SKUAST Journal of Research 26(1): 111-115; (2024)
(*DOI No. 10.5958/2349-297X.2024.00003.5*); NASS rating: 4.88

Research Paper

Quality changes and shelf life of common Carp (*Cyprinus carpio* L.) pickle at room temperature

Tariq Hussain*, Aimen Firdous, Faisal Rashid, Nasir Husain and Ashwani Kumar

Division of Post-Harvest Technology, Faculty of Fisheries, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Rangil Ganderbal-190006, Jammu and Kashmir (India)
*e-mail: *tariqbhatt@gmail.com*

(Received October10, 2023; accepted December 29, 2023)

ABSTRACT

Fish pickle from *Cyprinus carpio* was prepared with the objective that the track changes in quality of product over twelve months at room temperature were observed. The moisture, protein, fat and ash content of the freshly prepared fish pickle were found as 47.0, 14.05, 12.79 and 4.14 percent, respectively. The initial Peroxide value, TVBN, pH and titratable acidity values were found as 3.24mEqO2/kg, 4.34 mgN/100g, 5.03 and 0.6 mEq/100g respectively. The peroxide value showed an increasing trend reaching a final value of 10.23 mEqO_2/kg in the twelfth month of the study. Similarly, the TVBN value also increased and was found as 18.05 mgN/100g at the end of the study. The final titratable acidity value was found to be 0.19 mEq/100g whereas, pH value increased attaining a final value of 5.84 at the end of the study. Based on the biochemical, organoleptic quality evaluation, the pickle was rejected by the taste panel in the twelfth month of the trial, hence common carp pickle remains edible up to 11 months at room temperature.

Key words: Common carp, fish pickle, organoleptic quality

The demand for fish and its products is increasing due to their health benefits providing vital nutrients including polyunsaturated fatty acids, vitamins, minerals, and easily digestible proteins (Ahmmed, 2020). The current surge in socio-cultural shifts and rapid urbanization has increased demand for value-added fish products (Pagarkar *et al*., 2011). A range of ready-to-eat or ready-to-cook items are created by processing meat or fish by performing different processing and cooking techniques. The quality of the raw materials, handling, formulation, and processing know-how affects the final product's quality. Minced fish is used to make a variety of value-added fish products, such as fish balls, cutlets, patties, pastes, surimi, texturized goods, etc. Extensive work has been done to develop and assess the quality of various value-added fish products such as fish fingers (Praneetha *et al*., 2015), fish burgers (Ali *et al*., 2019) fish ball (Yi *et al*., 2011) etc.

Pickling is one of the easiest and most efficient ways to preserve fish for a long time (Hossain *et al*., 2018) as it involves preserving foodstuffs under high acid concentrations, enabling their preservation without refrigeration. Pickling makes a tasty and nutrient-dense appetizer, especially from fish and is believed to suppress the growth of pathogenic organisms (pH below 4.0) and have a considerable storage life (Waghmare, George, and Sonavane, 2017). The demand for fish pickles is on the rise due to increased acceptance in recent years. There are numerous techniques for producing fish pickles in India, both traditional and modern ones, wherein the fish is subjected to different processing treatments (i.e., salting, drying, frying, baking, smoking and pickling) in various combinations. Pickling fish in vinegar and edible oil with spices, salt and condiments provides a ready-to-eat, highly acceptable convenience product with good self-stability at room temperature because of which fish pickle is gaining more and more acceptance in recent years and the demand is on the rise.

A member of the largest freshwater fish family, the Cyprinidae, the common carp (*Cyprinus carpio*) is popular in Asia and a few European countries, though it is widely distributed worldwide. Common carp is one of the most frequently grown and economically significant freshwater fish species which accounts for about 7.7% of global finfish aquaculture production, (FAO, 2020). Value addition by pickling of common carp is one of the methods to increase its consumption and minimize post-harvest losses.

MATERIALS AND METHODS

Collection of Sample: Common carp (*Cyprinus carpio*) was procured from local retail market and brought to the laboratory in iced packed conditions using an insulated box. The experiment was conducted in the Fish Processing Laboratory of Division of Post-Harvest Technology, Faculty of Fisheries, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir.

