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Research Article

EFFECT OF FROZEN STORAGE ON BIOCHEMICAL AND SENSORY QUALITY CHANGES OF FISH CUTLETS, MADE FROM FRESH WATER FISH CATLA (*CATLA CATLA*)

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Abstract: Shelf life of fish cutlet prepared from fresh water fish catla (*Catla catla*) were evaluated on the basis of biochemical and sensory qualities during frozen storage. The meat was separated from the fish and cutlet was prepared by following standardized recipe then frozen stored (-18°C) and subjected to biochemical and sensory evaluation at interval of fifteen days through the study. Results indicated that the frozen cutlet was in acceptable condition upto 150 days at stored -18°C. Biochemical parameters viz. pH, peroxide value, free fatty acid and total volatile base-Nitrogen showed increasing trend during the study. Scores for sensory parameters appearance, color, taste, odour and overall acceptability of cutlet were determined during the storage period; it showed a decreasing trend but was within acceptable limits up to 150 days.

Keywords: Biochemical changes; Catla fish; Fish cutlets; Sensory evaluation and Storage study.

INTRODUCTION

The current situation in fish processing industry demands a need to introduce new products based on fish mince which are stable, acceptable and nutritious. Addition of fish in the diet not only improves the nutritional quality but also results in increased consumption of meal. Therefore, fish products as a condiment in 'ready-to-cook' or 'ready-to-eat' form appear to have a good potential (Reddy *et al*., 2012). Fish and fishery products contain high quality protein and other necessary nutrients; they are low in saturated fatty acids and contain high content of unsaturated fatty acids (Rathod *et al*., 2012).

The Indian major carps being the high-protein food form a major component of the Indian aquaculture, but carps have limited consumer acceptability because of the presence of intramuscular bones. Processing of carps into value-added battered products enhance their acceptability and market value as revealed by the sensory evaluation of the product.

Battered and breaded product is convenience food valued greatly by the consumers all over the world. The process of coating with batter and bread crumbs increases the bulk of the product, thereby reducing the content of costly fish and thus reducing the cost product, coating enhances the appearance, color, texture and taste of food products and also the nutritional value of the product (Rathod *et al*., 2012).

In the present work of a value added battered and breaded product "fish cutlet" was developed from fresh water fish Catla (*Catla catla*) and to investigate storage characteristics viz., biochemical (pH, PV, FFA and TVB-N) and sensory quality changes during its frozen storage.

MATERIALS AND METHODS

Sample preparation:

Catla fish (*Catla catla*) were obtained from the local fish market. Fish samples were between 5.5 and 10.5 kg and transferred to processing hall under iced condition and then they were washed thoroughly with potable water then beheaded, gutted and again washed meat was separated which yielded 36% of meat based on total weight of fish.

Using standardised recipe the cutlets were prepared (Pawar *et al*., 2012). The standardized cutlet recipe included 100gm cooked pangasius meat, 3gm salt, 10 ml oil, 5gm green chillies, 5gm coriander leaves, 5gm ginger, 5gm garlic, 25gm onions, 70gm cooked potatoes, 0.3gm pepper powder, 0.3gm clove powder, 0.2gm cinnamon powder, 0.2gm turmeric powder, 20gm bread powder.

The standardized batter mix (Pagarkar *et al.*, 2012) were prepared using 77.5% refined wheat flour, 9.7% corn flour, 9.7% bengal gram flour, 1.20% salt, 0.47% sodium tri polyphosphate (STPP), 0.47% turmeric

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powder, 0.96% carboxy methyl cellulose (CMC) which were mixed with water in the ratio of 1:2 and was blended to homogeneity. After the batter coating, it was covered with bread crumbs, they were flash fried at 180°C for 30 sec. later packed in polypropylene pouches of 100gm capacity and frozen stored at -18 °C.

Analysis:

Proximate composition viz., moisture, crude protein, fats, carbohydrate and ash of raw fish and fish cutlet on the initial day of production and at the end of the storage were analysed according to AOAC (2005). Biochemical and sensory quality was assessed during storage study at 15 days interval.

Chemical quality:

The pH, free fatty acid values were determined as per AOAC (2005). TVB-N contents of catla fish cutlet was determined by the procedure given by Beatty and Gibbons, (1937) using Conway micro-diffusion units and results were expressed in terms of nitrogen mg/100g.

Sensory quality:

Sensory quality of catla fish cutlets were evaluated directly by 10 trained panelists, using a nine point hedonic scale (1-dislike extremely to 9-like extremely) for product acceptability.

