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Research Article

BIOCHEMICAL AND SENSORY QUALITY CHANGES OF FISH CUTLETS, MADE FROM PANGASIUS FISH (PANGASIANODON HYPOPHTHALMUS), DURING STORAGE IN REFRIGERATED DISPLAY UNIT AT -15 TO -18 ^{O}C

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ABSTRACT

Shelf life of fish cutlet prepared from Pangasius (*Pangasianodon hypophthalmus*) fish were evaluated on the basis of biochemical and sensory qualities during its storage in refrigerated display unit (-15 to -18ºC). The meat was separated from the fish and cutlet was prepared by following standardized recipe. The cutlet was stored in a refrigerated display unit at -15 to -18ºC and subjected to biochemical and sensory evaluation at interval of two days through the study. Results of biochemical and sensory qualities indicated that the cutlet was in acceptable condition upto 16 days in refrigerated display unit (-15 to -18ºC). Biochemical parameters showed a rising trend pH, peroxide value, free fatty acid and total volatile base-Nitrogen, during the period of study. Scores for sensory parameters appearance, colour, taste, odour and overall acceptability showed a decreasing trend.

Key Words: *Biochemical Changes, Fish Cutlets, Pangasius Fish, Sensory Evaluation and Storage Study*

INTRODUCTION

Consumers around the world increased consumption of fish and fish product in recent years due to recognition of their nutritional value (Wang *et al.,* 2010). The dietary guidelines published by USFDA and department of health and human service asks to eat less fat since more fat consumption reduce approximately 30-40 % energy intake (Saritha and Patterson, 2012). There is wide scope to increase the consumption by developing value added products. There is great demand for seafood based product especially value added products, ready-to-eat 'convenience' form prominent among them is the group of battered and breaded products.

Production of Pangasius is increased in India but fish farmers practising aquaculture have expressed that the cost of feed, seed, fertilizers and lease rent have gone up considerably. Proportionately the farm gate price of fish has not increased leading to reduced margins. In fact, the fish farmers who are cultivating pangasius in the state of Andhra Pradesh, India are just about making it breakeven (Rathod *et al.,* 2012). During recent year's value addition have received wider attention because of increased urbanization there is a growing demand for value added products due to social and cultural changes in recent years (Pagarkar *et al.,* 2011). Therefore, to increase profitability development of value added product from pangasius (*P. hypophthalmus*) fish is urgent need of utilization for human consumption. However, there are almost no studies on fish cutlet developed form pangasius (*P. hypophthalmus*) fish meat. The aim of this study was to prepare fish cutlet from pangasius meat and to investigate storage characteristics viz., biochemical pH, peroxide value (PV), free fatty acid (FFA) and total volatile base-Nitrogen (TVB-N) and sensory quality changes during its storage in refrigerated display unit at -15 to -18ºC.

MATERIALS AND METHODS

Sample Preparation

Pangasius fish (*P. hypophthalmus*) were obtained from the local fish market. Fish samples were between 750 and 1200g transferred to processing hall under iced condition and then they were washed thoroughly with potable water then beheaded, gutted and again washed to get their fillets giving 57% yield, the fillets were boiled for 10 min and meat was separated manually from those cooked fillets which yielded 40% of meat based on total weight of fish.

Using standardised recipe of cutlets was prepared (Rathod *et al*., 2012). The pangasius cutlet included 40% cooked pangasius meat, 1% salt, 4% oil, 2% green chillies, 2% coriander leaves, 2.4% ginger, 2% garlic, 10% onions, 28% cooked potatoes, 0.12% pepper powder, 0.12% clove powder, 0.08% cinnamon powder, 0.08% turmeric powder, 8% bread powder.

The standardised batter mix (Pagarkat *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 powder, 0.96% car boxy 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 180ºC for 30 sec. later packed in polypropylene pouches of 100 gm capacity and stored in refrigerated display unit at -15 to -18 ºC.

