Asian Fisheries Science **18** (2005): 265- 273
ISSN: 0116-6514
https://doi.org/10.33997/j.afs.2005.18.3.007
Asian Fisheries Society, Manila, Philippines

Processing of horse conch, *Pleuroploca trapezium*, (Fasciolariidae) meat into meat balls

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Abstract

Value added product such as meat balls were prepared using underutilized gastropod, *Pleuroploca trapezium* meat and the quality was assessed in order to utilize the available marine resources fully. The meat balls have good characteristic flavour and appealing appearance for consumption. The minimum shelf life of the meat balls in 10 months. The biochemical and microbial values are also well within the acceptable limit after 10 months of frozen storage.

Introduction

Preparation of diversified and ready-to-serve products is suggested as the best method of utilizing underutilized marine resources. Fish ball is a popular convenience product commonly consumed with noodles in the Southeast Asian region. Fish balls are normally sold fresh or chilled frozen in supermarkets (Yu and Yeang 1993; and Nurul Huda 2001). Meat from underutilized marine gastropod like *Pleuroploca trapezium* is rich in protein and they can be an inexpensive source of nutrition. This horse conch is landed as by-catch in trawl nets in the Tuticorin coast of Southeastern India and the average monthly landing varies between 0.25 to 1.05 tons. The consumption of mollusk meat as such may not appeal to the public due to lack of awareness about its nutritive value, and so the value added products using mollusk meat would enhance consumer acceptability. Meat balls are ready to serve convenient product prepared using dried mollusk meat powder. The microbial and biochemical

qualities and organoleptic characteristics of the meat balls were analyzed during the storage period.

Material and Methods

Processing of raw gastropod meat

Fresh raw meat of gastropod, *Pleuroploca trapezium* was collected from the fish landing centre in Tuticorin, iced and stored in insulated boxes and brought to the laboratory. The meat was cleaned thoroughly using potable water to remove all the dirt and pigments. The cleaned meat was cooked for 30 minutes to remove the mucus. Then it was cut into small slices and deodorized following the method of Sen and Rao (1966). The raw gastropod meat was immersed in equal volume of water. The pH of the water was adjusted to 5.5 by the addition of orthophosphoric acid and boiled for five minutes. Then the meat was drained and again mixed with pH-adjusted water and the same process was repeated for more than three times. Finally, the meat was drained and dried in a hot air oven at 50ºC. The dried gastropod meat was pulverized, sieved and the fine meat powder was used for the preparation of meat balls. For 1kg of raw wet meat, nearly 300g of dry meat powder was obtained.

Preparation of meat balls

The major ingredients used for the preparation of meat balls are given in table 1. The onions were chopped into small pieces and fried in edible oil until golden brown in colour and kept aside. The sesame seeds were fried under low heat until bursting and removed from the pan and cooled. The meat powder was mixed with corn flour, curry powder, pepper powder, fried onions and sesame seeds and mixed well. The preservatives such as the ascorbic acid and sodium benzoate were added to this and the mixture was seasoned with salt to taste and mixed intimately. This was mixed with beaten eggs as well as 100 ml of water and made into dough. Then small balls of about 2-3 cm size were

Table 1. Ingredients for *Pleuroploca* meat balls

S. No	Ingredients	Quantity
1	Meat powder (deodorized)	450 g
2	Corn flour	75 g
3	Sesame seeds	120 g
4	Onions	Six
5	Eggs	Six
6	Curry powder	10 g
7	Pepper powder	15 g
8	Ascorbic acid	0.1 g
9	Sodium benzoate	1 g
10	Salt	To taste

made by rolling small amounts of dough between the palms. The meat balls prepared were tightly wrapped with aluminum foil and packed in LDPE pouches and stored at -18° C in a deep freezer. For consumption, the meat balls were fried in refined oil till the surface attained a uniform brown colour.

Shelf life assessment

For sensory evaluation, the meat balls were fried and served to the taste panel of six to eight members and the overall acceptability was determined using hedonic scale of one to nine (Amerine et al. 1965). The organoleptic score of the meat balls with a rating of nine is excellent; six is good and below four is unacceptable.

Biochemical composition of meat balls

The biochemical composition of meat balls such as protein and lipid were estimated during storage period by employing the methods of Raymont et al. (1964) and Bligh and Dyer (1959) respectively. The pH was measured using a digital pH meter after blending 10 g of sample with 100 ml of distilled water for 30 sec. Free Fatty Acid (FFA) was assessed as per the procedure described by Ke, Reyier and Ackman (1976). The Total Volatile Base Nitrogen (TVB-N) was assessed according to the Conway micro diffusion method of Beatty and Gibbons (1937).