Statistical analysis

Data were analysed to test significant difference by applying analysis of variances (ANOVA) tool available in MS-Excel 2007. The significant differences were tested by 5% level of significance and are mentioned as $p < 0.05$ for significances difference by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Proximate analysis of Catla fish meat and Catla fish cutlet

The moisture, crude protein, fat and ash contents in fresh catla fish (*Catla catla*) were 78.63, 19.15, 1.26 and 0.96% respectively (Table 1). Similarly, Devadasan *et al.* (1978) and Bhosale (2001) reported the moisture, crude protein, fat and ash contents in fresh catla with a little difference result were 76.28, 19.60, 1.32 and 0.93% and 75.90, 17.15, 1.15 and 0.96% respectively. Gopakumar (2002) reported the moisture, crude protein, fat and ash contents in catla fish was 76.30, 19.60, 1.30 and 0.90% respectively.

Catla fish cutlet kept in frozen storage showed slight reduction in moisture (65.71 to 64.86%) and protein (16.57 to 15.86%) throughout the storage (Table 1). The fat (14.50 to 15.20%) and ash (3.22 to 4.08%) content was increased in the same sample (Table 1). The increased in fat and reduction in moisture content in cutlet is due to deep frying as well as dehydration during chilled and frozen storage (Ninan *et al.* 2008). The reduction of protein is due to denaturation fish muscle during chilled and frozen storage (Gopakumar, 2002).

Joseph *et al.* (1984) reported moisture, protein, fat and ash content in flash fried and raw cutlet was 62.65, 15.41, 5.92 and 1.88% and 66.39, 16.51, 3.74 and 199% respectively. Crab cutlet prepared by Raju *et al.* (1997) content moisture, protein, fat and ash were 67.72, 17.07, 8.36 and 4.00% respectively. Kamat (1999) reported fish cutlet prepared from bleached and unbleached fish meat content of moisture, protein, fat and ash were 65.01, 12.06, 6.31 and 1.39% and 60.21, 16.20, 14.32 and 1.43% respectively. Ninan *et al.* (2008) reported tilapia fish cutlet content of moisture, protein, carbohydrate, fat and ash were 65.10, 17.51, 13.47, 2.14 and 1.78% respectively.

Table.1: Proximate composition of Catla meat, cutlet on the day of production and on the 180th day of spoilage

Attribute	Catla meat	Initial Cutlets (0 days)	Final Cutlets (18 days)
Moisture (%)	78.63	58.22	57.86
Crude Protein (%)	19.15	16.41	15.86
Fat (%)	1.26	17.28	18.20
Carbohydrate (%)	-	4.53	4.00
Ash (%)	0.96	3.56	4.08

Chemical quality parameters:

Changes in pH: The change in pH of fish muscle is usually a good index for quality assessment. The increase in pH is caused by the enzymatic degradation of fish muscle (Love, 1992 and Vareltzis *et al.*, 1997). In the present study cutlet showed slightly increased pH from 6.50 to 6.79 (Fig. 1) when stored at chilled temperature (-2 to -4°C). Bao *et al.* (2007) also reported the increasing trend of pH in Arctic charr (*Salvelinus alpines*) fillets at super chilling (-2°C) and chilling (3°C) storage temperature.

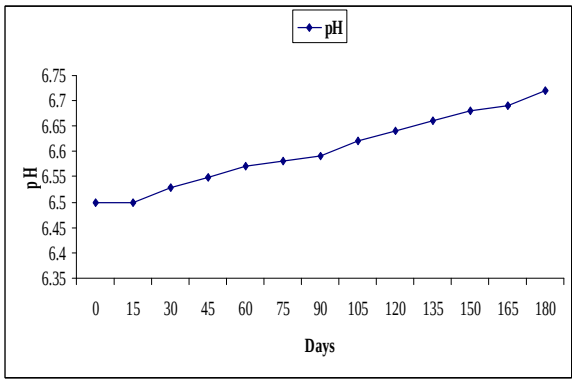

Fig. 1: Changes in pH of catla fish cutlet during frozen storage

Changes in peroxide value (PV):

The peroxide value (PV) in frozen stored cutlet showed increased from 2.6 to 5.2 meq of O_2 /Kg respectively (Fig. 2). Peroxide value of mackerel mince

