

# Improving the Quality of Catfish Burger by Adding *Zataria Multiflora* Boiss. Essential Oil

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## INTRODUCTION

- Essential oils (EOs) are regarded as “natural preservatives” as compared with chemical preservatives, and their use in foods meets the current demands of consumers for mildly processed or natural products (Nychas 1995). EOs are aromatic oily liquids obtained from plant material. Extracts from oregano, thyme, rosemary, sage and mint are some of the EOs that have been used to improve sensory characteristics (taste, odor, appearance) and extend the shelf life of foods (Tsigarida *et al.* 2000). *Zataria multiflora* Boiss is considered to be one of the most important natural preservatives.

- *Zataria multiflora* Boiss (Saatar or Zaatar) is a member of thyme family. The essential oil of *Z. multiflora* possesses significant quantities of phenolic compounds, which exhibits antioxidant, antibacterial and antifungal activities (Saei-Dehkordi et al., 2010; Moradi et al.,2011; Ehsani et al., 2013). In addition, one of the major limitations to the use of EOs in food preservation is the persistence of their strong aroma, which could affect the organoleptic properties of foods.

- The European catfish, *Silurus glanis* Linnaeus, 1758, also known as wels or sheatfish is one of the largest freshwater fish species. This species is native to rivers of Eastern Europe and Western Asia, but is currently spreading throughout Europe and the world due to its popularity among anglers and interest in it as a potential species for aquaculture (Alp et al. 2011). Two *Silurus* species inhabit Turkish freshwaters: *Silurus glanis* and *Silurus triostegus*.

- European catfish meat is very tasty, and as a fatty fish, provides more DHA and EPA; therefore, its application in fish burger production will definitely improve nutritional value of the product. **The objective of this study** was to examine the effects of *Z. multiflora* essential oil on the quality changes of catfish burgers during refrigerated storage at 4°C.

## MATERIALS AND METHODS

- *Zataria multiflora Boiss*

*Zataria multiflora* Boiss. essential oil was purchased from Arifoglu Company (Turkey).

- *Fish*

The fish samples were caught from Atatürk Dam (in the Turkey) lake by using gillnets. Having been transferred to the laboratory, the fish were cleaned, filleted and skinned.

## Catfish burger preparation

Fish burgers were prepared according to the method of Tokur et al. (2004). with minor modification.

85% minced european catfish, 7% corn flour, 5% wheat flour, 0.3% chile pepper, 0.3% garlic powder, 1.8 % salt and 0.6% sugar were thoroughly mixed for five minutes and divided three into portions. First portion was used as control, while the other portions were mixed with ZMEO (0.2 % and 0.4%), respectively.

After preparing mixture, the obtained pastes were formed into 50 g fishburger using cardboard meat box, packed in foam plates. Then, they were stored at 4 °C for 15 days and analysed periodically for sensory analysis, microbial growth and chemical.

- *Nutritional analysis*

- Lipid content was measured by the method of Bligh & Dyer (1959).
- Ash and moisture contents were determined as described by AOAC (1984).
- Crude protein content of the burgers was determined by applying the Micro-Kjeldahl method. (AOAC 1990).



- *Chemical analysis*

- *Thiobarbituric acid.* Thiobarbituric acid (TBA) was determined according to the method proposed by Tarladgis et al. (1960).
- The peroxide values were expressed in units of meq/ kg of sample (Mattissek et al. 1992).

- ***Microbiological analysis***

- For the preparation of samples, 10 g of catfish peptone water (Merck, Cat No. 107228) and homogenised for 2 min with a stomacher. Samples (0.1 mL) of serial dilutions of burger homogenates were spread on the surface of agar plates. Total viable counts were determined using plate count agar (Merck, 105463) after incubation for 48 h at 37°C. Microbiological data are logarithm of the number of colony-forming units per gram (log CFU/g).

- ***Sensory analysis***

The sensory evaluation panel consisted of 10 panelists aging between 25 and 60 years (students and researchers of Fisheries Faculty). Sensory analysis was performed using the methods of Kurtcan and Gonul (1987). Panelists were asked to evaluate the sample's overall acceptability of odor, flavour and appearance on a 5-point hedonic scale ranging from very poor (1) to very good (5). All burgers were served to panelists after being grilled (250-300 °C) for 3 min to evaluate the sensory attributes of the samples by using 5-point descriptive scale

