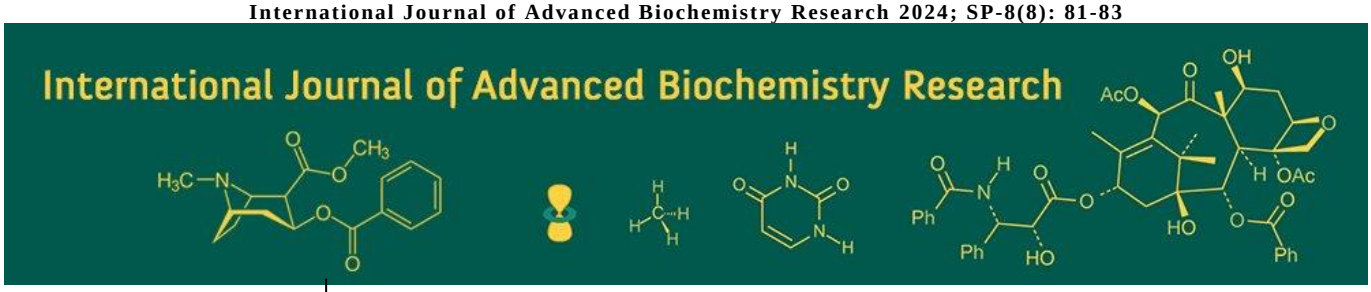

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Dalavi PD
M.Sc. Scholar, Department of PHM (Meat, Poultry, and Fish), PGI-PHTM, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Mulani SJ
M.Sc. Scholar, Department of PHM (Fruit, Vegetable, and Flower), PGI-PHTM, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Bhujbal PK
M.Sc. Scholar, Department of PHM (Meat, Poultry, and Fish), PGI-PHTM, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Corresponding Author:
Dalavi PD
M.Sc. Scholar, Department of PHM (Meat, Poultry, and Fish), PGI-PHTM, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Colour stability of tilapia (*Oreochromis niloticus*) fillets in - 18 °C for a 120 days storage period

Dalavi PD, Mulani SJ and Bhujbal PK

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Abstract
Tilapia is the second most farmed fish in the world. It is mostly preferred to be consumed in the form of fillets. The experiment entitled was conducted in Factorial Completely Randomised Design (FCRD) for different parameters with 4 main treatments *viz.* T0 (control) in which untreated fillets were done IQF at freezing temp:(- 40 °C) & storage at (-18 °C) for 120 days, T1 - Pre-treatment of NaCl (2%)+ STPP (3%) for 2 hrs + glazing - 10% + IQF freezing (Temp: - 40 °C) & frozen storage at (- 18 °C) for 120 days, T2 - Pre- treatment of NaCl (2%)+ STPP (3%) + blanching at temp:75 °C, Time: 2 Min + glazing - 10% + IQF freezing (temp: - 40 °C) & frozen storage at (-18 °C) for 120 days, T3 - Pre-treatment of NaCl (2%)+ STPP (3%) for 2 hrs, blast freezing & frozen storage at (-18 °C) for 120 days were analysed for changes in physical, biochemical, microbiological parameters and sensory qualities.
It was observed that fillets with pretreatment of NaCl (2%)+ STPP (3%) for 2 hrs+ blanching at temp:75 °C, Time: 2 Min + glazing - 10% + IQF freezing (Temp: - 40 °C) exhibited higher rate of L*, a* and b* colour values at the end of storage period of 120 days as compared to other fillets.

Keywords: Tilapia, fillets, treatments

Introduction
Seafood has a great nutritional value due to its abundance in necessary amino acids, vital fatty acids, minerals, and vitamins, as well as its low content in saturated fats and cholesterol. One of the most significant sources of animal protein in the tropics is fish, which is also widely acknowledged as an excellent source of other nutrients for the maintenance of a healthy body (Andrew, 2001) [1]. Due to the superior product quality, fish has been preserved by freezing for thousands of years (Persson and Londahl, 1993) [10]. The value of fish depends on how fresh it is, and as its exportability decreases, its look, flavour, and other quality of flavour, texture, and consumer acceptability declines (Kagawa *et al*. 2002) [5]. Fish fillets comprise the meat of the fish, which is the cadaverous muscles and fat as opposed to the bones and organs. Tilapia are often grown in ponds using comprehensive, semi-intensive, and intense production techniques. Rapid growth, high change tolerance, adaptation to a variety of environments with varying salinity and dissolved oxygen, resistance to stress and disease, captive reproduction, brief gestation periods, feeding from low nutrition levels, and accepting artificial food right away after absorbing the yolk sac are the main causes of the high level of tilapia production. Fillets are generally attained by slicing the fish parallel to the spine, rather than vertical to the spine as is the case with steaks. Fish from both marine and aquaculture origins can be refrigerated using freezing-point storage, which regulates the temperature between 0 °C and the fish's freezing point. The freezing point of tilapia is about -7 °C, according to (Chen and Pan, 1995) [2].
I.Q.F is the latest technology available in freezing and with the advent of the same, it is now possible to preserve and store for more than a year, with the colour, flavour and texture of produce remaining as good as fresh. In IQF, each piece is frozen individually using technique of fluidization resulting in freezing only in 10 to 12 minutes which otherwise takes at least 3 to 4 hours or even more in the blast freezer (Pruthi,1995). Air blast freezing is the process of taking a product at a temperature(generally chilled but occasionally at ambient temperature) and freezing it between 12 and 48 hrs, to its asked storehouse temperature which varies from product to product(e.g. fish = −20 °C, beef = −18 °C) (Dempsey *et al*., 2012) [4].