Preparation of fish pickle: Common carp pickle was prepared as per the formulation of Gopakumar (1998) with slight modification. Ingredients used for the preparation of the pickle are given in Table 1. Fish was dressed, washed, deboned, salted, drained and fried in vegetable oil and left to cool. Ginger garlic paste, green chili, red chili powder and other condiments were fried and mixed with the fried fish. After taking the mixture off the fire, the remaining salt and vinegar were added, and then it was allowed to cool. The pickle was then packed in the previously sterilized dry wide mouthed glass bottles and secured with lids and stored at room temperature.

Table 1: Ingredients for Fish Pickle

Ingredients	Quantity
Fish	1000g
Mustard seeds	25g
Green chilies	50g
Garlic	200g
Ginger	200g
Chili powder	35g
Garam masala	20g
Cumin powder	25g
Salt	40g
Vinegar	250ml
Mustard oil	400ml

Proximate composition: The moisture, crude protein, crude fat and ash of common carp pickle were analyzed according to the methods of AOAC (2010).

pH value: Tissue sample of 5 g was blended in 45 ml distilled water using homogenizer and then the pH was measured using digital pH meter.

Total Volatile Base Nitrogen (TVBN): The total volatile base nitrogen (TVBN) was determined based on an adaptation of the current official European steam-distillation method (EEC, 1995).

Peroxide value: Peroxide value was assessed by standard AOCS (1989) protocol and value was expressed as milli-Equivalents O_2/kg of fat.

Sensory evaluation: The sensory evaluation was performed by ten trained panelists. Samples were evaluated on a 10- point scale (IS: 6273 [II], 1971). The characteristics were texture, color, appearance, odor, succulence, and overall acceptability of the pickle during the storage study.

Statistical analysis: The statistical analysis package SPSS 20.0 (SPSS Inc, Chicago, IL, USA) was used to calculate mean and standard error of the values obtained for various parameters. Relevant graphs were prepared using Microsoft Office Excel 2019.

RESULTS AND DISCUSSION

Proximate Composition: Data pertaining to the proximate composition of fresh common carp and pickle is presented in the Table-2. Moisture content of the common carp was found to be 76.09 percent whereas that of the pickle was 47 percent. Protein content of the fresh fish and pickle was found as 17.95 and 14.05 percent, respectively. Frying of fish results in the loss of moisture and the decrease in the protein content in fish products is attributed to the denaturation of proteins and leaching out of extractable water-soluble protein fraction (Negara *et al*., 2021, Gandotra *et al.*, 2012). Lipid and ash content of fresh fish was 9.47 and 1.57 percent, respectively and for pickle the values of lipid and ash were 12.79 and 4.14 percent, respectively. Shikha *et al.*, (2018) also reported high lipid content in fish pickle prepared from Thai pangus (*Pangasianodon hypophthalamus*) muscle because of absorption of oil during deep frying. Ash content of pickle is also higher than the fresh fish due to moisture loss after frying and cooking of the fish and addition of other ingredients (Kocatepe *et al*., 2011).

Table 2: Proximate composition of fresh common carp and pickle

	Moisture (%)	Protein (%)	Lipid (%)	Ash (%)
Fresh Fish	76.09 ± 0.002	17.95 ± 0.008	9.47 ± 0.005	1.57 ± 0.01
Pickle	47.00 ± 0.005	14.05 ± 0.01	12.79 ± 0.15	4.14 ± 0.02

Data is expressed as mean ± SE

Changes in pH and Titratable acidity: The pH of the fish pickle increased from an initial value of 5.03 to a final value of 5.84 during the storage period (Fig 1). Similar changes in pH of various fish pickle were reported by Shirikar *et al*., 2009. Titratable acidity showed decreasing trend during the study and reached to a final value of value of 0.19 mEq/100g in the twelfth month (Fig. 1). The increased titratable acidity could be due to loss of moisture and the effect of condiments mix (Sahu *et al*., 2012).

