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Research Article

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Chemical composition, shelf-life studies and popularization on *Pleuroploca trapezium* meat pickle

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ABSTRACT

Seafood has been a popular food item and the main source of animal protein around the globe from time immemorial. The economic growth leads to the extensive demand of "ready-to-cook" or ready-to-serve products, which results in the development of 'convenience' products to meet out the need of the people. The diversified products using vegetables, egg, meat and few seafood are having good consumer perception and are now adopted by many entrepreneurs. Keeping this in mind, the underutilized gastropod meat of marine gastropod Pleuroplca trapezium was used for the preparation of few value - added products and shelf life was assessed for the proper utilization of the resource. P. trapezium meat pickles were prepared and organic acids such as Acetic, Lactic and citric acids were added individually as preservative and their storage life was analyzed. Along with that, a control pickle was kept without any preservative. The shelf life of the pickle with lactic acid was high with 6 months than that of other pickles.

Keywords: Marine mollusk, Entrepreneurship, Microbial analysis

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INTRODUCTION

Pickling is an ancient form of food preservation and there are historical evidences to suggest it was followed by the ancient Indians, Egyptians and Chinese. Pickled products are considered a delicacy and have a long shelf life. Currently, pickled fish and prawn are produced using organic acids as pickling agents along with spices. Pickling protects the food and also helps to retain its wholesomeness and nutritive value for a long time. At present there is an expanding market potential for pickles in countries where Asians live [1]. Pickles are mostly packed in glass bottles due to their rigidity, inertness, non-toxicity, durability, compatibility and indigenous availability. The glass packaging imparts long shelf life to pickle due to its inertness and impermeability to moisture and gases [2]. A number of molluscan species such as clams [3, 4], green mussel [1, 5], blood clams [6] and the gastropods *Chicoreus ramosus* [7,8] and *Babylonia spirata* Prem Anand *et al*., 2014; Patterson and Ayyakkannu, 1997 [9,10] have been used for the preparation of pickles. Pickle made from clam and mussel meat is already marketed to some extent on a commercial scale [11].

The Horse Conch, *Pleuroploca trapezium* though consumed in South East Asian countries is not familiar seafood in India, and till today, very little work has been done to utilize this gastropod as food. Pickling has been found to be a comparatively cheaper method of preservation and so production of ready to serve pickled products from gastropods appears to be the best method for its economic utilization. Thus different pickled products were prepared out of *P. trapezium* meat and their storage life was analyzed.

EXPERIMENTAL SECTION

Processing of Raw Meat

The cleaned meat was softened by cooking under pressure at 15 lbs / sq. inch for 20 minutes. The softened meat was used for the preparation of pickle using the ingredients listed in Table 1.

Method of Preparation

Commercially available spices, food grade organic acids and other materials (Table 1) were purchased locally. Glass bottle (500g capacity) with plastic screw caps were sterilized in boiling water for 30 minutes and dried at 100^{o} C in a hot air oven. The pickles were prepared in four batches with the same ingredients except for the organic acids. The first batch was prepared by adding 1.5 % Acetic acid, second batch using 1.5 % lactic acid, third batch with 1.5 % citric acid and the last batch without the addition of any acid and kept as control.

Table 1. Ingredients for *Plueuroploca trapezium* pickle

S.No	Ingredients	Quantity (grams)
1	Cooked meat	1000
2	Garlic	500
3	Ginger	200
4	Chilli powder	100
5	Coriander powder	100
6	Mustard seeds	20
7	Turmeric powder	10
8	Asafoetidea	20
9	Gingili oil	100
10	1.5 % Organic acid	200ml
11	Salt	To taste

The softened meat was thoroughly mixed in a mixture of 4g of turmeric powder, 20g of salt and 40g of chilly powder and kept for 30 minutes. Ginger and garlic were fried in oil until it became golden brown in colour and removed from the fire. Then the meat was fried in gingili oil until it turns into golden brown and cooled. In another big pan, mustard seeds were fried in gingili oil until bursting and all the other ingredients were heated under low flame. The fried meat, ginger and garlic were added to this and stirred thoroughly for 10 minutes. The content was cooled sufficiently and divided into four batches and 200 ml of the respective organic acids were added to each batch and mixed thoroughly.

