



## **A study on biochemical and sensory quality changes of value added products from *Scomberomorus guttatus***

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### **Abstract**

The aim of the present investigation was to study the shelf life of value added products (pickle and chakkali) prepared from marine edible fish *Scomberomorus guttatus* on the basis of biochemical, microbial and sensory qualities during its storage period. Fish pickle and chakkali were prepared from the meat of *S. guttatus* without adding any chemical preservatives. Results indicated that the fish pickle was in acceptable condition up to 38 to 45 days at room temperature. Nutritional composition such as moisture, protein, carbohydrate, lipid and ash contents showed decreasing trend. pH was recorded as low and total viable count was initially low but increased during the storage period. Fish chakkali was in acceptable condition up to 18 to 21 days at room temperature. Protein content of fish chakkali decreased during the storage period and increasing trend in the pH, moisture and ash contents were recorded. Total viable count of fish chakkali was recorded as low count in storage period. Scores for sensory parameters appearance, colour, flavour, odour, mouth feel, texture and overall acceptability of the products were determined during the storage period; it showed a decreasing trend but was within the acceptable limits.

**Keywords:** *Scomberomorus guttatus*, Fish pickle, Fish chakkali, Biochemical composition, Sensory quality

### **Introduction**

Fish is a highly proteinous food consumed by a larger percentage of populace because of its availability and palatability, while fewer percentages do so because of its nutritional value (Foran et al., 2005). Often fish provides essential nourishment, especially high quality proteins and fats (omega 3 and 6 fatty acids), vitamins and minerals. Increasing population and industrialization of cities tend to growing of tendency to ready to eat products. The products

are manufactured from fish meat according to its nutritional value have a special among the ready to eat products (Venugopal, 2006).

Pickling is an ancient method of food preservation. Pickles are significant among the dietary items consumed by man and it is one of the remarkable appetizers. Pickles are the preserved food and it retains its wholesomeness, nutritive values and has long shelf life and is used as an important side dish in India. Normally pickles are prepared from fruits and vegetables

with the addition of salt, vinegar, spices and its shelf life is generally 8 to 10 months. Compared to the vegetarian pickle, the seafood pickle acts as a table enricher and is becoming popular. The seafood pickle is delicious and constitutes a good source of protein, glycogen and minerals compared with vegetarian pickles because of its omega fatty acid content. Seafood pickles are safe without any harmful bacteria and are having long shelf life period at ambient temperature. Ready to eat products are susceptible to environmental contamination with spoilage and pathogenic microorganisms during handling of these products after cooking and before cooking or during packing (Zhu et al., 2004). These undesirable changes result from protein denaturation and lipid oxidation (Benjakul et al., 2005). Chakkali is a traditional savoury product with strong spicy flavour from Indian origin. The most widely consumed extruded snacks are made primarily with cereals or grains due to their good expansion characteristics; however, they tend to be low in protein and many other nutrients. Since fish have been claimed as the high protein sources, the addition of this ingredient will increase the protein content of chakkali (Meng et al., 2010).

Biochemical and sensory quality changes of fish cutlets, made from pangasius fish (*Pangasianodon hypophthalmus*), during storage in refrigerated display unit at -15 to -18°C was studied by Rathod and Pagarkar (2013). Viji et al., (2015) studied the effects of turmeric treatment and smoking on the shelf life of ready-to-cook fillets from Pangasius catfish during chill storage. Gupta and Roopma (2019) studied on the biochemical and sensory changes in the value added product (Fish Noodles) stored under ambient storage conditions. Nutritional and sensory quality of value added food products from Indian mackerel, *Rastrelliger kanagartha* was analysed by Feona and Chitra (2020). Biochemical properties and shelf life of value-added fish cube and powder developed from hilsa shad (*Tenualosa ilisha*) was tested by Nowsad et al., (2021). Balikci et al., (2022) studied the Impact of thyme, rosemary and basil extracts on the chemical, sensory and microbiological quality of vacuumed packed mackerel balls. With this

background, the objective of this study was designed to prepare the ready to eat value added fish products (fish pickle and fish chakkali) from *Scomberomorus guttatus* and to investigate the biochemical, microbiological and sensory quality changes during its storage period.