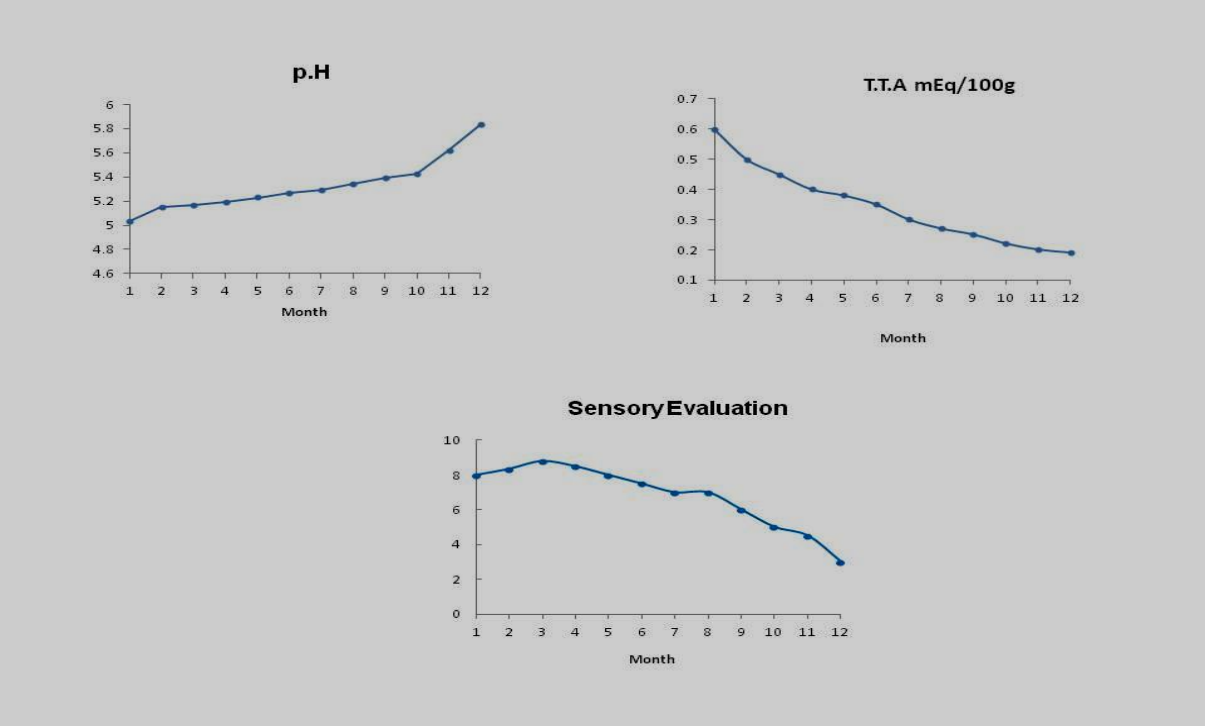

Fig 1: Changes in the p.H, Titratable acidity and overall sensory score of common carp pickle during storage

Changes in TVBN and Peroxide value: The TVBN values of fish pickle showed an increasing trend throughout the storage period (Table 3). The initial TVBN value of fish pickle was 4.34 mg/100g which gradually increased with the storage period and reached to a value of 18.05 mg/100g in the 12th month. TVBN mainly accumulates in fish during the later phase of spoilage after the bacterial population has grown. Wahgmare *et al*., (2015) also observed an increasing trend in the TVBN value of rohu pickle during storage for 72 days. Shikha *et al*., (2018) reported that the TVBN value increases with increase in bacterial activity.

The result of present study corroborates the findings of many researchers who also reported an increasing trend in TVBN (Saritha *et al*., 2014; Farid *et al*., 2014), however very less bacterial activity was witnessed in fish pickle in the current study as TVB-N value remained below the consumable limit of less than 20 mg N/100 g (Pearson, 1997). The initial Peroxide value of the fish pickle was 3.24 mEq O_2/kg of oil, which increased to 10.23 mEqO2/kg of oil in the 12th month at room temperature storage (Table 3). In the present study, the PV value of fish pickle surpassed the permitted range of 10–20 mEqO_2/kg of fat in a year (Connell, 1995). The increased peroxide value could be attributed to fat oxidation that takes place during storage (Patil *et al*., 2014).