cutlet prepared from bleached and unbleached surimi increased (Kamat, 1999) gradually from an initial value of 2.8 and 3.4 to 30 and 40 meq of O_2 /Kg at the end of 9 and 5 weeks period of storage at -14°C respectively. Joseph *et al.* (1984) reported decreasing trend of peroxide value in both flash fried and raw cutlets. The peroxide value of flash fried cutlets were 8.16 to 5.81, 8.16 to 1.59 and 8.16 to 4.50 meq of O_2 /Kg and raw cutlets were 9.5 to 6.23, 9.50 to 3.98 and 9.55 to 6.22 meq of O_2 /Kg at 4°C, -8°C and -20°C respectively. The cutlet is highly spiced and anti-oxidant properties of spices because of that further reduced the peroxide formation (Zain, 1980). The peroxide value of tilapia (*Oreocromis mossambicus*) fish cutlet was gradually increased upto 12-15 weeks in frozen storage and thereafter decreased (Ninan *et al.,* 2008). Battering and breading of the products can act as oxygen barrier, which will prevent the oxidation. The inclusion of spices which has strong anti-oxidant effect in the mince for the preparation of the cutlet can increase the frozen storage stability of the mince (Joseph *et al.*, 1992).

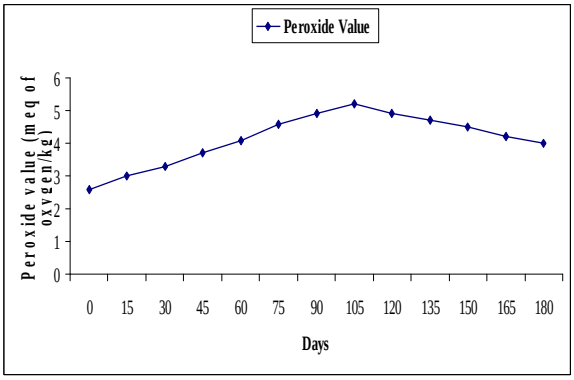

Fig. 2: Changes in peroxide value of catla fish cutlet during frozen storage

Changes in free fatty acid (FFA):

Free fatty acid of catla fish cutlet stored in chilled frozen storage showed increased in FFA from 0.95 to 2.12 mg/100g till 105th day and then onward stared decreasing to 1.77 mg/100g on 180th day (Fig. 3). The FFA is a result of enzymatic decomposition of lipid during chilled and frozen storage (Tokur *et al.*, 2004). Joseph *et al.* (1984) reported FFA in flash fried and raw cutlet at -8°C and -20°C showed insignificant changes during storage period. Reddy *et al.* (1992) reported increasing FFA in fish finger developed from croaker and pink perch meat upto 6th week and 10th week respectively and then decreased slightly upto 14th week and remained almost stable at -20°C. Tokur *et al.* (2004) reported increased FFA from the beginning of the storage up to 8th month. The result shows that FFA increased with the duration of storage.

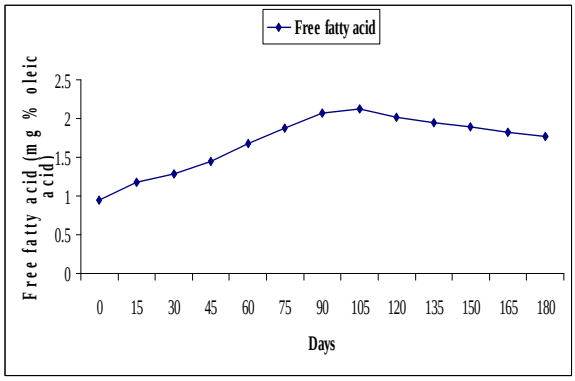

Fig. 3: Changes in free fatty acid of catla fish cutlet during frozen storage

Changes in TVB-N:

TVB-N is a commonly used chemical method to determine spoilage of fish. The TVB-N in freshwater fish and their products comes from ammonia (Tokur *et al.* 2004). TVB-N of catla fish cutlet during frozen storage increased from 4.15 to 15.06 mg/100g till 105th day and then onward stared decreasing to 10.53 mg/100g on 180th day (Fig. 4). Tokur *et al.* (2004) reported the changes in TVB-N value of fish burger produced from tilapia (*Oreochromis niloticus*) during frozen storage for 8 months. The TVB-N values decreased significantly till the 4th month, then increased in significantly, but at the end of the period had decreased to less than the fresh value. Ninan *et al.,* (2008) reported the TVB-N value was in the range of 12.4 to 20.2 mg % in tilapia (*Oreocromis mossambicus*) fish cutlet. Mohmaudzadeh *et al.* (2010) reported TVB-N in deep flounder (*Pseudorhombus elvatus*) and brushtooth lizardfish (*Saurida undosquamis*) during storage at -18°C for 5 months. TVB-N value in both groups increased significantly at the end of the second month, However, there was a decrease or no significant changes afterward. The increasing TVB-N value is related with bacterial spoilage and activity of endogenous enzymes (Chomnawang *et al.*, 2007).

