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Quality and storage stability of low acid Murrel (*Channa striatus*) fish pickle at room temperature

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Abstract

Low acid murrel meat pickle was prepared using deboned meat from marketable size murrel (700 ± 59 g). The product was evaluated after an elapse of seven days on maturation for change in physico-chemical, microbiological and organoleptic properties at an interval of 15 days up to 60 days at 32 ± 0.5^{0}C. Results showed that pH and titratable acidity of the low acid pickle was 4.83 and 0.68, where as in control murrel pickle, these values were 4.68 and 0.74 respectively. After 60 days of storage period microbiological count and sensory quality traits did not show appreciable change and remained satisfactory throughout the storage period. Low acid pickles had significantly lower sourness and high overall acceptability compared to the control. Murrel pickle has the potential of becoming ready-to-eat, self stable, highly acceptable health food products of indigenous origin.

Introduction

High perishability of fish and fish products is a serious problem in tropical countries like India due to prevailing climatic conditions. Emphasis is being given on developing self-stable fish and fish food products, which can be stored at a 32 ± 0.5^{0}C ambient temperature. The striped murrel *Channa striatus* is one of the most important food fish in India, Thailand, Vietnam, Malaysia and Philippines (Pillay and Kutty, 2005). Murrels are excellent rounded meaty fish with single skeleton and minimum intra muscular bones. Murrel meat is white, moist, resilient, firm with meaty flavour (Sahu *et al*., 2011). Murrels have dressing percentage (89.59%) and meat bone ratio of 3.43. Snakehead fish (*Channa striatus*) is recognized in Asia-Pacific countries as a remedy for healing of wounds. The fish enhances dermal wound healing and reduces post operative pain and discomfort (Gam *et al*., 2006).

Channa striatus flesh is rich in protein, polyunsaturated fatty acids (PUFA) and antioxidants; usually this fish is extracted and marketed in the form of liquid concentrated health food supplement. Hui *et al*. (2010), produced encapsulated extracts using spray drying process. The main purpose is for easy handling and preservation of the biochemical compounds. The biochemical compounds in the powder produced are expected to have properties such as enhanced stability and longer shelf life. Fish is known to contain poly-unsaturated fatty acids that can regulate prostaglandin synthesis and hence induce wound healing (Zuraini *et al*., 2006). Certain amino acids like glycine, aspartic acid, glutamic acid are also known to play important role in the process of wound healing (Chyun and Griming, 1984). Oral administration of *Channa striatus* extracts can be a good alternative product for osteoarthritis (Michelle *et al*., 2004).

Channa straitus is both a popular food choice and a natural remedy in traditional medicine, particularly popular in post operative patients to induce wound healing. Its chemical composition includes high level of essential amino acids and a good profile of fatty acids that could directly improve tissue growth and would healing. Other pharmacological activities include antimicrobial, anti-inflammatory, cell proliferation, induction of platelet aggregation and anti nociceptive properties (Mat Jais, 2007).

Fish pickling in vinegar and edible oil with added salt, spices and condiments provide ready to eat highly acceptable convenience product with good self-stability at an ambient temperature. Low moisture and reduced pH are the important major factors contributing to the self-stability of the pickles (Frazier and Westhoff, 1984). Pickling also helps

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in improving the desirable characteristics like taste and flavor along with the preservative effect. The preliminary trials and evaluation of market fish pickle has indicated that, with pH range 4.4 - 4.7, the products are objectionably sour; consequently its acceptability was decreased. Information on development and storage stability of low acid murrel pickle is limited. Therefore the objective of the present study was to prepare highly acceptable low acid murrel pickle and study their storage stability at 32 ± 0.5^{0}C.

Materials and Methods

The study was conducted in post-harvest laboratory of Central Institute of Freshwater Aquaculture, Bhubaneswar-751002, India, during April-June (summer season) when the average temperature is in the range of 32 - 35^{0}C.

Source of fish

Murrel fish of size 550-750g were sacrificed and hygienically processed, deboned and chunks were stored at -20^{0}C till further use for pickle preparation. Frozen murrel stripes were allowed to thaw for 15-20 h at 4 ± 1^{0}C and then cut into pieces of 2-3 cm^2 at the time of use.