Table 3: Changes in the TVBN and Peroxide value of common carp pickle during storage

Month	Parameter	
	TVBN (mg/100g)	**PV** (mEqO_2/Kg fat)
1	4.34±0.01	3.24±0.02
2	4.66±0.02	3.60±0.01
3	4.98±0.09	3.78±0.01
4	5.32±0.01	4.15±0.02
5	5.99±0.01	4.69±0.09
6	6.4± 0.03	5.01±0.04
7	7.25±0.07	5.87±0.09
8	8.71±0.09	6.52±0.02
9	9.56±0.02	7.19±0.09
10	12.25±0.01	8.53±0.01
11	15.76±0.03	9.77±0.02
12	18.01±0.09	10.23±0.08

Kumar and Basu (2001) also found that the peroxide value increased in prawn pickles from 1.37 to 10.25 mEqO2/kg of oil during the 7-month storage period. Patil *et al*., (2014) also reported an increasing trend of peroxide value throughout the storage study of 150 days from 0.29 to 1.16 mEqO2/kg of oil for pangus pickle.

Data is expressed as Mean ± SE

Sensory evaluation: Sensory score data of the fish pickle stored at room temperature for a period of 12 months is presented in Fig 1. Quality of fish products is affected by the changes in the underlying physico-chemical properties (Bhat *et al.*, 2018). The overall sensory acceptability rating increased in first 4 months after which it showed a downward trend. The sensory score indicated rejection of the fish pickle in the 12th month of the storage. Dhar and Karthikeyan (2014) also reported that the sensory attributes of prawn pickles decreased over time during 180 days of storage at ambient temperature.

CONCLUSION

The best way to preserve fish and decrease post-harvest losses can be achieved by the process of pickling. Based on biochemical and organoleptic quality evaluation, common carp pickle remains edible up to 11 months at room temperature.

REFERENCES

Ahmmed, M. K., Ahmmed, F., Tian, H., Carne, A., and Bekhit, A. E. D. 2020. Marine omega-3 (n-3) phospholipids: A comprehensive review of their properties, sources, bioavailability, and relation to brain health. *Comprehensive Reviews in Food Science and Food Safety*, **19:** 64-123.

Ali, H. A., Mansour, E. H., E-lBedawey, A. E. F. A. and Osheba, A. S. 2019. Evaluation of tilapia fish burgers as affected by different replacement levels of mashed pumpkin or mashed potato. *Journal of the Saudi Society of Agricultural Sciences*, **18**: 127-132.

AOAC. 2010. Official methods of analysis (18th ed.). Washington, DC: Association of Official Analytical Chemists.

AOCS. 1989. Official methods and recommended practices of American oil chemist's society.5thEdition. AOAC international, Washington DC.

Bhat, T. H., Chouksey, M. K., Balange, A. K., and Nayak, B. B. 2018. Effect of severing skeletal muscle at different stage of rigor on the quality of pacific white shrimp (*Litopenaeus vannamei).Journal of Food Processing and Preservation*, **42**: e13363.

Connell J. J. 1995. Control of fish quality. Fourth edition published by fishing Books, a division of Blackwell Scientific Ltd.

Dhar, B., and Karthikeyan, M. 2014. Functional relationship between storage time and quality parameters of prawn pickle from *Macrobrachium dayanum* (Henderson, 1893).

EEC.1995 Decision 95/149/EC. Total volatile basic nitrogen TVBN limit values for certain categories of fishery products and specifying the analysis method to be used. *Official Journal*, **97**: 84-87

Farid FB, Latifa GA, Nahid MN, *et al*. 2014. Effect of Sun-drying on proximate composition and pH of Shoal fish (*C. striatus*; Bloch, 1801) treated with Salt and Salt turmeric storage at Room Temperature (27°C–30°C). IOSR *Journal of Agriculture and Veterinary Science*, **7:** 1–8.

FAO. 2020. The State of World Aquaculture. Rome: FAO Fisheries Department.

Gandotra R, Koul M, Gupta S, *et al*. 2012 Change in proximate composition and microbial count by low temperature preservation in fish muscle of *Labeo rohita* (Ham-Buch). *Journal of Pharmacy and Biological Sciences*, **2:** 13-17.