Thaw and drip loss was estimated by refreezing the meat balls in a polythene bag. The bag was kept under running tap water at room temperature for 1 to 2 hours and the drip formed in the bag was drained and the drip loss was measured. The percentage of differences in initial and final weight gives the percentage of thawed meat ball. The moisture content was determined by drying 5 gm of meat ball in pre-weighed Petri plates and keeping them in mechanical drier for 2 days and the final weight was taken.

Microbial analyses

The Total Plate Count (TPC) was enumerated as per the methods of APHA (1992). For TPC, 10g of sample was taken and serially diluted for enumeration. Enumeration of pathogenic bacteria like *Vibrio*, *Salmonella* and *E. coli* using MPN Technique was carried out throughout the storage period by following the methods of USFDA (1998). The total fungal count (TFC) was enumerated by following the method described by Funder (1960).

Results

The meat balls possess good characteristic flavour and appealing appearance (Fig.1). The percentage of thaw and drip loss and moisture content is given in table 2. The drip loss increased gradually from 0.052 to 1.15 after 10 months of storage and the percentage moisture content increased also from 46.8 to 54.33. The protein and lipid content of the meat balls were 10.28 and 5.98% respectively. The changes in pH, FFA and TVB-N of meat balls during storage period are given in table 3. The pH of the meat balls was reduced from 7.22 to 6.6 during 10 months of frozen storage. However, the FFA content (% oleic acid) was increased from 0.004 to 0.029. The TVB-N contents increased steadily from an initial value of 0.76 to 18.69 mg $100g^{-1}$ after 10 months of storage. TVB-N values were well within the acceptable limit during 10 months of frozen storage. The changes in TPC and TFC during frozen storage of meat balls are given in table 4. The pathogenic bacteria such as *Salmonella*, *Vibrio sp*. and the faecal indicator *E.coli* were absent in all the samples. The TPC of meatballs varied between 103 and 104 during storage period of 3rd and 4th month, and after that it gradually decreased. The TPC varied between 31 $x10^3$ and 94 $x10^3$ CFU g^{-1} whereas TFC varied between 1 $x10^2$ and 5 $x10^2$ CFU g^{-1} during the 10 months of frozen storage. Organoleptic ratings of the product during storage are given in table 5. A gradual decrease in the ratings occurred for all the physical characteristics and the overall acceptability during the period of storage. The decrease in the ratings was more for the taste, texture and flavour of the products, where they decreased from an initial score of above 8 to below 6.97 for taste, 6.18 for texture and 6.66 for flavor after 10 months. But the scores were well above the acceptability level of 5 throughout the frozen storage period of 10 months.

Fig. 1. Meatballs before and after frying

Table 2. Percentage moisture content and thaw and drip loss in *Pleuroploca* meat balls

S. No	Storage Months	Moisture (%)	Thaw and drip loss (%)
1	Initial	46.8	0.052
2	1	48.5	0.084
3	2	49.89	9.338
4	3	50.65	0.42
5	4	52.5	0.45
6	5	52.2	0.68
7	6	53.63	0.99
8	7	53.67	1.15
9	8	53.89	1.23
10	9	54.12	1.35
11	10	54.33	1.58

Table 3. pH, FFA and TVB – N of *Pleuroploca* meat balls

S. No	Storage Months	FFA (% oleic acid)	pH	TVB-N ($mg.100g^{-1}$)
1	Initial	0.004	7.22	0.76
2	1	0.006	7.24	2.23
3	2	0.024	6.5	3.87
4	3	0.025	6.3	5.11
5	4	0.025	6.3	5.94
6	5	0.026	6.4	7.23
7	6	0.027	6.5	9.16
8	7	0.027	6.5	10.98
9	8	0.027	6.6	13.07
10	9	0.028	6.6	15.26
11	10	0.029	6.6	18.69

