



Suitability of *Pangasius hypophthalmus* as a Raw Material for Ngari-like product- A Fermented Product

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ABSTRACT

Ngari is a delicious and familiar fermented fish product, a native of Manipur, prepared from unsalted sun-dried fish. The present investigation was carried out to evaluate the suitability of *Pangasius hypophthalmus* as a raw material for the preparation of *ngari-like product*. During the study, the dried pangasius steaks were packed in oil conditioned earthen pot and allowed to ferment for 6 months. The quality of fermented Pangasius was analysed and the quality parameters evaluated were- the changes in proximate composition, physicochemical parameters [total volatile base nitrogen (TVBN), peroxide value (PV), free fatty acid (FFA), pH, thiobarbituric acid reactive substances (TBARS)], total viable count (TVC) and sensory evaluation. It was observed that not much variation was observed in proximate composition. The biochemical parameters namely TVBN, PV and FFA were increased after fermentation. Similarly, TVC and sensory scores reportedly increased after fermentation. The results indicate that Pangasius can be used as a suitable raw material for the preparation of *ngari-like product*.

Key Words: Ngari, Pangasius, Quality, Sensory, Suitability.

INTRODUCTION

Fish usually contain high amounts of unsaturated fats providing health benefits by protecting against cardiovascular diseases and in countering obesity. Fish also helps in the development of the brain and nervous system in foetal and infant stages of growth (FAO, 2016). Though highly nutritious, the high moisture content of fish makes it susceptible to rapid spoilage post-harvest (Huss *et al*, 1974). Fermentation is a traditional method of preserving fish exclusively confined to the Asian region where proteins in raw fish are broken down to simpler molecules due to the action of organic catalysts, enzymes or ferments. The fermented fish products may be either salted or unsalted.

Salting, drying, smoking and fermentation are principal traditional methods of preservation in South-East Asia (Cooke *et al*, 1993). Fermentation not only preserves food but also enhances the flavour, increase digestibility, improve nutritional value and pharmacological value (Jeyaramet *al*, 2009). According to Tamang (2001), the ethnic people of North-East Asia used to catch fish from lakes and rivers and ferment them. *Ngari*, a fermented fish product of Manipur is a similar product. *Ngari* is made from sundried non-salted fish (Phadke *et al*, 2014). According to Thapa (2002), *Ngari* is prepared by rubbing (*Puntius sophore*) with salt, drying for 3-4 days in the sun, pressing tightly in an earthen pot, sealing tightly and then storing at room temperature for 4-6 m.

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The subcutaneous layer of *Pangasius* consists of high-fat content. Due to the presence of high subcutaneous fatty layer, *Pangasius* may be utilized as an alternative species for the preparation of *ngari-like product*. Hence, the present study aims to evaluate the suitability of *Pangasius* as a raw material for the preparation of *ngari-like product*.

MATERIALS AND METHODS

Ngari- like product preparation

The *ngari-like product* was prepared in a similar method practised by the people of Manipur. Upon arrival to the laboratory, the fish were washed with chilled water to remove dirt and slime, beheaded, eviscerated and fillets were prepared. Steaks of 5 cm were made from the fillets. The steaks were washed thoroughly with chilled water to remove adhering blood and viscera. After draining, the steaks were dried in a mechanical dryer at 60 °C till the steaks had reached moisture below 20 per cent. After drying, the dried steaks were kept overnight at room temperature so that the steaks may absorb a little moisture (approx. 30-40%). The steaks after keeping at room temperature were considered as 0th day. Early in the morning, the steaks were packed in earthen pots which were already conditioned with oil. Conditioning was done until the layers of pot were saturated with oil. The steaks were packed tight in earthen pots till the top. Later, the lid of the pot was placed and packed with clay packing the space between pot and lid. The packed pots were kept in dark place for 6 months like the traditional method. After 6 months, the pots were opened to evaluate the quality of the fermented product and its suitability.

Proximate composition

Moisture content was determined as given in AOAC (2000). The samples in triplicates were dried in a hot-air oven at 100±5 °C overnight and the differences in weight were recorded to determine the moisture content. The micro-Kjeldahl method using Kelplus equipment (Pelican instruments, Chennai, India) was used to analyze the crude protein

content. Ash content was obtained by incinerating the sample in a muffle furnace (CEM Corporation, USA) at 550±50 °C until white ash was obtained and the difference in weight was recorded to analyse the ash content. Soxhlet extraction method with diethyl ether as a solvent was used to analyze total lipid content.