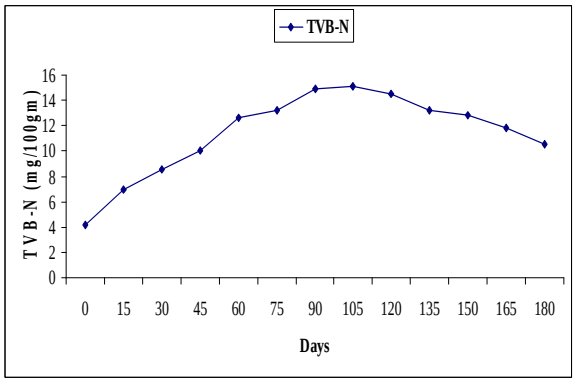

Fig. 4: Changes in TVB-N of catla fish cutlet during frozen storage

Changes in sensory quality characteristics:

The result of sensory evaluation of cutlet kept in frozen storage observed slight decrease in overall

acceptability when storage period increased from 0 to 180 days. The cutlet kept in frozen stored was not in acceptable condition after 150 days (Fig. 5). This may be due to formation of some volatile low molecular weight compounds, lipid oxidation and protein degradation during chilled and frozen storage (Undeland and Lingnert, 1999).

Joseph *et al.* (1984) reported raw and flash fried cutlets prepared from lizard fish, threadfin bream, jew fish and miscellaneous fish among that lizard fish cutlet showed highest acceptability. The raw cutlet had storage life of 6 days, 11 weeks and 19 weeks at 4°C, -8°C and -20°C respectively. The flash fried cutlets had shelf life of 22 weeks at -20°C. The flash fried cutlets were superior in organoleptic quality compared to raw cutlet during early stage of storage and at the end of storage both had almost same rating.

Reddy *et al.* (1992) reported organoleptic score of frozen fish fingers from croaker and perch during storage. The taste panel scores decreased only slightly in both the samples during the period of storage. The panelist preferred the fish fingers prepared from pink perch than those from croaker though both were quite acceptable to them. Both types of fish fingers were acceptable up to 22 weeks at -20°C. Kamat (1999) reported fish cutlets prepared from bleached and unbleached mackerel meat did not show changes in the appearance, colour and texture during storage at -14°C. Changes were more prominent in odour, taste and overall acceptability, which decreased gradually from 1st day to the end of storage. Fish cutlets prepared from bleached mackerel meat were acceptable for 2 months and from unbleached mackerel meat were acceptable upto 1 month at -14°C. Tokur *et al.* (2004) reported few changes in the sensory qualities of fish burger developed from tilapia (*Oreochromis niloticus*) at -18°C for 8 months storage. Sensory evaluation indicated that tilapia burger after 8 months storage remain acceptable. Tokur *et al.* (2006) reported fish fingers prepare from mirror carp washed mince (WF) and unwashed mince (UWF) decreased their sensory score throughout the 5 of months frozen storage at -18°C. Ninan *et al.* (2008) reported fish cutlets prepared from tilapia (*Oreocromis mossambicus*) had initially sensory score above 7, rated as good to excellent after which loss in flavor and texture was noticed. Mohmaudzadeh *et al.* (2010) reported that sensory parameters of fish burgers from deep flounder (*Pseudorhombus elvatus*) and brushtooth lizardfish (*Saurida undosquamis*) decreased significantly during storage at -18°C for 5 months. But during the storage deep flounder fish burgers receiving higher score than brushtooth lizardfish burgers at the beginning and end of the storage period.

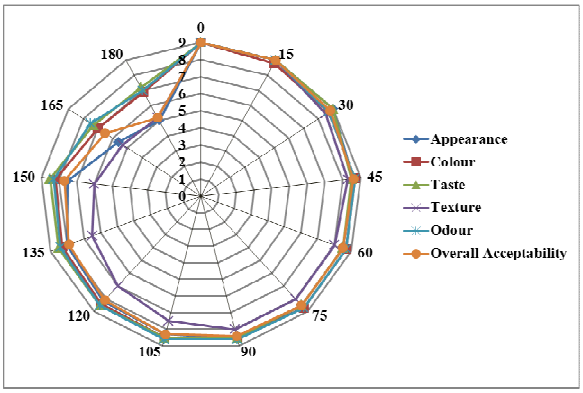

Fig. 5: Sensory evaluation of catla fish cutlet during frozen storage

CONCLUSION

The paper described quality changes of batter and bearded fish product fish cutlet based on evaluation of biochemical parameters (pH, PV, FFA and TVB-N) and sensory qualities on frozen storage. The rate of quality deterioration was an accelerated process with the passage of storage time which was assessed by means of biochemical parameters and sensory evaluation score. The batter and bearded fish product fish cutlet prepared following standardised recipe from catla, had a shelf life of 150 days.

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