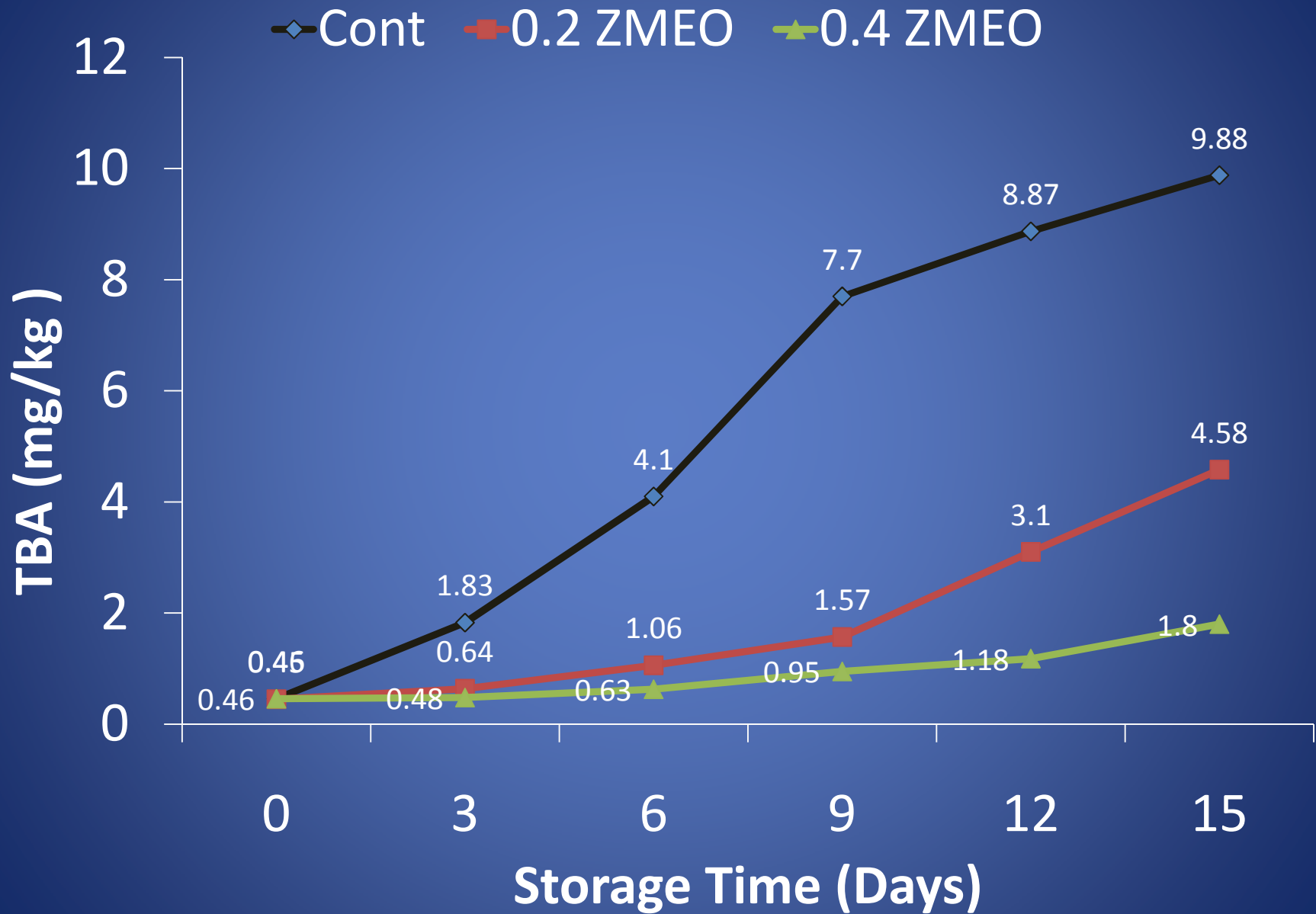
- ***Statistical analysis***

All analytical determinations were performed every three days for 15 days. By using the SAS program, the data was processed by the analysis of variance.