Biochemical quality parameters

For pH measurement, 10g of fish sample was added to 50 ml distilled water and homogenized using a homogenizer (Polytron system PT 2100, Kinematica, AG, Germany) for 30 sec and the pH was measured using the digital pH meter (Eutech tutor pH/ °C meter, Eutech Instruments, Singapore). The steam distillation method using Trichloroacetic acid was used to determine TVBN as described by Vyncke (1996). Jacob (1958) method was used to determine Peroxide value (PV) and the results were expressed as meq of O₂/ kg of fat. The free fatty acids (FFA) were determined according to AOAC (2000) from the chloroform extracts from muscles ground with anhydrous sodium sulphate. Tarladgiset *al* (1960) method was used to estimate thiobarbituric acid reactive substances (TBARS).

Microbiological quality parameters

The microbiological parameter Total viable count (TVC) was carried out as per APHA (2001). Ten grams portion of the sample was aseptically weighed and transferred to a sterile stomacher bag and 90 ml of sterile physiological saline (0.85% w/v/ NaCl) was added and the mixture was homogenized using a stomacher (Lab Blender 400, Seward Medical, UK). For the enumeration of total plate count, 0.1 ml of the serial dilution of homogenate was spread on plate count agar (Himedia, India) and incubated at 37 °C for two days.

Sensory Evaluation

For sensory evaluation, the samples were cooked at 100 °C for 20 min and were cooled to room temperature. The cooled samples were provided to 10 trained Panellists for sensory evaluation of dried *Pangasius* (0th day) and fermented *ngari* (6 months)

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10 point hedonic scales viz., Excellent (10), Very good (9), Good (8), Satisfactory (7) and Fair (6).

Statistical Analysis

All analyses were carried out in triplicates and subjected to independent samples t-test to check for the significant difference between the means at $P < 0.05$ using SPSS 16 (SPSS Inc., Chicago, IL, USA). Results were reported as mean values of determinations \pm Standard Deviation.

RESULTS AND DISCUSSION

Changes in proximate composition

The initial moisture content of *Pangasius* steaks on the 0th day was 30.23 percent whereas it was 31.32 percent after maturation of *ngari* (Table 1). The lower moisture content in the *ngari-like product* can be attributed to the drying of steaks. There was not much variation in moisture content during the period of fermentation. Taorem and Sarojnalini (2012) studied the changes in *ngari* and reported that the fluctuation in moisture content might have attributed to their fat content. El-Sebaiy and Metwalli (1989) fermented Bowri fish muscles prepared from *Mugil cephalus* and observed a reduction in moisture.

There was only a slight reduction in protein and lipid of *ngari-like product* with values of 51.32 and 8.80 percent from an initial value of 52.37 and 9.51 percent, respectively (Table 1). The decrease in protein and lipid during the period of fermentation of *Pangasius* could be attributed to the degradation of protein, hydrolysis and oxidation of lipids. Taorem and Sarojnalini (2012) reported that not much variation was observed in protein and fat during the production of *ngari* at different

temperatures. The protein and fat contents of different fermented products prepared by Taorem and Sarojnalini (2012), Sarojnalini and Vishwanath (1995) and Majumdar *et al* (2015) were 38.90 and 14.68, 33.38 and 13.60 and 42.87 & 13.51 per cent, respectively.

The ash content of *ngari-like product* increased to 6.64 percent from an initial value of 4.53 per cent (Table 1). The increase in ash content during the fermentation might be due to increasing degradation from lipids and protein. Taorem and Sarojnalini (2012) reported an increase in ash content initially and stabilised after 90 d of fermentation.

Changes in physico-chemical parameters

An increase in pH was observed in the *ngari-like product* prepared from *Pangasius* from 6.12 (0th day) to 6.97 in the final product (Table 2). The increase in the pH might be due to the formation of basic nitrogenous compounds (Soyiri *et al.*, 2003) and due to the anaerobic breakdown of proteins (Taorem and Sarojnalini, 2012). According to Yatsunami and Takenaka (1996), during the fermentation of fish, volatile compounds will be produced due to which pH will increase. Majumdar *et al* (2015) observed a pH value of 6.14 in *ngari* and 6.11 in *Hentak* stating that the higher pH in *ngari* and *Hentak*, when compared to other products, might be due to the production of volatile basic compounds and their accumulation in the product.

There was a significant increase ($P \leq 0.05$) in the TVBN value of *ngari-like product* prepared from *Pangasius* from 5.51 mg N/100g (0th day) to 156.53 mg N/100g in the final product (Table 2). The increase in TVBN value might be due to the microbiological and biochemical changes in the

Table 1. Changes in proximate composition during the preparation of *ngari* from *Pangasius*.