Packaging of Pickle for storage

The gastropod pickle was then packed in the sterilized glass bottles, covered with caps, sealed and stored at ambient temperature (30±2^{o}C). While packing care was taken not to trap any air bubbles inside the content and before sealing, a layer of heated gingerly oil was ensured at the top to cover the solids to act as an air seal protection against entry of moulds and bacteria from air.

Shelf life studies

The biochemical analysis and shelf life studies were carried out following the methods given in AOAC.

RESULTS

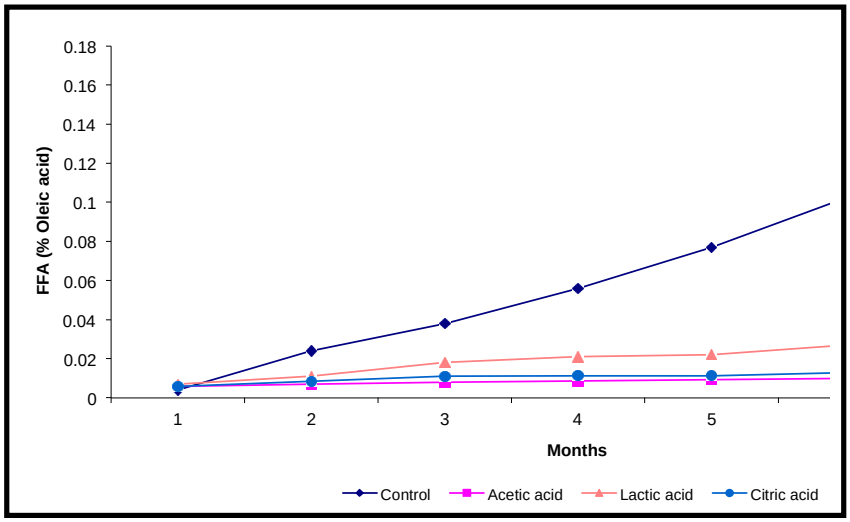
The pickles looked like the other seafood pickles and had good flavour and taste. The protein and lipid content of the pickle without organic acids were 25.3 and 16.9 % respectively. The changes in pH of *Pleuroploca* meat pickle during storage are presented in Table 2. The pH increased in the control pickle from 5.5 to 5.72 and in the pickles containing acetic acid, lactic acid and citric acid there was reduction in the pH values from 5.49 to 5.25, 5.11 and 5.27 respectively.

The changes in Free Fatty Acid (FFA) during storage of pickles prepared with different organic acids are presented in Fig. 1. FFA content (% Oleic acid) was low and it steadily increased during storage in all the samples. In the control sample it increased from 0.004 to 0.162 after 6 months of storage at ambient temperature. In the treated samples, the increase was 0.012 and 0.014 in pickles with acetic acid and citric acid respectively from the initial value of 0.0057. In the pickle with lactic acid, the increase was high and it was 0.0068 to 0.035 after 6 months of storage.

Table.2. Changes in pH of *Pleuroploca* meat pickles

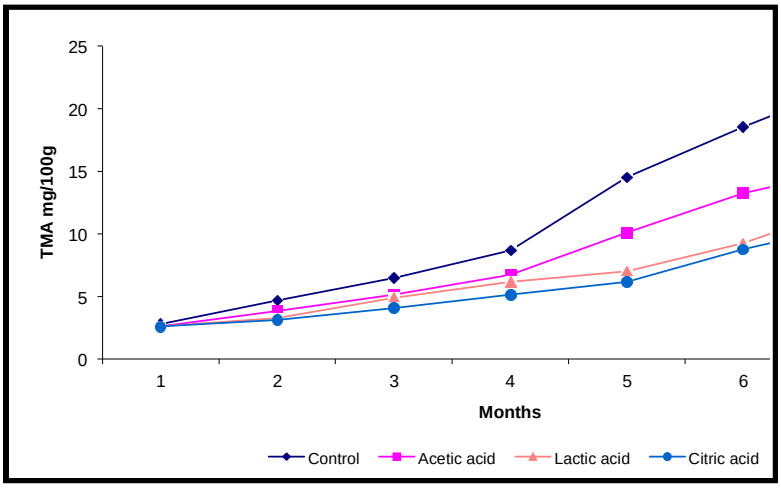
Storage (Months)	Control	Acetic acid	Lactic acid	Citric acid
In	5.5	5.49	5.49	5.49
1	5.54	5.42	5.35	5.48
2	5.6	5.33	5.21	5.48
3	5.63	5.31	5.19	5.43
4	5.66	5.3	5.17	5.38
5	5.69	5.28	5.14	5.32
6	5.72	2.25	5.11	3.27