## **Materials and Methods**

### **Sample collection and preparation**

Freshly landed *Scomberomorus guttatus* were collected from Pamban at Rameswaram (Landing centre) and the samples were transported to the laboratory using a deep freezer. Upon arrival, fish samples were washed thoroughly with potable water then beheaded and gutted. Washed meat was separated and minced or filleted by hand.

### **Fish pickle**

**For marination:** Fish - 500 g, Chilli powder - 2 tsp, Turmeric powder- ½ tsp, Salt – 10g.

**For pickle:** Based on the highest average sensory scores for all attributes, the best recipe was selected with the ingredients of Marinated fish mince - 500g, Garlic - 5 piece, Ginger - ½ inch, Chilli powder - 3 tsp, Mustard seed - 1 tsp, Fenugreek - 5g, Turmeric powder -1 tsp, Vinegar - 2 ml, Salt – 25g, Gingely oil - 100ml.

### **Method for preparation**

The soft fish meats were cut into small pieces and thoroughly mixed with turmeric powder, chilli powder, salt and kept for 30 minutes for marination. Ginger and garlic were fried in oil until it became golden brown in colour. The marinate was fried in oil until it turns in to golden brown and cooled. Mustard and fenugreek were fried in oil until bursting and all the ingredients were heated under low flame. Then the fried meat, ginger and garlic were added and stirred thoroughly for 15 minutes. The final product was cooled and packed in an air tight glass containers. Analytical procedure for biochemical, microbiological and sensory quality changes were done for 45 days of storage in room temperature.

## Fish chakkali

**Ingredients:** Fish mince - 100g, Rice flour - 250 g, Black gram flour - 50 g, Roasted flour - As per need, Cumin - 2 g, Butter - 5g, Sesame seeds – 5gm, Sunflower oil - 200 ml and salt -12 g.

## Method for preparation

The fish fillets were boiled for 10 - 15 minutes and cooled at room temperature. The muscles were made in to a fine paste in an electric or stone grinder. The fish paste were added into the rice powder along with other ingredients and knead in to a soft dough by adding sufficient amount of water and was kept for 15 minutes. The soft dough was put into the piston type hand extruder having a designed die at the end of the extruder to form a product with desirable shapes as that of popular chakkali. For deep fat frying, oil was pre-heated up to 180°C. Then the chakkali was deep fried for 2-3 minutes. The products were removed from the pan with the help of strainer and were allowed to cool and the products were packed in air tight containers and stored in room temperature for 0 to 20 days.

## Determination of Biochemical composition

To estimate the freshness and nutritional quality of the products, pH (Ronald and Ronald, 1991), moisture (AOAC, 2005), protein (Lowry et al., 1951), lipid and ash contents were analysed using the standard procedures.

## Microbial analysis

One gram (1g) of fish sample was dissolved in sterile deionized water and serially diluted. One millilitre (1ml) of appropriate dilutions was seeded on plate count agar using spread plate method, the medium was then incubated at 37° C for 24 hours. The plate count agar was examined and colonies present were counted and recorded after incubation period to get the total viable count in cfu/g.

## Sensory analysis of fish products produced from *Scomberomorus guttatus*

Various sensory characteristics such as appearance, colour, flavour, odour, mouth feel, texture and the overall acceptability were evaluated during the storage period by a group of 7 panellists using a nine (9) point hedonic scale. The average score of 5 was considered to be the borderline of acceptability (9- like extremely; 8- like very much; 7- like moderately; 6- like slightly; < 5 bad).

