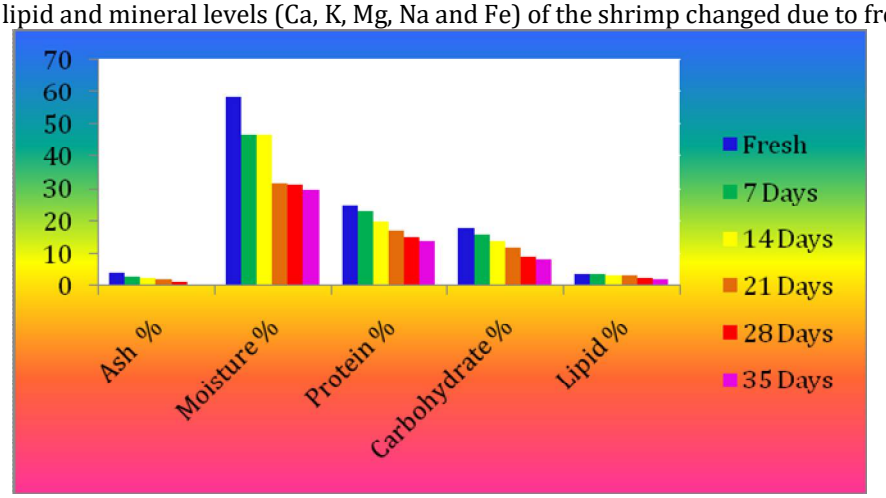

Fig. 1: Biochemical composition in the flesh of fresh and frozen white shrimp

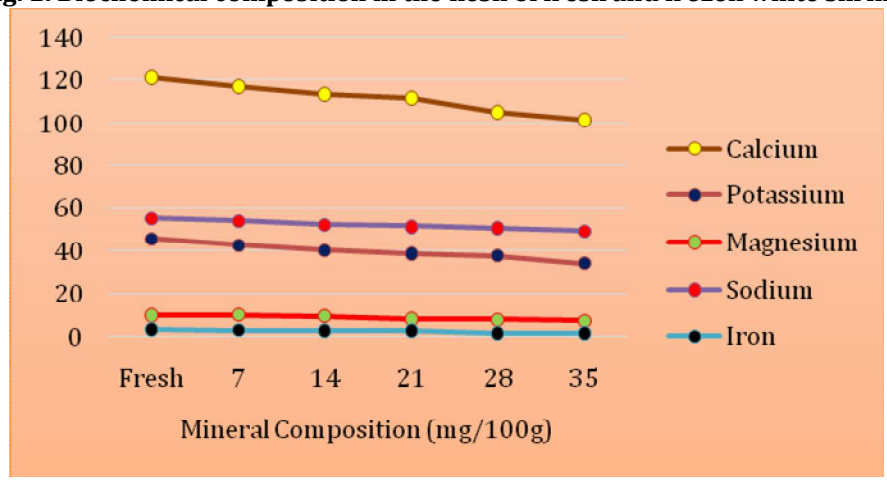

Fig. 2: Mineral composition in the flesh of fresh and frozen white shrimp

CONCLUSION

The present study showed that freshly collected shrimp consisted of the proximal composition of 3.86%, 58.3%, 25%, 18%, 3.74%. But after 7,14,21,28,35 days it started to decrease. Thus research into different freezing methods is needed to preserve quality of the shrimp to the seafood industry.
It was concluded that though the shrimp can be consumed after freezing, but should be consumed as early as possible as quality remains better in the earlier stage.

ACKNOWLEDGEMENT

The authors acknowledge the financial assistance (102/IFD/SAN/5071/2018-2019) funded by the Department of Biotechnology, Government of India, New Delhi under the STAR college scheme for the successful completion of this work.

