Research Article

# Potential Utilization of Tulsi Extract as Natural Preservative for Tuna Fish during Chilled Storage

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**Abstract**

The present study was conducted to assess the effects of tulsi extract or water dip (control) treatments on the physical, chemical and sensorial quality attributes of Big Eye Tuna (*Thunnus obesus*) chunks during chilled storage for 10 days. Results indicated that control tuna chunks samples have been shown to lose texture, color and gradual deterioration in quality attributes with chilled storage. The rate of these deteriorations are increased as the time of storage progressed. On the other hand, tulsi extract treated tuna chunk samples exhibited significantly higher moisture retention, tenderness and bound water at any given time of chilled storage as compared with control samples. The present work also demonstrated significantly lower values of drip loss and peroxide value and higher sensory quality attributes in tulsi extract treated samples. Results indicated that economic, physical, chemical and sensorial quality advantages have been resulted from soaking Big Eye Tuna chunk in 3% tulsi extract solution for 30 minutes prior to chilling. With these results, we can suggest that 3% tulsi extract treatment would be an alternative way to improve the quality of tuna chunks during chilled storage.

**Keywords:** Fish chunk, Tulsi extract, Drip loss, Quality change, Peroxide value

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## Introduction

Fish is one of the highly nutritious food commodities which constitute an important component of diet for many peoples around the world. At the same time fish and seafood is highly perishable commodity, susceptible to both chemical and microbial deterioration. Presence of high levels of moisture content, nutrients and pH render fish an easily perishable product, often going bad within a short period of post mortem [1]. Total marine fish landings of India has increased from 2.88 MT to 3.49 MT in the last 12 years (2007-2018) registering a growth of 21.1 % [2]. Total landings of tunnies in 2018 were 1.09 million tonnes as reported by CMFRI (2019) [3]. Several antimicrobial compounds have been used since long to delay microbial proliferation and oxidative changes in fish [4]. Several studies on preservation of shrimps using food grade STPP has been done by Suyani *et al.* (2019b) [5]. But recently, researchers have been focusing on natural preservatives for controlling the microbial and chemical mechanisms responsible for spoilage in fish.

*Ociumum tenuiflorum* commonly called Tulsi is an aromatic plant. Tulsi have antioxidant, antibacterial and immunomodulatory properties [6, 7]. Several studies of antimicrobial properties of tulsi extract against human pathogens has been done Subramanian *et al.* (2014) [8]. But still now no studies of tulsi extract has been carried against fish preservation. Thus the aim of this study was to determine the effectiveness and quality difference between tulsi extract treated and non-treated Big Eye Tuna chunks samples.

## Materials and Methods

### *Sample preparation*

The present study was conducted at College of Fisheries Science, Junagadh Agricultural University, Veraval, Gujarat, India in the year 2018. Initially, 2 Kg Big eye tuna (*Thunnus obesus*) was purchased from Kharakuwa fish market located near Veraval, Gujarat, India. Then it was washed and cut into chunks and again washed with the tap water for several times, then divided into four groups (each contains 194.03±2.86 g of chunks) and immediately cooled on ice before being treated in tulsi extract solution. Tuna chunks were divided into 2 groups, one group of samples were soaked in 1%, 2% and 3% tulsi extract solution for 30 min (Tulsi extract treated) and were named as T1, T2 and T3 respectively and second group of samples were soaked in cold distilled water for 30 min (Control). Then samples

were packed in LDPE plastic pouch. Control and tulsi extract treated samples were subjected to chilled storage for different intervals of time up to 10 days. Samples of control, 1%, 2% and 3% were analyzed at 3 days interval for examination.

### *Analytical methods*

Big eye tuna chunk samples were analyzed before chilling (zero time), after 4, 7 and 10 days of chilled storage for their chemical composition, physical properties & organoleptic evaluation. At each time of interval, the samples were thawed at room temperature prior to analysis. Peroxide value was determined according to the method descried by Nielsen [9]. Yield (%) was calculated by analyzing weight differences observed in the samples before and after chilled storage. Sensory quality was analyzed based on the organoleptic test by scoring appearance, odor, texture and overall acceptability of treated and non-treated tuna chunk samples. The evaluation of tuna chunk samples were used a 9-point hedonic scale when 1, extremely dislike; 2, very much dislike; 3, moderately dislike; 4, slightly dislike; 5, neither like nor dislike; 6, slightly like; 7, moderately like; 8, very much like; 9, extremely like [10].