## RESULTS AND DISCUSSION

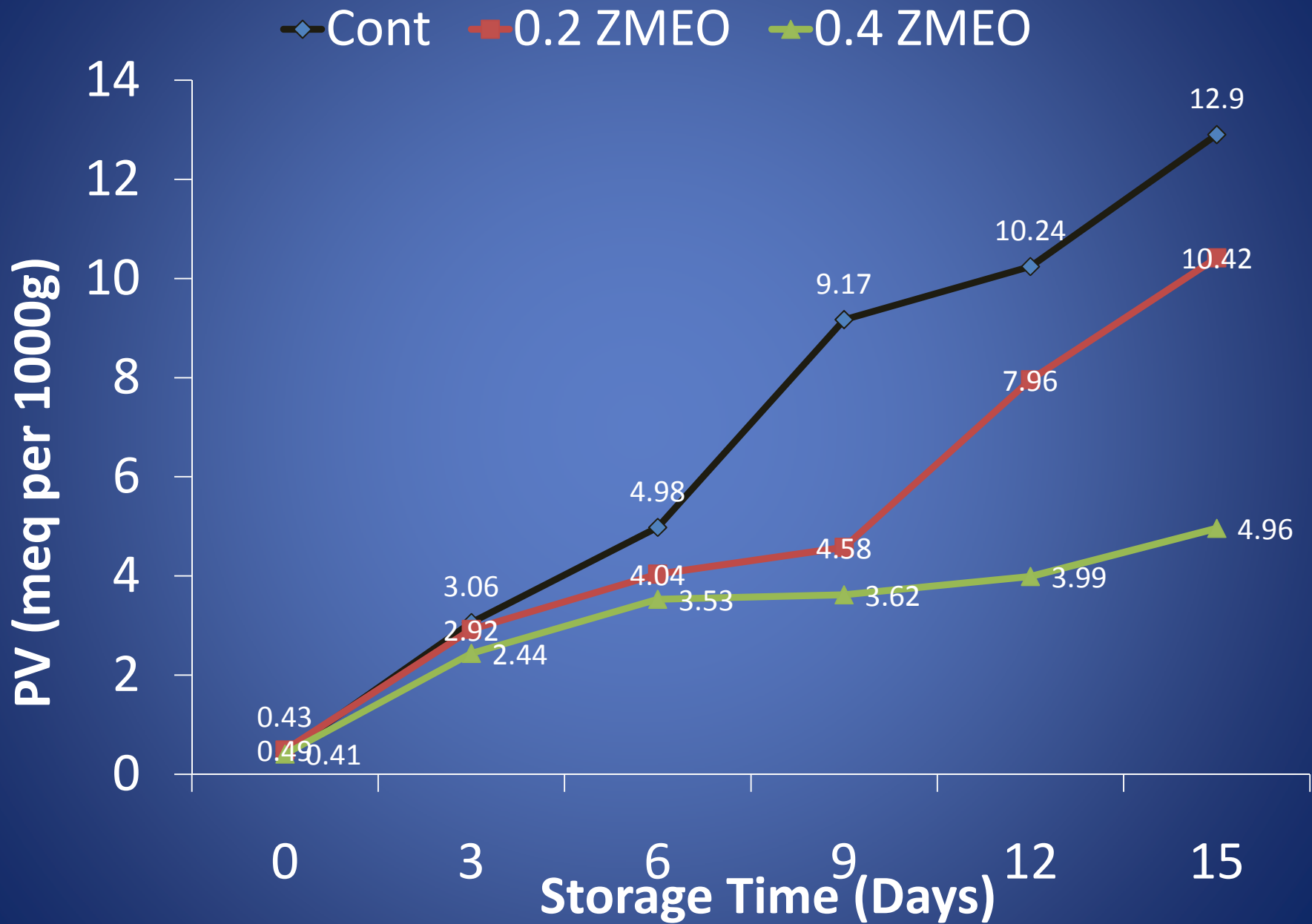
- The proximate composition of fish burgers was as follows:
- protein 18.11%,
- fat 5.8%,
- ash 3.7%,
- carbohydrate 6.1%,
- and moisture 66.29%

- TBA (Thiobarbituric acid )



- The TBA test is widely used to measure lipid oxidation in food products (Yu et al. 2002). Consumability limit value of TBA content is between 7 and 8 mgMDA/kg (Sinnuber and Yu 1958). Figure 1. shows the amount of TBA of the treatments during storage period. The initial TBA index values for burgers were 0.46, 0.45, 0.46mg MDA/kg for Cont, 2% ZMEO and 4% ZMEO respectively. At the third day of storage significant increase ( $p < 0.05$ ) of TBA-values of control group was obvious. TBA index value of all group increased during storage TBA values of control group reached to the acceptable limit (7-8 mgMDA/kg) at the 9th of storage. The lowest TBA-values were recorded in samples containing 4% ZMEO at the end of storage time. Such findings may be attributed to the high antioxidant effect of ZMEO, which is related to the phenolic content as thymol, carvacrol, cymene and terpinene (Moshafi et al., 2007; Sharififar et al., 2011; Ehsani et al., 2013).