CONFLICT OF INTEREST

The authors declare no conflict of interest

REFERENCES

1. Ravichandran, S., Rameshkumar, G. & Rosario Prince, A. (2009). Biochemical Composition of Shell and Flesh of the Indian White Shrimp *Penaeus indicus* (H.milne Edwards 1837). *American-Eurasian Journal of Science and Research*., 4 (3), 191-194.
2. Willenberg, B.J. (2013). Freezing Basics. Columbia: University of Miossouri-Columbia. *Food Science and Human Nutrition*. p. 1501.
3. Obuz, E. & Dikeman M.E. (2003). Effect of cooking beef muscle from frozen or thawed states on cooking traits palatability. *Meat Science*, 65:993-997.
4. Beroumand, A.A. & Jooyandeh, H. (2010). Storage quality and chemical and structural changes of fresh and frozen-Thawed Fish. *World Journal of Fish and Marine Science*, 2(3), 251-253.
5. Nakazawa, N & Okazaki, E. (2020). Recent research on factors infuencing the quality of frozen seafood. *Fisheries Science*, 86, 231–244. https://doi.org/10.1007/s12562-020-01402-8.
6. Anderson, J.M. & Ingram J.S.I. (1993). Tropical Soil Biology and Fertility: A Handbook of Methods. CAB International, The Cambrian News, Aberstwyth, United Kingdom.
7. AOAC (1984). Official Methods of Analysis of the Association of the Official Analysis Chemists. Association of Official Analytical Chemists, AOAC International, Washington, DC.
8. Buondonno, A., Rashad, A.A. & Coppola, E. (1995). Comparing tests for soil fertility II. The hydrogen peroxide/sulfuric acid treatment as and alternative to the copper/selenium catalyzed digestion process for routine determination of soil nitrogen-kjeldahl. *Commun.Soil Sci. Plant Anal*., 6 (9–10), 1607–1619.
9. Seifter, S.S., Dayton, B., Novic & Mantwyler, E. (1950). The estimation of glycogen with anthrone reagent. *Arch. of Biochem. and Biophy*., 25, 190 – 220.
10. Bligh, E.G. & Dyer W.J. (1959). A rapid method of total lipid extraction and purification, *Can. J. Biochem. Physiol*., 37, 911–917.
11. Pauwels, J.M., Van Ranst, E. Verloo, M & Mvondo, Z.A. (1992). Manuel de laboratoire de pédologie. Publications Agricoles 28, AGCD, Brussels.
12. Benton, J.J.Jr. (1990). Case, Sampling, handling and analyzing plant tissue samples. Soil Testing and Plant Analysis, SSSA Book Series No.3.
13. Hazim Ali Hussein, Mohammed Noori Salman, Ali M. Jawad. (2020). Effect of freezing on chemical composition and nutritional value in meat. *Drug Inv. Today*,13 (2), 329-333.
14. Aberoumand, A. (2013). Impact of freezing on nutritional composition of some less known selected fresh fishes in Iran. *Int. Food Res. J*., 20(1), 347-350.
15. Bereket Abraha., Habtamu Admassu., Abdu Mahmud., Negasi Tsighe., Xia Wen Shui & Yang Fang. (2018). Effect of processing methods on nutritional and physico-chemical composition of fish. ***Curr. Res. Nutr. Food Sci.*** *MOJ Food Proc. & Technol*., 6(4), 376-382. DOI: 10.15406/mojfpt.2018.06.00191.
16. Lakshmisha, I.P., Ravishankar, C.N., Ninan, G., Mohan, C.O. & Gopal, T.K.S. (2008). Effect of freezing time on the quality of Indian mackerel (*Rastrelliger kanagurta*) during frozen storage. *J. Food Sci*., 73(7), S345-53. DOI: 10.1111/j.1750-3841.2008.00876.x.
17. Standal, I.B., Mozuraityte, R., Rustad, T., Alinasabhematabadi, L., Carlsson, N.G. & Undeland, I. (2018). Quality of filleted Atlantic mackerel (*Scomber scombrus*) during chilled and frozen storage: changes in lipids, vitamin D, proteins, and small metabolites, including biogenic amines. *J. Aqua. Food Prod. Technol*., 27: 338–357. DOI: https://doi.org/10.1080/10498850.2018.1436107.
18. Ninan, G., Bindu, J. & Joseph, J. (2008). Frozen storage studies of value-added minced-based products developed from tilapia (*Oreochromis mossambicus*, Peter 1852). *Fish Technol*., 45(1), 35-42. https://doi.org/10.1111/j.1745-4549.2009.00379.x.

CITATION OF THIS ARTICLE

P.Subavathy* and A.Arockia Jenecius Alphonse. Impact of Freezing on the Nutritive Content of *Penaeus indicus*in Thoothukudi Coastal Region of Tamil Nadu, India. Bull. Env. Pharmacol. Life Sci., Vol Spl Issue [3] 2022: 350-353