### *Calculation*

$$\text{Drip loss (\%)} = \frac{(W1 - W2)\ X\ 100}{(W1)}$$

### *Statistical analysis*

All the statistical analysis was carried out in triplicates and data obtained were compared and analyzed under Microsoft Excel Ver. 2013 software. Drip loss (%) was calculated by the weight differences during the study period.

## Results and Discussion

### *Drip loss*

Referring to **Table 1**, it could be observed that at any given time of chilled storage tulsi extract treated samples showed lower drip loss as compared with control sample. Concerning drip loss, it is worth mentioning that drip results from the inability of the thawed muscle to reabsorb all of the separated water, which had been previously frozen. Formation of drip brings about the loss of weight, nutrient and flavor components, an unpleasant appearance of seafood, and a tough texture. Therefore, the more drip loss the lower the biological value and palatability properties of chunk samples and this will lead to weight loss which will have negative impact on financial value [11]. Also, T3 samples showed the significant least drip loss than control and T1 and T2 samples.

**Table 1** Physical analysis includes the yield (%) or drip loss of control and tulsi extract-treated Big eye tuna chunk samples

| Tuna chunk samples | Control | T1 | T2 | T3 |
|---|---|---|---|---|
| Weight before frozen storage (W1) | 195.43±0.41 | 196.14±0.25 | 193.93±0.20 | 190.17±0.30 |
| Weight after frozen storage (4days) (W2) | 148.17±0.47 | 154.93±0.30 | 153.33±0.49 | 161.80±0.43 |
| Drip loss (%) | 24.18±0.12 | 21.01±0.15 | 20.93±0.19 | 14.92±0.14 |

### *Sensory Evaluation*

Organoleptic evaluations for the raw tuna chunk samples (at zero time) were rated as excellent (≥ 9), at that time the samples had fresh seaweedy odor; red color of tuna chunk flesh; bright shining appearance and firm and elastic texture. Throughout the storage period, there were decreases and significant changes in all sensorial criteria (appearance, odor, taste and overall acceptability). However, at the end of frozen storage time overall acceptability scores indicated that control samples were organoleptically unacceptable, they were rated as poor quality. During chilled storage, the sensory qualities decreased because the major cellular components of fish were gradually deteriorated and the leaching of pigments along with drip water resulted a gradual loss of brightness of fish muscle [12] (**Table 2**). The degree of freshness of the tuna chunk samples treated with tulsi extract was higher than those treated in water containing no tulsi extract (Control) (Table 2). However, the sample treated with 3% tulsi extract showed the significantly higher acceptability than control and 1% and 2% treated samples. Thus control samples after 10 days of storage will be unacceptable for consumption and but further studies required for treated samples for enhanced shelf life of the samples.

**Table 2** Sensory panel scores of control (C) and tulsi extract treated (1%, 2% and 3%) tuna chunk samples

| Storage period (days) | Chunk Samples | Appearance | Color | Odor | Overall acceptability |
|---|---|---|---|---|---|
| 4 | Control | 8.20±0.10 | 8.27±0.06 | 8.39±0.04 | 8.22±0.11 |
| | T1 | 8.18±0.05 | 8.15±0.17 | 7.89±0.10 | 7.97±0.05 |
| | T2 | 7.20±0.26 | 7.22±0.11 | 7.62±0.14 | 7.43±0.25 |
| | T3 | 8.01±0.03 | 7.85±0.05 | 7.55±0.06 | 7.60±0.05 |
| 7 | Control | 7.26±0.20 | 7.10±0.10 | 7.63±0.20 | 7.23±0.06 |
| | T1 | 6.98±0.00 | 7.33±0.32 | 7.31±0.12 | 7.21±0.11 |
| | T2 | 6.95±0.04 | 7.02±0.06 | 6.83±0.06 | 6.93±0.03 |
| | T3 | 6.96±0.05 | 7.46±0.05 | 7.34±0.05 | 7.25±0.02 |
| 10 | Control | 5.16±0.05 | 5.15±0.05 | 5.20±0.01 | 5.17±0.02 |
| | T1 | 5.34±0.20 | 5.11±0.11 | 5.27±0.15 | 5.24±0.05 |
| | T2 | 5.37±0.06 | 5.53±0.06 | 5.63±0.14 | 5.51±0.01 |
| | T3 | 6.03±0.07 | 6.03±0.05 | 6.10±0.09 | 6.05±0.04 |