	Moisture	Protein	Fat	Ash
0 Day	30.23 \pm 0.29 ^a	52.37 \pm 0.64 ^b	9.51 \pm 0.31 ^b	4.53 \pm 0.34 ^a
<i>ngari</i> final	31.32 \pm 0.14 ^b	51.32 \pm 0.30 ^a	8.80 \pm 0.49 ^a	6.64 \pm 0.16 ^b

Data expressed as mean \pm SD (n=3), the mean value in the same column with different small letters superscripts are significantly different ($p < 0.05$).

fish muscle which impart the characteristic flavour during fermentation (Sarojnalini and Suchitra, 2009). The increase in TVBN value indicated that the volatile compounds were produced due to the breakdown of protein by microbes (Babu *et al*, 2005) which gave a typical aroma and flavour to the final product (Majumdar *et al*, 2005). There was an increase in the peroxide value during the period of fermentation from 4.57 to 32.37 mg MDA/kg (Table 2) indicating that oxidation has occurred during the fermentation. Sarojnalini and Vishwanath (1995) reported a peroxide value of 6.00 in *Hentak* and 9.46 in *ngari*.

Very low TBARS values were recorded during the fermentation of *ngari-like product* (0.93 meq O₂/kg) from an initial value of 0.14 meq O₂/kg (Table 2). The lower TBARS value might be due to the microaerobic condition and also the absence of pro-oxidants (Majumdar *et al*, 2015). According to Karaçam and Boran (1996), TBARS values above 3-4 indicates a quality loss.

There was a slight increase in the free fatty acid of *ngari-like product* (14.33% oleic acid) from 0.85 per cent oleic acid (0th day) (Table 2). This increase in fatty acids might be due to the activity of lipase that breaks down lipids. Lipid hydrolysis is catalysed by lipases which cleave fatty acids from the glycerol backbone of both triglycerides and phospholipids (Hardy, 1980). Sarojnalini and Vishwanath (1995) reported an FFA value of 83.59 in *ngari* and 97.60 in *Hentak*. Sarojnalini and Suchitra (2009) reported a value of 64.30% oleic acid of FFA in traditionally

prepared *ngari*. Taorem and Sarojnalini (2012) reported that the increase in FFA might be due to protein denaturation and lipid hydrolysis.

Microbial changes

The total viable count in this study increased from 3.68 to 9.17 log CFU/g during the period of fermentation of *ngari-like product* prepared from *Pangasius* (Table 2). The results indicate that there was an increase in the bacterial loads in the fermented product and microbes might have a major role in fermentation. Microbes produce volatile compounds by degrading fish proteins (Lopetcharat and Park, 2002). Sarojnalini and Suchitra (2009) reported a TPC of 2.13×10^6 in naturally fermented *ngari*. Majumdar *et al* (2015) reported TPC counts of 6.65 log CFU/g in *ngari* and 7.81 in *Hentak*.

Sensory changes

The results (Table 3) revealed that the sensory scores of the initial day were very low and of *ngari-like product* were higher. The increase in sensory scores of the product indicates that fermentation has occurred in the final *ngari-like product*. The initial low sensory scores of the product suggest that the fermentation has not started. The overall score of *ngari-like product* was 8.94 whereas the initial overall score was 5.86. It was observed that the odour of the product increased in final *ngari-like product* indicating that characteristic odour of *ngari* was attained but the odour of *ngari* was more rancid than the traditional *ngari*. The increase in the texture of the final *ngari-like product* shows that

Table 2. Physico-chemical and microbial changes during the preparation of *ngari-like product* from *Pangasius*.

	pH	TVBN	PV	TBA	FFA	TVC (Log cfu/g)
0 Day	6.12±0.01 ^a	5.51±0.21 ^a	4.57±0.09 ^a	0.14±0.06 ^a	0.85±0.44 ^a	3.68
<i>ngari</i> final	6.97±0.01 ^b	156.53±5.62 ^b	32.37±0.70 ^b	0.93±0.12 ^b	14.33±0.08 ^b	9.17

Data expressed as mean± SD (n=3), the mean value in the same column with different small letters superscripts are significantly different (p<0.05).

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Table 3. Changes in sensory characteristics during the preparation of ngari-like product from Pangasius.

	Colour	Appearance	Odour	Texture	Overall acceptability
0 Day	5.88±0.22 ^a	6.14±0.30 ^a	6.16±0.21 ^a	6.08±0.13 ^a	5.86±0.55 ^a
ngari final	8.72±0.42 ^b	9.00±0.12 ^b	8.64±0.37 ^b	8.72±0.19 ^b	8.94±0.38 ^b

Data expressed as mean± SD (n=10), the mean value in the same column with different small letters superscripts are significantly different (p<0.05).

the product was soft and was almost similar to the traditional product.

CONCLUSION

The results of TVBN, PV and FFA indicate that smaller molecules have been produced due to lipid and protein degradation. The increase in TVC indicates that anaerobic microbes might have caused this breakdown of proteins and lipids. The sensory scores indicate that *ngari-like product* from *Pangasius* has attained its peculiar flavour and was similar to the traditional ngari. Hence, it was concluded that *Pangasius* can be utilized as an alternative species for preparation of *ngari* thereby increasing the protein availability.

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