Fig. 1. FFA content in Pleuroplaca meat pickle during storage



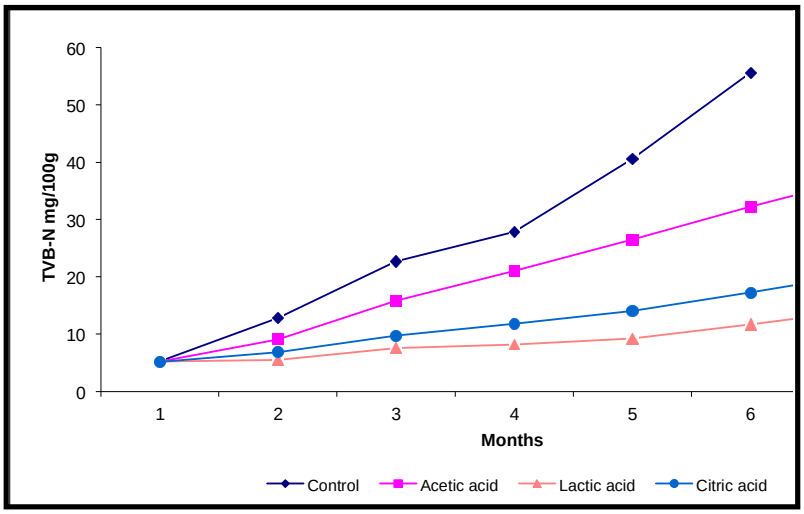
The TMA-N content in the control sample the TMA-N content increased from 2.8 to 22.25 after 6 months of storage whereas in organic acid treated pickles the increase was comparatively lower than that of the control (Fig. 2).

Fig. 2: TMA-N content in Plueroplaca meat pickle during storage



The TVB-N analysis of pickle at different stages at room temperature is presented in Fig. 3. TVB-N values were found to increase steadily during the 6 months of storage. In the control samples, the value increased from 5.3 to 55.64 after 6 months of storage. In acetic acid and lactic acid treated pickles the TVB-N content increased from 5.2 to 37.57 and 14.32 respectively after 6 months of storage, whereas in citric acid treated pickle the increase was from 5.15 to 20.67 mg / 100g.

Fig. 3. TVB-N content in Plueroplaca pickle during storage



The Total Plate Count in the control pickle decreased slightly during the first month but in the subsequent months it gradually increased and after 6 months of storage it reached from 97×10^3 to 57×10^4 CFU/g. In the pickles containing acetic acid and lactic acid, the TPC decreased from 95×10^3 to 60×10^3 and 45×10^3 to 19×10^2 CFU/g respectively in the first two months and then increased to 42×10^4 and 38×10^4 CFU/g after six months of storage. The TPC showed an increasing trend in the pickle containing citric acid and the increase was from 70×10^2 to 66×10^3 after six months of storage. Mold growth was observed in control pickles after four months of storage (Table. 3). The pathogenic bacteria such as *E.coli*, *Salmonella* and *Vibrio sp*. were not observed during processing and storing of the pickles.

Table 3. Total Plate Counts in *Pleuroploca* meat pickle

Parameter	Storage Period (Months)	Control	Acetic acid	Lactic acid	Citric acid
Total Plate Count (CFU/g)	Initial	97×10^3	95×10^3	45×10^3	70×10^2
	1	85×10^3	78×10^3	36×10^3	41×10^3
	2	130×10^3	60×10^3	19×10^2	50×10^3
	3	148×10^3	117×10^3	41×10^3	47×10^3
	4	32×10^4	126×10^3	58×10^3	51×10^3
	5	49×10^4	32×10^3	67×10^3	54×10^3
	6	57×10^4	42×10^4	38×10^4	66×10^3

Popularization:

The present study highlights the nutritional quality of *P. trapezium* meat as an important meat pickle source that can be utilized just like other seafood. The different value added products that have been developed in the present study have good shelf life and nutritive value and so these products can be popularized among the local population for effective utilization of the protein rich meat pickle.