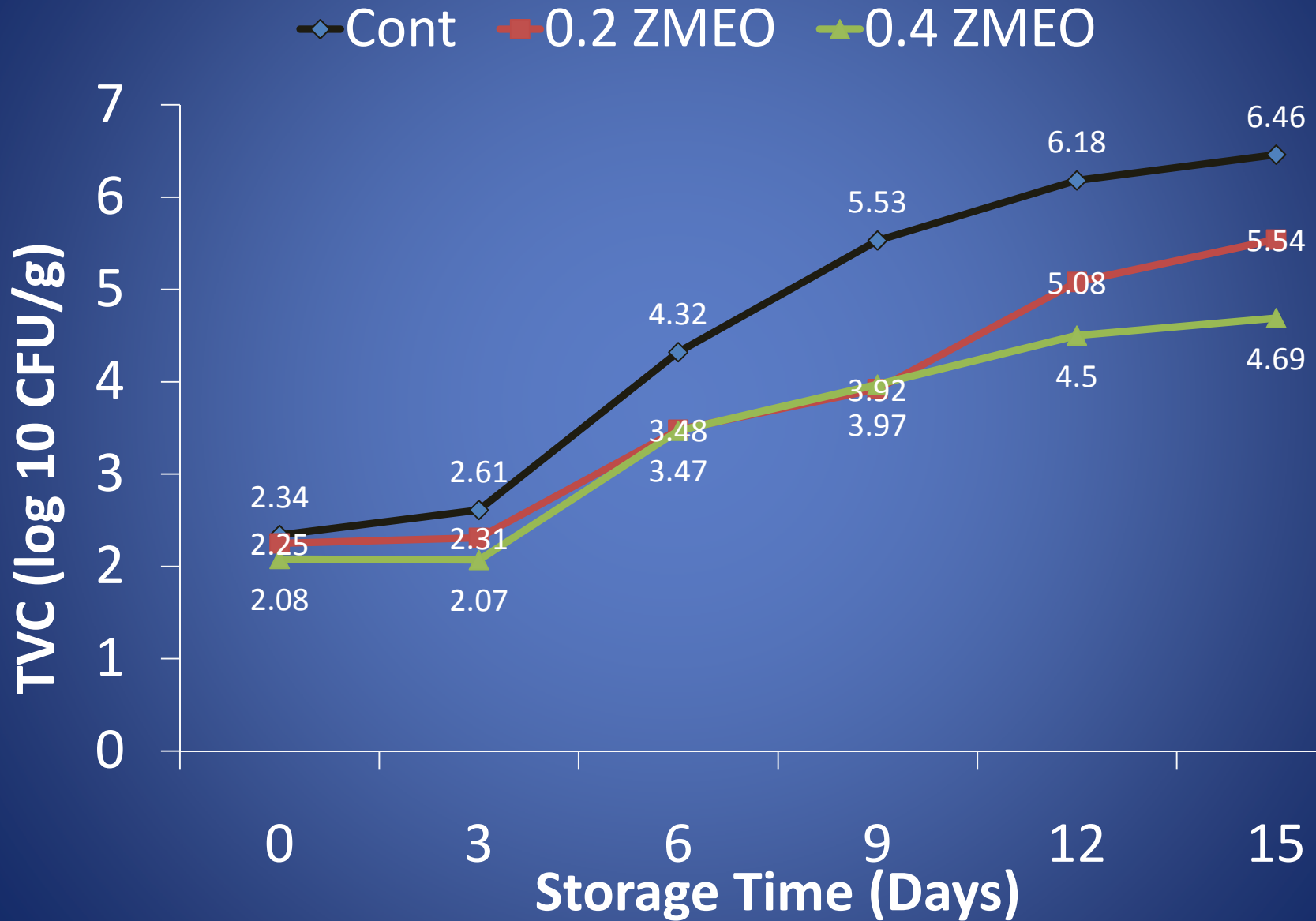
- PV ( Peroxide value )



- Shelf life of oil fish species is limited due to the oxidation of lipid. The primary product of lipid oxidation is fatty acid hydroperoxide, measured as PV. Peroxides are unstable compounds, and they break down to aldehydes, ketones and alcohols that are volatile products causing off-flavour in products (Ucak et al. 2011). The peroxide value is expected to be below 2 mmole active oxygen/kg lipids in very good material, and not to exceed 5 mmole active oxygen/kg lipids in good material. During storage period, increase in PV was observed for all groups. PV increase in the control group was higher than treated groups during storage ( $p < 0.05$ ). PV values of control group and 0.2% ZMEO group has reached to the acceptable limit (5mm  $O_2$ /kg) at the 9<sup>th</sup> and 12<sup>th</sup> of storage, respectively. At the end of the storage period, PV was found to be 4.96 mm  $O_2$ /kg for 0.4% Zataria added group. This could be explained ZMEO prevents fish burgers from undergoing oxidation or inhibits bacterial enzyme activity. The antioxidant attributes of *Zataria multiflora* essential oil stem from carnosol, carnosic acid, and rosmarinic acid found in its structure.