Gopakumar, K. 1998. Utilization of bycatches and low-value fish in India. RAP Publication (FAO).

Hossain, M. I., Shikha, F. H., and Akter, K. 2018. Changes in the nutritional composition of Thai pangus (*Pangasianodon hypophthalamus*) pickle during storage at refrigeration temperature: Changes in nutritional composition of fish pickle. *Journal of the Bangladesh Agricultural University*, **16:** 553-559.

IS: 6273[II]. 1971. Indian Standard, Guide for sensory evaluation of foods (Part-II, Methods and evaluation cards). New Delhi, India: Indian Standards Institution

Kocatepe D, Turan H, Taskaya G., *et al*. 2011. Effects of cooking methods on the proximate composition of Black Sea anchovy (*Engraulis encrasicolus*). *Academic Food Journal*, **36:** 71-75.

Kumar, S., and Basu, S. 2001. Preparation of prawn pickle and its storage characteristics. *Journal of the Indian Fisheries Association*, **28:** 105-111.

Negara, B. F. S. P., Tirtawijaya, G., Cho, W. H., Harwanto, D., Sohn, J. H., Kim, J. S., and Choi, J. S. 2021. Effects of Frying Processes on the Nutritional and Sensory Characteristics of Different Mackerel Products. *Processes*, **9:** 1645.

Pagarkar, A.U., Joshi, V.R., Baug, T.E., *et al*. 2011. Value addition is need of seafood industries. *Fish Coops*, **23:** 8-14.

Patil, S. S., Pagarkar, A. U., Chaudhary, K. J., Desai, A. S., and Shaikh, S. M. 2014. Organoleptic and biochemical quality changes in fish pickle prepared from freshwater catfish pangasius (*Pangasianodon hypothalamus*). *Indian Veterinary Journal*, **91:** 12-14.

Pearson, D. 1997. The Chemical Analysis of Foods.6th Edition. Long Man Group Ltd., SafiyariSh, Moradi. pp. 488-518.

Praneetha, S. S., Dhanapal, K., Reddy, G. V. S. and Balasubramanian, A. 2015. Development of fish finger from rohu (*Labeo rohita*) and its quality evaluation during refrigerated storage condition. *International Journal of Science Environment and Technology*, **4:** 1457-1468.

Sahu, B. B., Maji, U. J., Samal, R., Sahoo, M., Mohanty, U. L., Sahu, A. K., and Kumar, R. 2012. Quality and storage stability of low acid Murrel (*Channa striatus*) fish pickle at room temperature.

Saritha, K., Jeyasanta, K. and Patterson, J. 2014. Physico-chemical and sensorial characteristics of commercial seafood pickles of Tuticorin super markets, Tamil Nadu, India. *International Food Research Journal*, **21:** 649-654.

Shikha, F. H., Hossain, M. I., Akter, K., and Rahman, M. A. 2018. Development of pickle from Thai pangus (*Pangasianodon hypophthalamus*) muscle and changes in its nutritional composition during storage: Development of pickle from Thai pangus and its shelf-life. *Journal of the Bangladesh Agricultural University*, **16:** 545-552.

Shirikar, D. A., Khedkar G. D. and Sudhakar, N. S. 2009. Preparation of pickle products from Anchovies (*Stolephorus sp.)* and studies on quality changes during storage. *Journal food processing and preservation*, **34:** 176-190.

Waghmare, K. M., Devkate, A. D., Golandaj, A. A., and Surnar, S. R. 2015. Standardising Smoking Treatments for Improved Organoleptic Quality and Storage Stability of Carp Pickle. *Research Journal of Recent Sciences*, ISSN, 2277, 2502.

Waghmare, K. M., George, S., and Sonavane, A. E. 2017. Standardising preprocess treatments for improved sensory quality and storage stability of carp pickle. *International Journal of Food and Fermentation Technology*, **7:** 55-66.

Yi, S., Li, J., Zhu, J., Lin, Y., Fu, L., Chen, W. and Li, X. 2011.Effect of tea polyphenols on microbiological and biochemical quality of Collichthys fish ball. *Journal of the Science of Food and Agriculture*, **91:** 1591-1597.