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). Chemical quality analysis was performed in triplicate. Chemical and sensory quality was assessed during storage study at two days interval.

Chemical Quality

The pH was determined by taking sample (5 g) was ground with 45 ml distilled water and filtered using a filter paper. The pH of filtrate was recorded using a pH meter AOAC (2005). Oxidative stability of stored (-15 to -18ºC) pangasius fish cutlet was also measured using titrimetric determination of the amount of peroxide or hydro peroxide groups, the initial product of lipid oxidation (peroxide value). The peroxide value (PV) was expressed as milli equivalent of O_2/kg fat AOAC (2005). Free fatty acid (FFA) value was determined as per AOAC, (2005) and expressed as percent (%) of oleic acid. TVB-N contents of pangasius 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 Pangasius fish cutlets were evaluated directly by 10 trained panellists, using a nine point hedonic scale (1-dislike extremely to 9-like extremely) for product acceptability. The cutlet was deep-fried in sunflower oil until they were cooked before being presented to the panellists. Panellists scored for appearance, colour, taste, texture, odour and overall acceptability. During the evaluation sessions, the samples were coded by a letter and presented in random order

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 Pangasius Fish Meat and Pangasius Fish Cutlet

The moisture, crude protein, lipid and crude ash contents of pangasius fish meat were found to be 76.62, 14.37, 6.76 and 2.25% respectively (Table 1). Similarly, with slight variation was reported by Natrajan and Shreenivasan (1961) in moisture (78.3-79.5%), crude protein (16.8-17.5%), fat (0.69-2.4%) and ash (1.06-1.13%) contents in fresh pangasius, whereas Orban *et al.*, (2008) reported the moisture, crude

protein, fat and ash contents in fresh pangasius were 83.57, 13.60, 1.84 and 1.25%, respectively. The moisture, crude protein, lipid, carbohydrate and ash of pangasius fish cutlet were found to be 53.34, 18.43, 21.02, 4.43 and 2.78 % respectively (Table 1) which at the end of storage period in refrigerated display unit (-15 to -18ºC) changed and showed slight variation in moisture (53.34 to 53.03%), protein (18.43 to 17.36%) and carbohydrate (4.43 to 4.09%) during the storage study. The fat (23.02 to 24.93%) and ash (3.28 to 3.85%) content was increased in the same sample during its storage for 18 days (Table 1).The increase in fat and reduction in moisture content in cutlet is due to deep frying as well as dehydration during chilled storage (Ninan *et al*., 2008). The reduction of protein is due to denaturation fish muscle during chilled and frozen storage (Gopakumar, 2002). 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. Pawar (2011) reported moisture, protein, fat and ash content in flash fried cutlets was 65.71, 16.57, 14.50 and 3.22% respectively, which after chilled storage for 13 days was 65.50, 15.53, 15.05 and 3.92% respectively.

Table 1: Proximate composition of Pangasius meat, cutlet on the day of production and on the 18th day of spoilage

Attribute	Pangasius meat	Initial Cutlets (0 days)	Final Cutlets (18 days)
Moisture (%)	76.62	53.34	53.03
Crude Protein (%)	14.37	18.43	17.36
Fat (%)	06.76	21.02	22.47
Carbohydrate (%)	-	04.43	04.09
Ash (%)	02.25	02.78	03.05

Chemical Quality Parameters

The change in pH of fish muscle is usually a good index for quality assessment. It is important determining of fish quality as texture of fish.