Preparation of murrel fish pickle

Murrel fish pickle was prepared as per the formulation reported by Sahu *et al*. (2011) in 2 kg batches using 4% salt, 4% dry spices mix, 10% condiment mix, 25% mustard oil, 1% acetic acid, 0.15% citric acid was taken as control. The low acid murrel fish pickle without citric acid and only 0.85% acetic acid was used with 15% tomato puree and 5% sugar. Dry spice mix was prepared using cumin seed 20%, coriander powder 20%, black pepper 10%, red pepper15%, turmeric 20%, aniseed powder 7.5%, mustard powder 6%, cardamom 0.5%, cinnamon 0.5% and cloves 0.5%. Condiment mix was prepared using onion 50%, green chilies 16%, ginger 16%, asafetida 0.1% and curry leaves 2%. Murrel flesh was pre salted with 80 g salt (4%), 40g turmeric powder (2%) and mixed properly for uniform dispersion and seasoning. The seasoned murrel chunks were deep fried with a deep fat fryer in heated mustard oil till golden brown colour appeared. Dry spice and condiment mix were fried in the remaining mustard oil. Vinegar and tomato puree were added to make a broth and heated with high constant stirring till boiling started. Fried murrel meat was added to it and allowed to boil for two minutes. The pickles were allowed to cool to room temperature. After cooling the murrel pickle was packed in the polyethylene terephthalate (PET) 200 g bottles and stored at 32 ± 0.5^{0}C.

Analysis of samples

Physico-chemical, microbiological and organoleptic properties were monitored after 7 days maturation period and thereafter at an interval of 15 days up to 60 days. The pH of the pickle was determined using combined electrode of a digital pH meter (Eutech). The procedure out lined by Fisher and Peters (1968) was used for titratable acidity (% acetic acid) estimation. Total plate count (TPC), halophilic count and total mold count (TMC) in the sample were determined by the method described by Speck (1984). A 10g sample was ground in a sterile mortar and pestle with 90 ml sterile 0.1% peptone water; plated in duplicate. The incubation time and temperature of the plates were 24 h and 35 ± 2^{0}C respectively for total plate counts. Whereas the plates were incubated at 25^{0}C for 5 days to count yeast and mold. Three similar trials were conducted and results were analyzed using analysis of variance following Duncan's multiple range tests (Snedecor and Cochran, 1995).

Sensory evaluation of pickle

A twenty member sensory panel of the Institute including 50% ladies evaluated the sensory attributes viz. colour, flavor, texture, juiciness and overall acceptability of the pickle using a 9 point descriptive hedonic scale, where 9 denoted extremely desirable and 1 denoted extremely undesirable.

Results and Discussion

Results after a maturation period of 7 days, like pH and titratable acidity of low acid murrel pickles were significantly ($P<0.05$) different from standard murrel pickles (control). There was slight increase in pH from 4.57 to 4.63 in control and from 4.94 to 4.99 in low acid murrel pickle during 60 days storage period. Similar patterns of change in pH of various fish pickle were reported earlier (Shirikar *et al*., 2009). The pH of pickles did not show statistically appreciable changes throughout the storage period (Table 1) and was below 5.0, which is considered to be critical for storage stability of pickled meat products (Dziezak, 1986). The overall mean titratable acidity of control and low acid murrel pickle was reported to be 0.86 and 0.60 respectively. This difference was due to critical concentration of acetic acid used. There was significant difference in titratable acidity between control and low acid pickle and at different storage intervals. Titratable acidity in low acid pickle was

Table 1. Changes in physico-chemical and microbiological quality of murrel fish pickle during storage period

Traits	Treatments	Storage period (days) 0	15	30	45	60	Treatment mean
pH	Medium acid (control)	4.57	4.57	4.61	4.62	4.63	4.61 ± 0.01^{B}
	Low acid	4.94	4.96	4.96	4.97	4.99	4.96 ± 0.01^{A}
Titratable acidity (% acetic acid)	Medium acid (control)	0.84^{b}	0.85^{ab}	0.86^{ab}	0.87^{ab}	0.89^{a}	0.86 ± 0.01^{A}
	Low acid	0.58^{b}	0.59^{b}	0.58^{b}	0.59^{b}	0.61^{a}	0.60 ± 0.01^{B}
TPC(log cfu g^{-1})	Medium acid (control)	3.88	3.88	4.02	3.98	4.06	3.96 ± 0.25
	Low acid	3.99	4.03	4.08	4.07	4.12	4.06 ± 0.19
TMC(log cfu g^{-1})	Medium acid (control)	1.55	1.6	1.64	1.8	1.82	1.68 ± 0.12
	Low acid	1.68	1.7	1.76	1.85	1.95	1.79 ± 0.16
Halophiles (log cfu g^{-1})	Medium acid (control)	3.47^{b}	3.52^{ab}	3.59^{ab}	3.72^{ab}	4.05^{a}	3.67 ± 0.07
	Low acid	3.53^{b}	3.62^{b}	3.75^{ab}	3.82^{ab}	4.13^{a}	3.77 ± 0.09