## Results and Discussion

The pH, moisture, protein, lipid, ash and TVC count of raw muscle *Scomberomorus guttatus* were found to be 6.91, 73.9%, 22.2%, 1.56% and  $3 \times 10^2$  cfu/g respectively.

## Fish pickle

The proximate compositions of raw fillets of *S. guttatus* are shown in table 1. The proximate composition of *S. guttatus* pickle at the initial (0 day) and final days (45<sup>th</sup>day) were recorded in Table (2). On the initial day  $31.6 \pm 0.1\%$  of moisture,  $19.3 \pm 0.19\%$  of protein,  $12.5 \pm 0.1\%$  of lipid and  $2.35 \pm 0.07\%$  of ash contents were recorded. At the end of the 45<sup>th</sup> day, the fish pickle kept in storage at room temperature showed slight variation in the proximate composition and had moisture, protein, fat and ash contents of  $26.2 \pm 0.2\%$ ,  $13.5 \pm 0.2\%$ ,  $11.05 \pm 0.022\%$  and  $2.0 \pm 0.07\%$  respectively. The changes in pH and TVC count of *S. guttatus* fish pickle during storage were presented in table 3. At the initial stage the pH value was recorded as  $6.31 \pm 0.70$  and at the end of the storage period it was recorded as  $6.0 \pm 0.0$ . TVC count on the initial day was recorded as  $1.5 \times 10^3$  Cfug. At the end of the 45<sup>th</sup> day of storage period the TVC was recorded as  $2.0 \times 10^3$  Cfug.

**Table 1: Proximate composition and microbial count of raw fillets of *S. Guttatus***

S. No.	Parameters	Raw fillets
1.	Moisture (%)	73.9± 0.07
2.	Protein (%)	22.2±0.1
3.	Lipid (%)	0.22± 0.1
3.	Ash (%)	1.56±0.02
4.	pH	6.91±0.07
5.	TVC (Cfu/g)	3×10 <sup>2</sup>

Values are shown as mean ± SD

**Table 2: Biochemical composition of *S. guttatus* fish pickle and fish chakkali during storage period**

S.No	Parameters	Fish pickle		Fish chakkali	
		Initial Day (1 <sup>st</sup> day)	Final Day (45 <sup>th</sup> Day)	Initial Day (1 <sup>st</sup> day)	Final Day (21 <sup>st</sup> Day)
1.	Moisture (%)	31.6±0.1	26.2 ± 0.2	0.80 ± 0.07	2.40 ± 0.07
2.	Protein (%)	19.3 ± 0.19	13.5 ± 0.2	6.43±0.07	6.39 ± 0.6
3.	Lipid (%)	12.5 ± 0.1	11.05±0.022	13.50 ± 0.03	14.20 ± 0.01
4.	Ash (%)	2.35 ± 0.07	2.0 ± 0.07	2.46 ± 0.01	2.90 ± 0.01

Values are shown as mean ± SD

**Table 3: pH and Total Viable Count of fish pickle and fish chakkali during storage period**

S.No.	Parameters	Fish pickle		Fish chakkali	
		Initial Day (1 <sup>st</sup> day)	Final Day (45 <sup>th</sup> Day)	Initial Day (1 <sup>st</sup> day)	Final Day (21 <sup>st</sup> Day)
1.	pH	6.31±0.70	6.0±0.0	7.0±0.1	7.6±0.1
2.	TVC (Cfu/g)	1.5×10 <sup>3</sup>	2.0×10 <sup>3</sup>	Very low count	Very low count

Values are shown as mean ± SD

The assessment of sensory characteristics of the pickle immediately after preparation was evaluated by panel members. The sensory parameters such as general appearance, colour, flavour, texture, taste and overall acceptability of the product was examined and results were shown in table 4. The general appearance of the fish pickle was bright shining with reddish brown colour. The flavour of the pickle was natural odour. According to the panel members, the taste

of the pickle prepared from *S. guttatus* was very good taste after mouth chewing. The overall quality of the pickle prepared from *S. guttatus* was excellent. The initial scores of sensory analysis for appearance, colour, flavour, odour, mouth feel, texture and overall acceptability were 9.0, 9.0, 8.85, 8.71, 9.0, 8.71 and 9.0 respectively. At the end of the 45<sup>th</sup> day storage, the scores were 6.85, 7.14, 6.42, 7.0, 7.28, 7.0 and 6.5 respectively.