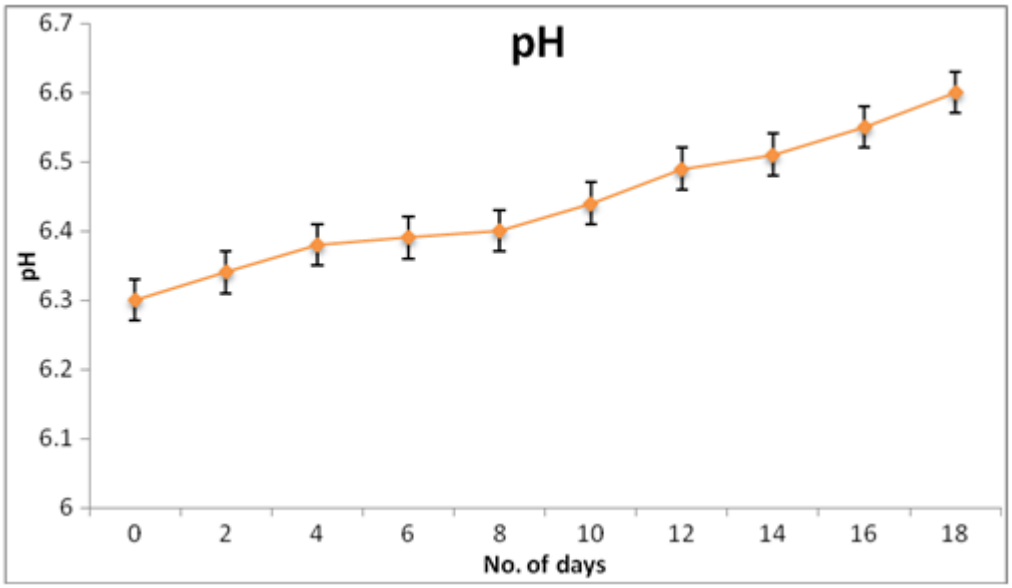

Figure 1: Changes in pH of pangasius fish cutlet during storage at -15 to -18°C for 18 days with Standard error

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 6.30 to 6.60 during storage period from 1 to 18 days when stored in refrigerated display unit (-15 to -18°C) (Figure 1). Pawar (2011) reported the cutlet made from catla fish showed increasing trend of pH from 6.50 to 6.79 when stored at -2 to -4°C.

The peroxide value (PV) in pangasius cutlet stored in refrigerated display unit (-15 to -18°C) showed an increased trend from 2.4 to 3.2 meq of O_2 /Kg respectively (Figure 2). Peroxide value (PV) is a measure of the degree of oxidation in the fat (Govindan, 1985; Gopakumar, 2002). The peroxide value was employed for determining the formation of primary oxidation products during the storage period. Oxidative rancidity is very complex deterioration in which oxygen first reacts with unsaturated fat (lipid) to form hydro peroxides, which then breaks down to substances that render the objectionable rancid flavour. The PV is a measure of first stage of rancidity. The cutlet is highly spiced and anti-oxidant properties of spices because of that further reduction in peroxide formation (Zain, 1980). Tokur *et al*., (2006) reported the changes in peroxide value of fish burger produced from tilapia (*Oreochromis niloticus*) during frozen storage for 8 months. PV was 0.18 meq/kg at the beginning of storage but increased to 5.03 meq/kg at the 6th month of storage and then decreased to 0.82 meq/kg at the 8th month. PV decreasing at the end of storage period was due to decomposition of hydro peroxide into smaller molecules. 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 cutlet (Joseph *et al*., 1992).