***Peroxide value***

The changes of peroxide value as primary products of lipid oxidation are shown in **Figure 1**. The PV content significantly increased in all the treatments during the 10 days storage. The highest value (4.73±0.15 mEq/kg) of peroxide was recorded for the control, while the lowest value (0.56±0.05 mEq/kg) was observed in the sample treated with 3% tulsi extract. Also, it was observed that the PV content decreased progressively, as the concentration of the tulsi extract increases. Since peroxides are inversely related to development of rancidity, it is inferential that the sample with the highest concentration (3%) of tulsi extract was the most effective in slowing down primary peroxidation, when compared to other samples. This result is in agreement with studies done by Kumolu-Johnson and Ndimele (2011) on ginger extract preservation of smoked catfish [13]. It also agrees with the studies of Siripongvutikorn *et al.* (2009) [14], that spices activities as antioxidant are directly related to their concentration.

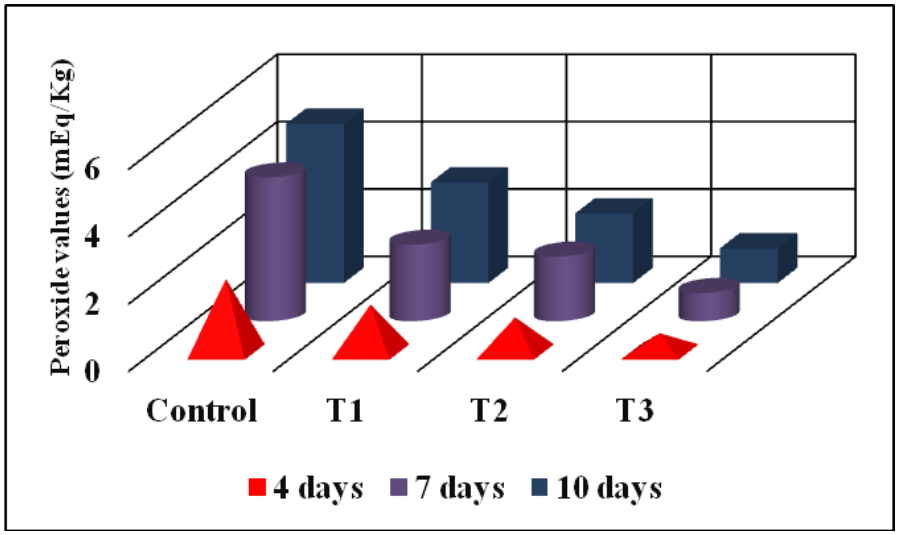


**Figure 1** Effect of tulsi extract concentration and storage duration on Peroxide value of Tuna chunks

## Conclusion

From the results it is apparent that tulsi extract is a natural preservative used for the maintenance of the functional properties of the seafood proteins which helps in the preservation of the muscle integrity, inhibits the drip loss and helps to prevent the economic loss during the thawing. 3% tulsi extract treated samples showed good color, texture and odor. Also it showed less peroxide value which indicates low level of lipid oxidation and thereby enhancing tenderness of seafood by restricting protein denaturation; and reduces other deterioration of tuna chunks quality during chilled storage. However, more studies are still required to optimize the encapsulation process and support the observed results for higher concentration and use of other plant extracts.

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