Table 4. Total plate count and total fungal count of *Pleuroploca* meat balls

S. No	Storage Months	TPC CFU.g^{-1}	TFC CFU.g^{-1}
1	Initial	46 x 10^3	5 x10^3
2	1	42 x 10^3	3 x10^3
3	2	37 x 10^3	1 x10^3
4	3	67 x 10^4	1 x10^3
5	4	51 x 10^4	1 x10^3
6	5	45 x10^3	3 x10^2
7	6	31 x10^3	2 x10^2
8	7	94 x10^3	2 x10^2
9	8	76 x10^3	1 x10^2
10	9	72 x10^3	1 x10^2
11	10	42 x10^3	1 x10^2

Table 5. Organoleptic analysis of *Pleuroploca* meat balls

Storage Months	Appearance	Colour	Odour	Taste	Texture	Flavour	Overall acceptability
Initial	8.13	8.15	8.12	8.12	8.4	8	8.1
1	7. 87	8	7.7	8.1	8	7.87	7.75
2	7.9	7.88	7.68	7.5	7.87	7.75	7.75
3	7.57	7.82	7.5	7.42	7.42	7.5	7.75
4	7.74	7.8	7.5	7.4	7.2	7.5	7.5
5	7.75	8	7.5	7.25	7	7.47	7.5
6	7.71	7.71	7.42	7.2	6.8	7.14	7.64
7	7.68	7.69	7.38	7.15	6.67	6.94	7.48
8	7.63	7.62	7.27	7.08	6.48	6.85	7.35
9	7.54	7.58	7.21	7.05	6.32	6.72	7.21
10	7.48	7.48	7.16	6.97	6.18	6.66	7.18

Discussion

The nutritive value of meat ball was found to be good with 10.28% protein and 5.98% lipid content. The percentage of thaw and drip loss also increased progressively with the frozen storage time. Similar results have been obtained by many authors working on frozen storage of other sea foods (George, 1974, Rajeswari and Hameed 1998, George et al. 1990). George (1994) reported that the duration and temperature of frozen storage are the important factors influencing drip loss. George (1973) reported a loss in moisture accompanied by larger drip loss during thawing of frozen crabs. The pH of *Pleuroploca* meat ball was found to decrease in the first five months and then it increases slightly and became steady at 6.6 till the end of the storage period of ten months. The pH of meat has been reported to be one of the most important factors in determining the drip loss in thawed meat. Lawrie (1974) and Haard (1977) reported reduction in pH with an increase in percentage drip loss. The Free Fatty Acid level (% Oleic acid) of the *Pleuroploca* meat balls showed an increasing trend with the storage period, but the values were very low (0.004 to 0.029) compared to other frozen stored sea food products. This may be because of the anti oxidative effect of ascorbic acid that has been added to the meat balls. Total Volatile Base Nitrogen (TVB-N) is one of the important parameters used for seafood quality analysis. It is a general term that includes the measurement of trimethylamine, dimethylamine, ammonia and other volatile basic nitrogenous compounds associated with sea food spoilage, but the values do not reflect the mode of spoilage (bacterial or autolytic). The TVB-N values of *Pleuroploca* meat balls were found to increase during the 10 months storage period, but even after 10 months, the values were well within the acceptability limit of 30mg $100g^{-1}$ (DOH 1996). The lower levels may be due to several factors such as the addition of the preservative, sodium benzoate, and also the packing in aluminum foil and LDPE that limit moisture and gas permeation to some extent during frozen storage. The Total Plate Count of meat balls showed considerable variations during the storage period. To determine the plate count limits the sanitation standard (3×10^6 $CFU.g^{-1}$) for frozen seafood was used (DOH 1996). Throughout the storage period, the counts were found to be well within the acceptability limit. The Total Fungal Count was found to decrease considerably during the storage period and this may be attributed to the action of the preservative, sodium benzoate. In the development of any new product, the knowledge of shelf life is one of the important aspects. In the present study, the meat balls were found to be acceptable for more than 10 months in frozen storage.

Conclusion

The conventional food habits of people of India restrict the preference of food. The *Pleuroploca* gastropod meat is consumed by a small section of fisher folk in Southeastern India after converting the meat into chips. The meat balls developed using gastropod meat possess delicacy, appealing appearance and long shelf life under frozen storage and it is a new variety of ready to cook product to consumers. This product could be popularized in the seafood industry for the benefit of the consumers particularly in urban areas and thereby the harvested underutilized marine resources could be fully utilized in a proper manner.

Acknowledgment

Authors are thankful to Professor Jorgen Hylleberg, Programme Director, Tropical Marine Mollusc Programme; DANIDA, Denmark for the financial support and Dr. J. K. Patterson Edward, Director SDMRI for the facilities.

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