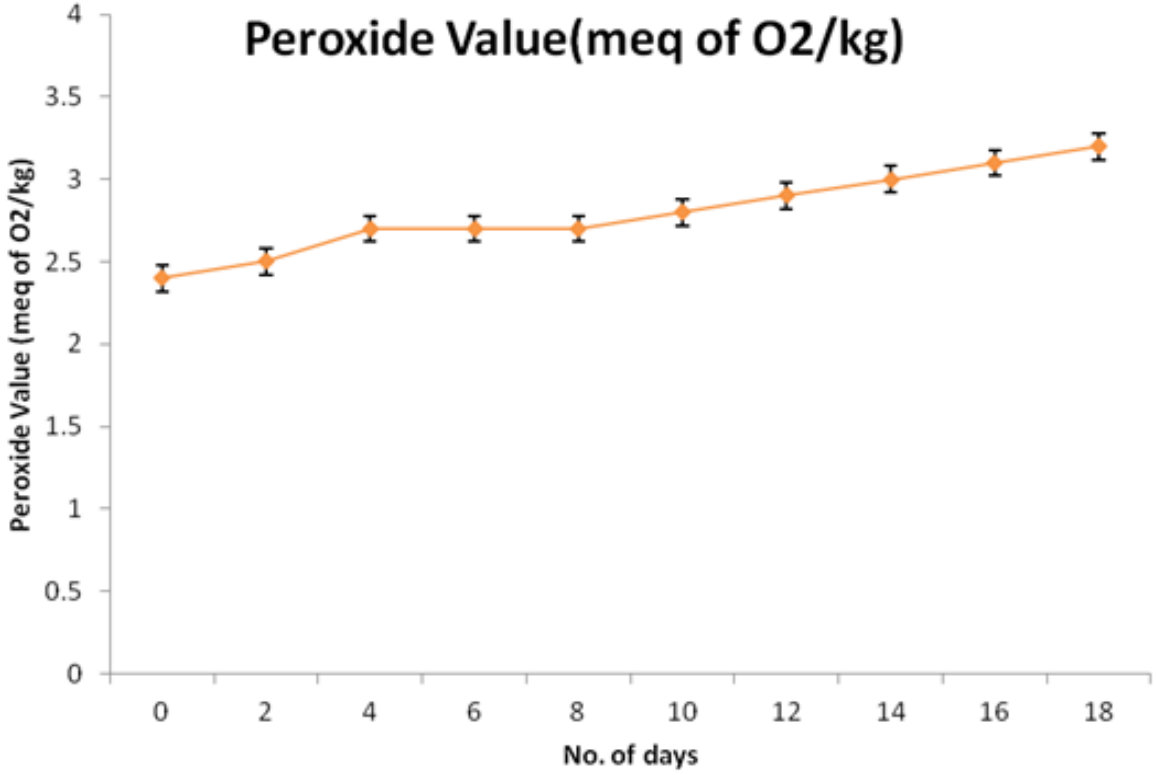

Figure 2: Changes in peroxide value of pangasius fish cutlet during storage at -15 to -18°C for 18 days with Standard error

Free Fatty Acid

(FFA) of Pangasius fish cutlet stored in refrigerated display unit (-15 to -18ºC) showed an increasing trend from 1.26 to 4.83 mg/100g (Figure 3). The FFA is a result of enzymatic decomposition of lipid during storage (Tokur *et al.*, 2006). The FFA content in the lipid of a fish is an indication of lipid hydrolysis. As the freshness quality of fish gets reduced, the FFA content in the lipids of fish increases due to the action of lipases Reddy *et al.* (2012).

Joseph *et al.*, (1984) reported FFA content in flashed fried and raw cutlet in the range of 0.98 to 1.49 and 2.03 to 2.82 mg/100g respectively at 4°C. 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.*, (2006) reported increased FFA from the beginning of the storage up to 8th month. The result shows that FFA increased with the duration of storage.