On the first day of fish pickle preparation, pH value observed was  $6.31 \pm 0.70$  and it was dropped gradually ( $6.0 \pm 0.0$ ) during storage of pickle. Dhanapal et al., (1994) and Behanan et al., (1992) also observed a decreasing trend in pH value during the storage of fish pickles. Kumar and Basu (2001) also observed a decreasing ( $4.64$  to  $4.51$ ) trend in pH value during the storage (120 days) of prawn pickles. Chellaram (2015) found that reduction in the pH values from  $5.49$  to  $5.25$  in *P. trapezium* meat pickle. Hafiz et al., (2013) also observed a decreased ( $3.94$  to  $3.80$ ) trend in pH values during the storage of meat pickle.

The maximum moisture content recorded on initial day ( $31.6 \pm 0.1\%$ ) and it was gradually decreased to  $26.2 \pm 0.2\%$  on 45<sup>th</sup> day of storage. The protein content of the fish pickle was higher ( $19.3 \pm 0.19\%$ ) on the initial day and it was gradually reduced during storage period ( $13.5 \pm 0.2\%$ ). According to Silva (2002), the protein content in lean fish has 15 - 20%. The protein level variations are probably due to the quality and quantity variation in seafood, the level of salt used and the period of preservation, which determined the degree of proteolytic activity during storage (Saritha, 2014). The maximum lipid content was recorded on initial day ( $12.5 \pm 0.1\%$ ) and the lowest value ( $11.05 \pm 0.022\%$ ) was on final day. Generally, higher lipid content was observed in pickle than comparing to the fresh raw fish. This may be due to deep frying and addition of high quantity gingelly oil increase lipid content of seafood pickles (Renita and Patterson, 2013) and it decreased during storage period.

The sensory evaluation studies on pickle prepared using *S. guttatus* muscles was subjected to various pre-process treatments have demonstrated that marinating and frying are beneficial to the improvement in the consumer acceptability of the products. The acid source of vinegar has also been found most acceptable. From the results the sensory analysis scores of fish pickle at the initial stage was rated as “like extremely” by the panel members. At the end of the 45 days of storage the scores were declined and rated as “like

moderately”. The results of sensory evaluation of pickle stored at ambient temperature showed gradual decrease in overall acceptability from 0 - 45 days. Fish pickle stored at room temperature had the shelf life of 38 to 45 days. After 45 days of preservation the significant changes were noticed and the pickle remarked as unpleasant to consume.

The TVC of fish pickle were found to be low initially but increased during storage period, the relatively lower level of bacterial load in the fish pickles may be due to the presence of added spices and vinegar. In the present study the mustard, turmeric powder, garlic and ginger were used for the preparation of pickle and they may have a role in reducing the growth of microorganisms. In the traditional types of pickles prepared from fresh mango, lemon and other vegetables, the organic acids are provided by the fruit itself and since the fish pickle meat dose not contribute any organic acids, it becomes necessary to add the acids to provide the necessary texture and flavour and to bring down the pH level (Challaram, 2015).