Blanching - It is a unit operation previous to freezing, canning, drying in which substances are hotted for the purpose of inactivating enzymes; modifying texture; conserving colour, flavour, and nutritive value; and removing trapped air. (Corcuera *et al*. 2004) [3]

Materials and Methods

Freshwater tilapia (*Oreochromis niloticus)* locally known as *chilapi* were procured from the market and filleted. The fillets were taken to the factory in an icebox. The fillets were then washed thoroughly and divided into 15 each for 4 different treatments as T0, T1, T2, T3. Firstly the untreated/control (T0) were frozen by IQF. Then the remaining fillets were treated with 2% NaCl and 3% STPP for 2 hrs. T1 & T2 are glazed & blanched and only T3 fillets were used for blast freezing, remaining T1, T2 fillets were separately IQF. At last all fillets were put into separate LDPE packets according to their treatments and packed in a corrugated fibre board & kept in frozen storage at -18 °C for 120 days.

Methods of Analysis

The stored samples were analysed on a regular interval of every 15 days from the day of storage.

Colour: Konica minolta colour reader was used. The Color readings were expressed by machine (L*, a* and b*) system (Marcet *et al*., 2018) [8]. L*,a* and b* indicate the whiteness/darkness, which could be white. The minimum for L* would be zero, which could be black. The axes have no numerical limits. Positive a* is red and negative of a* is green. Positive of b* is yellow and negative of b* is blue. The Color of the samples was evaluated after 10 min cooling at room temperature.

Statistical Evaluation

The data were analysed to test significant differences by applying an analysis of variances (ANOVA) tool available in Ms-Excel 2010. The significant differences were tested by 5% level of significance and are mentioned as $p<0.05$ for significant differences (Panse and Sukhatme,1985).The experimental data was analysed statistically using Factorial Completely Randomised Design (FCRD).