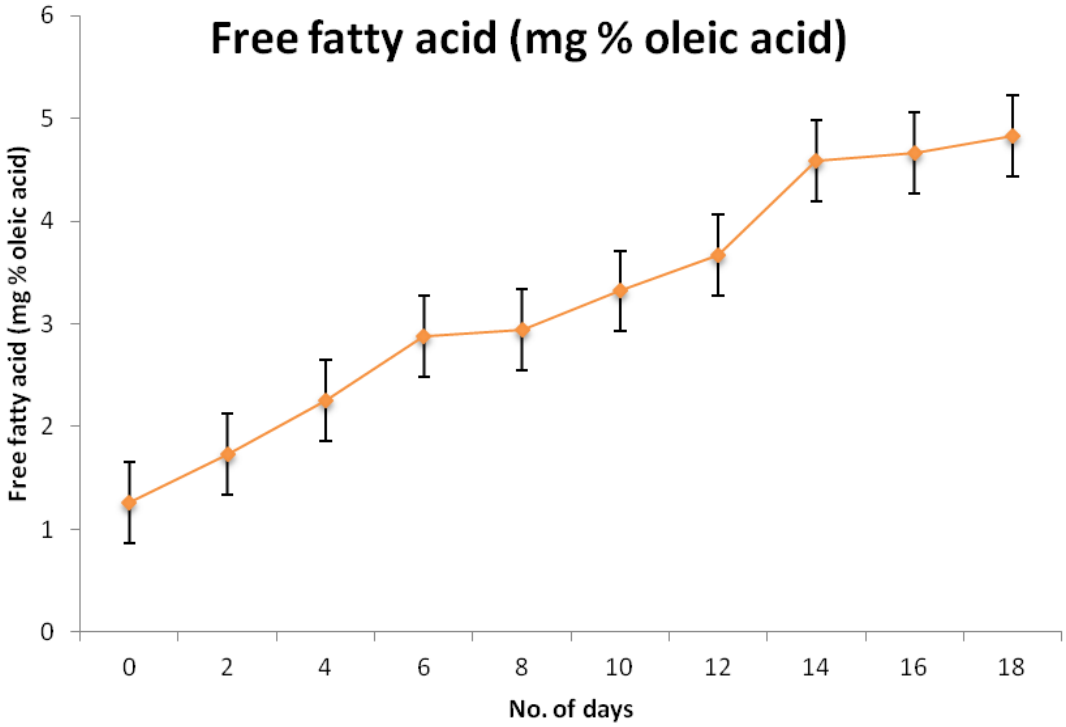

Figure 3: Changes in free fatty acid (mg % oleic acid) of pangasius fish cutlet during storage at -15 to -18°C for 18 days with Standard error

TVB-N (Total Volatile Base-Nitrogen)

Total volatile base-Nitrogen 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.*, (2006). TVB-N of pangasius fish cutlet stored in refrigerated display unit (-15 to -18ºC) in the present study showed increasing trend from 2.52 to 22.4 mg/100g (Figure 4). Bao *et al.*, (2007) reported the increasing trend of TVB-N in Arctic charr (*Salvelinus alpines*) fillets at super chilling (-2°C) and chilling (3°C) storage temperature. Tokur *et al.*, (2006) reported the changes in TVB-N value of fish burger produced from tilapia (*O. 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 (*O. mossambicus*) fish cutlet.

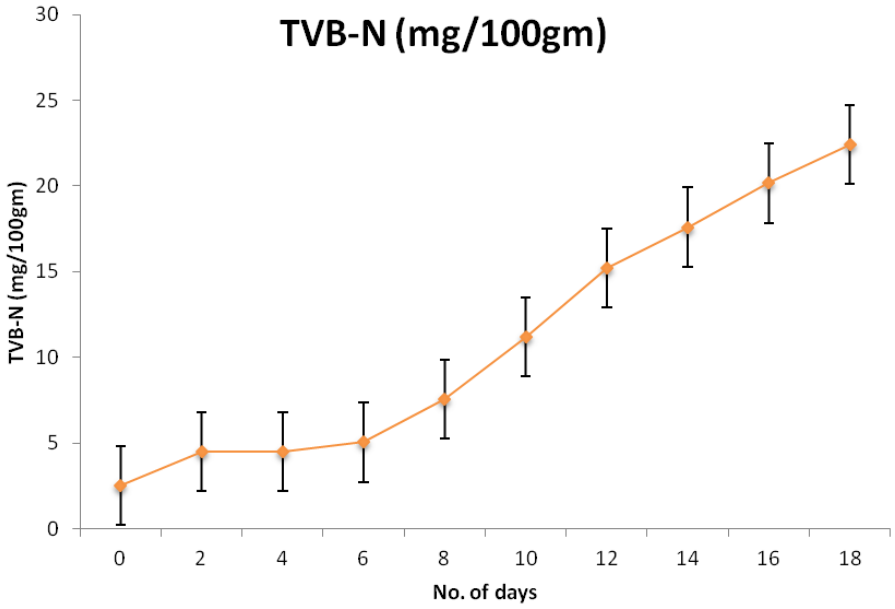

Figure 4: Changes in TVB-N (mg/100g) of pangasius fish cutlet during storage at -15 to -18°C for 18 days with Standard error