### **Fish chakkali**

The changes in moisture, protein and ash content of fish chakkali prepared from *S. guttatus* are presented in table (2). Moisture content on the initial day was  $0.80 \pm 0.07\%$  and on the final day it was  $2.40 \pm 0.07\%$ . On the initial day protein, lipid and ash contents recorded as  $6.43 \pm 0.07\%$ ,  $13.50 \pm 0.031\%$  and  $2.46 \pm 0.01\%$  respectively.  $6.39 \pm 0.6\%$ ,  $14.20 \pm 0.01\%$  and  $2.90 \pm 0.01\%$  of protein, lipid and ash contents were recorded on the final day. On the initial day (0 day), pH of fish chakkali was  $7.0 \pm 0.1$  and on the final day (21days) the recorded pH was  $7.6 \pm 0.1$ . The TVC was very low count on initial and final days (Table 3). The initial scores of sensory analysis for appearance, colour, flavour, odour, mouth feel, texture and overall acceptability were 9.0, 9.0, 8.71, 8.85, 9.0, 9.0 and 9.0 respectively. At the end of the 21<sup>st</sup> day storage, the scores were 6.0, 6.57, 6.28, 6.28, 6.14, 6.0 and 6.0 respectively (Table 4).

**Table 4: Sensory analysis of fish pickle and fish chakkali prepared from *S. Guttatus***

Sensory Characters	Fish pickle		Fish chakkali	
	Initial Day (1 <sup>st</sup> day)	Final Day (45 <sup>th</sup> Day)	Initial Day (1 <sup>st</sup> day)	Final Day (21 <sup>st</sup> Day)
Appearance	9.0±0.0	6.85±0.69	9.0±0.0	6.0±0.57
Colour	9.0±0.0	7.14±0.69	9.0±0.0	6.57±0.98
Flavour	8.85±0.38	6.42±0.69	8.71±0.5	6.28±0.76
Odour	8.71±0.5	7.0± 1.15	8.85±0.38	6.28±0.76
Mouth feel	9.0±0.0	7.28±0.54	9.0±0.0	6.14±0.90
Texture	8.71±0.5	7.0± 0.81	9.0±0.0	6.0±1.15
Overall acceptability	9.0±0.0	6.5±0.69	9.0±0.0	6.0±1.15

Values are shown as mean ± SD

The results showed that the pH of the fish chakkali sample gradually increased during storage period. Initial day it had low moisture content (0.80 ± 0.07%) and had a very crispy texture. High moisture content (2.40 ± 0.07%) was recorded on final day and it had a less crispiness. The protein content was decreased

during the storage period; this may be due the increase of moisture content in chakkali sample. The ash content was increased during the storage period: this may be due to the addition of the ingredients during the preparation of fish products.

**Table 5: Shelf life fish pickle and fish chakkali during storage period**

Shelf life (Days)	Fish pickle	Fish chakkali
	38 - 45	18 – 21

The sensory analysis was mainly attributed by ‘crispy’ and ‘crunchy’. For a product to be ‘crispy’ and ‘crunchy’ the texture should be firm and brittle. It is also clear that the sound emission during biting and mastication has a large effect on the sensory perception (Sarangam et al., 2015). The results of the sensory evaluation of fish chakkali showed that there was a decline in overall quality characteristics during storage period of 18 to 21 days. The initial scores of overall acceptability for fish chakkali rated as “extremely like” and the end of the storage scores were declined and rated as “like slightly”. After storage period the changes was highly marked and the fish chakkali was remarked as unpleasant to consume.

## Conclusion

Ready to serve value added fish products are recent innovation in local market. The present investigation focused on the biochemical, sensory and shelf life qualities of pickle and chakkali prepared from *Scomberomorus guttatus* and the results indicate that the qualities during storage period were within the acceptable limit. The maximum shelf life period of pickle and chakkali were 45 and 21 days respectively. Sensory qualities of the products can fulfil the consumers’ demands with quality assurance and longer shelf life. The information presented in this study will promote the greater and more effective value added fish products from nutritionally rich marine edible fish *Scomberomorus guttatus*.

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**How to cite this article:**

Chitra G. and Merline, X. (2023). A study on biochemical and sensory quality changes of value added products from *Scomberomorus guttatus*. *Int. J. Adv. Res. Biol. Sci.* 10(2): 18-25.  
DOI: <http://dx.doi.org/10.22192/ijarbs.2023.10.02.003>