Results and Discussion

Colour

L* Value -

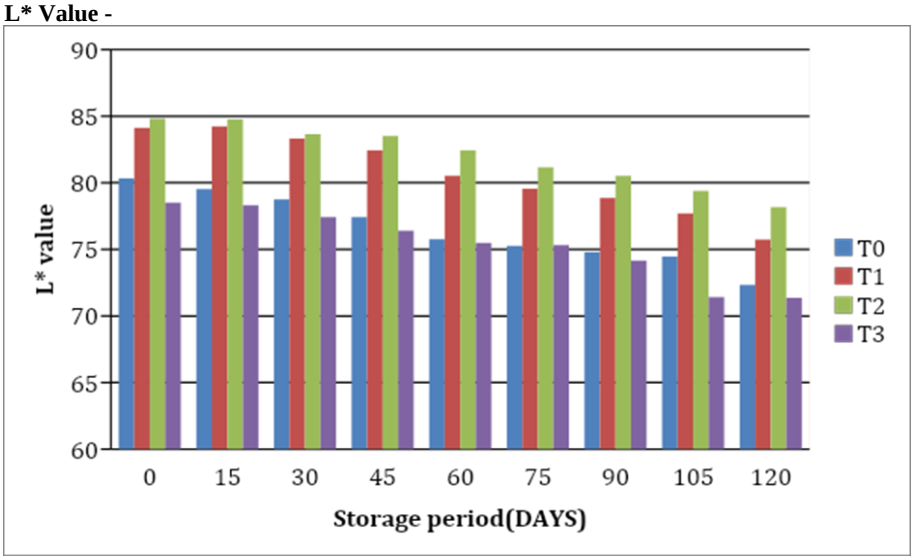

Fig 1: Effect of treatments on L* value of tilapia fillets during frozen storage

a* Value –

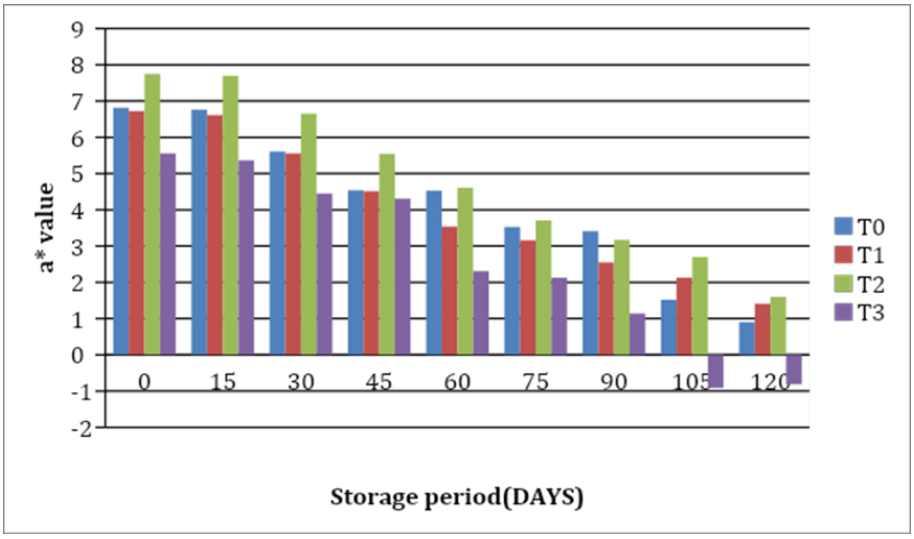

Fig 2: Effect of treatments on a* value of tilapia fillets during frozen storage.

b* value –

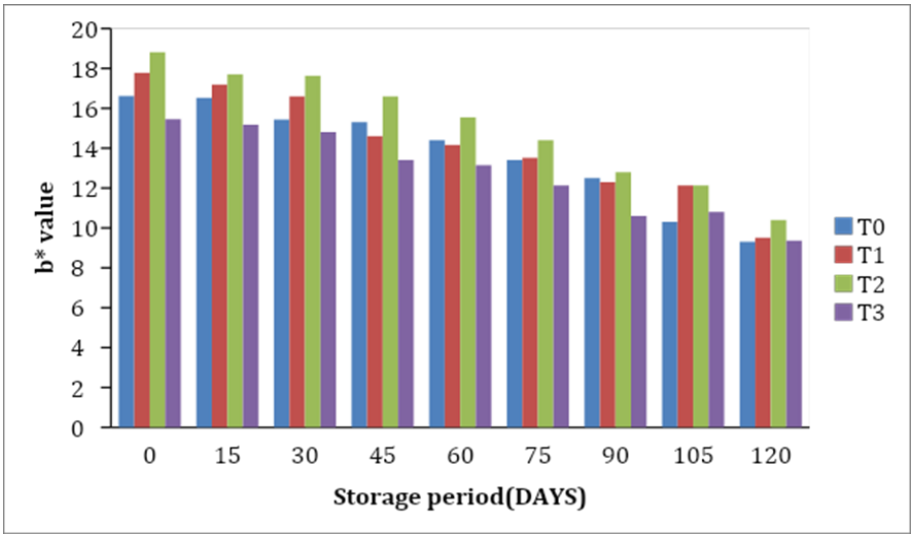

Fig 3: Effect of treatments on b* value of tilapia fillets during frozen storage

Colour values decreased as the storage period increased. Similar results were observed by Sajjan *et al*., (2015) [12] in deboned tilapia fish in which the highest colour values (L *= 52.10, a *=2.08 and b *= 12.30) were observed in the fresh deboned samples that were not subjected to frozen storage, while the least colour value (L *= 45.93, a *= 0.28 and b *= 10.86) was recorded for a deboned meat sample that was stored for 90 days. With the increase in the storage period the colour values were decreasing. Also the similar trend was observed by Kermit and Jerry (1991) [6] on characterization and frozen storage stability of cod mince subjected to mechanical separation of seal worms or cod worm. The difference in colour values in samples probably could be attributed to dissimilarities in properties of the light-scattering cellular matrix, as mentioned by (Little *et al*., 1979) [7].

Conclusion

Present investigation concluded that fillets with pretreatment of NaCl (2%)+ STPP (3%) for 2 hrs+ blanching at temp:75 °C, Time: 2 Min + glazing - 10% + IQF freezing (Temp: -40 °C) exhibited higher rate of L*, a* and b* colour values at the end of storage period of 120 days as compared to other fillets.

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