The sensory qualities of fish cutlet produced from pangasius fish were evaluated in terms of appearance, colour, taste, texture, odour and overall acceptability (Figure 5). The result of organoleptic evaluation of cutlet kept in storage (-15 to -18°C) showed slight decrease in overall acceptability of the pangasius fish cutlet when storage period increased from 0 to 18 days. The cutlet kept in storage was not in acceptable condition after 16 days.

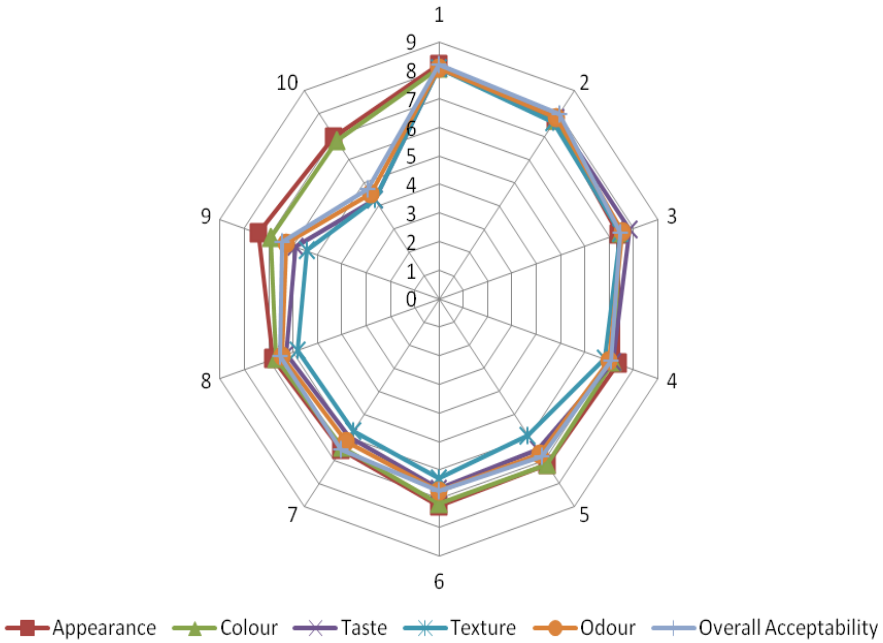

Figure 5: Organoleptic evaluation of pangasius fish cutlet during storage at -15 to -18°C for 18 days with Standard error

This may be due to formation of some volatile low molecular weight compounds, lipid oxidation and protein degradation during storage (Undeland and Lingnert, 1999) and (Pawar, 2011). The stored cutlet also showed reduced crispiness, loss in flavour and texture during storage study. The results of sensory evaluation were supported by the results of chemical analysis.

Conclusion

The paper described quality changes of batter and bearded product fish cutlet based on evaluation of biochemical parameters (pH, PV, FFA and TVB-N) and sensory qualities on storage in a refrigerated display unit (-15 to -18ºC). The rate of quality deterioration was an accelerated process with the passage of storage time. Biochemical parameters showed a rising trend pH, peroxide value, free fatty acid and total volatile base-Nitrogen, during the period of study. Scores for sensory parameters appearance, colour, taste, odour and overall acceptability showed a decreasing trend. Biochemical and sensory qualities indicated that the cutlet was in acceptable condition upto 16 days in refrigerated display unit at -15 to -18ºC.

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