DISCUSSION

In the present study, pH value in control was found to increase on prolonged storage. Whereas in the organic acid treated samples there was an overall decrease in the pH values during storage. This may be due to the activity of certain types of bacteria, which produce acid at low pH. Gupta and Basu, 1985 and Chandrashekar *et al.*,1978 [1,12] also observed a decreasing trend in pH values during the storage of cockle meat and in fish pickles prepared with vinegar. In the present study, FFA content was initially low in control but increased steadily during storage and this may be due to lipid hydrolysis. But in the pickles with organic acids the increase was slow and gradual. Same increasing trend in FFA content was also reported earlier in other seafood pickles [12, 13]. The TMA-N values of *Pleuroploca* meat pickle increased in all the samples, and in the control sample the increase was at a faster rate. The values reached the lowest limit of acceptability after four months in control, five months in acetic acid treated

pickle, but in lactic acid and citric acid added pickles, the values did not fall to the acceptably limit of 15mg / 100g even beyond six months of storage. The values of TMA-N in the present study were found to increase with the decrease in sensory scores but Chandrasekhar *et al.*, (1978) and Nicholson, (1930) [12, 14] have reported that the TMA-N values in fish pickles do not correlate well with the sensory scores.

The TVB-N values in the present study were found to have a similar trend as the TMA-N values. The lowest limit of acceptability of 30mg / 100g. Tanikawa, (1935) [15] was reached after four months in control samples and five months in pickles with acetic acid. The TVB-N values in pickles with lactic acid and citric acid were found to be well within the acceptability level even after 6 months of storage. The increase in TVB-N values was reflected in the sensory scores and this might be because of the production of off-odours by volatile bases by bacterial activity during spoilage. It has been reported that a significant increase in TVB-N in fish and shell fish coincides with bacterial spoilage. The purpose of microbiological examination is to detect for pathogenic bacteria (*Salmonella* sp., *Vibrio* sp.), and for organisms that are possible indications of fecal contamination (*E.coli*) and other types of general contamination (Total plate count). In the present study the pathogenic bacteria such as *Salmonella sp., Vibrio sp* and *E.coli* were found to be absent. The Total Plate Count values were found to be low initially but increased during storage, and throughout the storage the TPC was in the range of 10^2 to 10^4 g^{-1}. Chandrasekhar, (1979) [16] and Abraham *et al*. (1996) [17] have reported a Total Viable Count in prawn pickle in the range of 10^3 to 10^5 g^{-1} and 10^3 to 10^5 g^{-1} respectively. In the present study, mould growth was observed after 4 months of storage in control pickles and after six months of storage in organic acid treated pickles. The relatively lower level of bacterial load in the *P. trapezium* meat pickles may be due to the presence of spices and other ingredients and the addition of organic acids. Jarvis (1950) and Stansby (1963) [18, 19] reported that the spices are light preservatives and retard bacterial spoilage. In the present study also mustard, turmeric powder, garlic and ginger were used for the preparation of pickles and they may have a role in arresting the growth of microorganisms. Chattopadhyay *et al*. (1985) [20] reported that there is a need to investigate the possibility of replacing acetic acid with other acid bearing ingredients that may help to suit the taste of the people of different regions. In the traditional type of pickles prepared from fresh lemon and mangoes, the organic acids are provided by the fruit itself, and since the gastropod meat does not contribute any organic acid, it becomes necessary to add the acids to provide the necessary texture and flavour and to bring down the pH level. In the present study, pickles with conventional vinegar (acetic acid) and other organic acids like lactic acid and citric acid have also been used as preservative and flavoring agent.

CONCLUSION

It has been found in the present study that the organic acids such as citric acid and lactic acid are better than acetic acid for the preservation and flavouring of *Pleuroploca* meat pickles. The control pickle had a shelf life of 4 months under room temperature whereas in pickle with acetic acid the shelf life was 5 months and the pickle with lactic and citric acid had 6 months of storage life. Pickles prepared using seafood like prawns and fishes have attained commercial status like other vegetable pickles, likewise this *P. trapezium* pickle can also be popularized to utilize the underutilized protein rich gastropod meat.

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