Means in the same row and column with the different superscripts are significantly different (P<0.05)

Table 2. Sensory attributes* of murrel (*Channa striatus*) fish pickle during storage at room temperature

Traits	Treatments	Storage period (days) 0	15	30	45	60	Treatment mean
Colour	Medium acid (Control)	7.87	7.75	7.67	7.83	7.67	7.76 ± 0.13
	Low acid	8.33	7.75	7.67	7.77	7.79	7.86 ± 0.11
Flavour	Medium acid (Control)	7.93	7.85	7.50	7.30	7.24	7.56 ± 0.18
	Low acid	8.08	8.04	8.01	7.93	7.33	7.88 ± 0.14
Juiciness	Medium acid (Control)	8.03	7.98	7.80	7.65	7.60	7.81 ± 0.16
	Low acid	8.38	8.32	8.18	8.08	8.02	8.20 ± 0.13
Texture	Medium acid (Control)	6.84	7.43	7.42	7.52	7.60	7.36 ± 0.11
	Low acid	7.68	7.58	7.59	7.73	7.92	7.66 ± 0.14
Saltiness	Medium acid (Control)	7.75	7.77	7.80	7.33	7.17	7.56 ± 0.11
	Low acid	7.83	7.88	7.83	7.67	7.77	7.80 ± 0.18
Sourness	Medium acid (Control)	6.20	5.8	5.82	5.80	5.78	5.88 ± 0.11^{b}
	Low acid	6.56	6.62	6.75	6.80	6.85	6.72 ± 0.10^{a}
Overall acceptability	Medium acid (Control)	7.25	7.58	7.42	7.58	7.33	7.43 ± 0.09^{b}
	Low acid	8.42	8.23	8.09	8.15	8.18	8.21 ± 0.04^{a}

Mean in the same row and column with the different superscripts are significantly different (P<0.05). * Based on the 9 point hedonic scale (9=extremely desirable; 1=extremely undesirable)

unaffected up to 45 days and there after it increased significantly (P<0.05). The increased titrable acidity could be due to more loss of moisture and the effect of condiments mix.

The total plate count (TPC) of pickle remained almost unaffected throughout the storage period, whereas halophilic counts increased significantly (P<0.05) on sixteenth day of storage (Table 1). There was no significant (P<0.05) difference in microbial count between control and low acid model pickle. A gradual increase in bacterial count of pickle was observed with increased storage time (Khanna *et al*., 2004). But in this study, the microbial count was reported to remain satisfactory even after 60 days of storage at 32°C as the count remained in the range of 4 log cycles.

Sensory attributes of the products such as colour, flavor, texture and saltiness did not differ significantly between medium and low acid murrel pickle. A significant (P<0.01) difference in sourness scores were obtained in both the pickles. All other sensory traits did not alter significantly in both the products (Table 2). Texture, juiciness and sourness score of low acid murrel pickle ranged between good to very good over the entire period of storage at room temperature. The low acid murrel pickle rated better than medium acid (control) murrel pickle by the panelist. The low sourness of the murrel pickle has significantly enhanced the overall acceptability score of the product.

Conclusion

Low acid murrel fish pickle showed no deteriorative changes during the storage period at ambient temperature. The microbial count remained low and all the sensory attributes rated between good to very good. Therefore, it can be concluded that highly acceptable low acid murrel meat pickle can be prepared using deboned murrel meat chunks, vinegar and tomato puree and can safely be stored for 60 days at ambient temperature. Low acid murrel pickle has the potential of becoming ready to eat, highly acceptable, shelf stable, convenience fish product of indigenous origin.

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