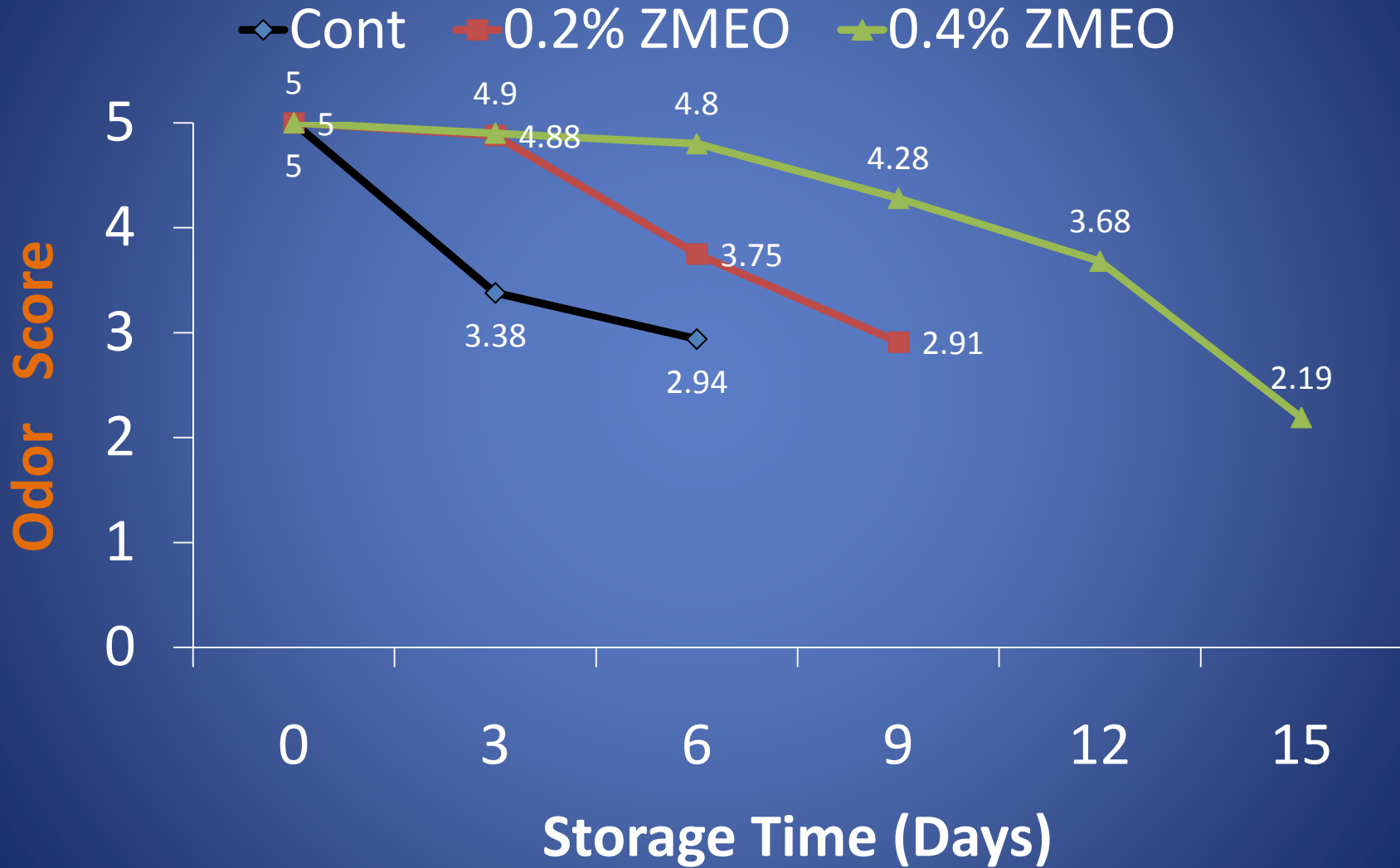


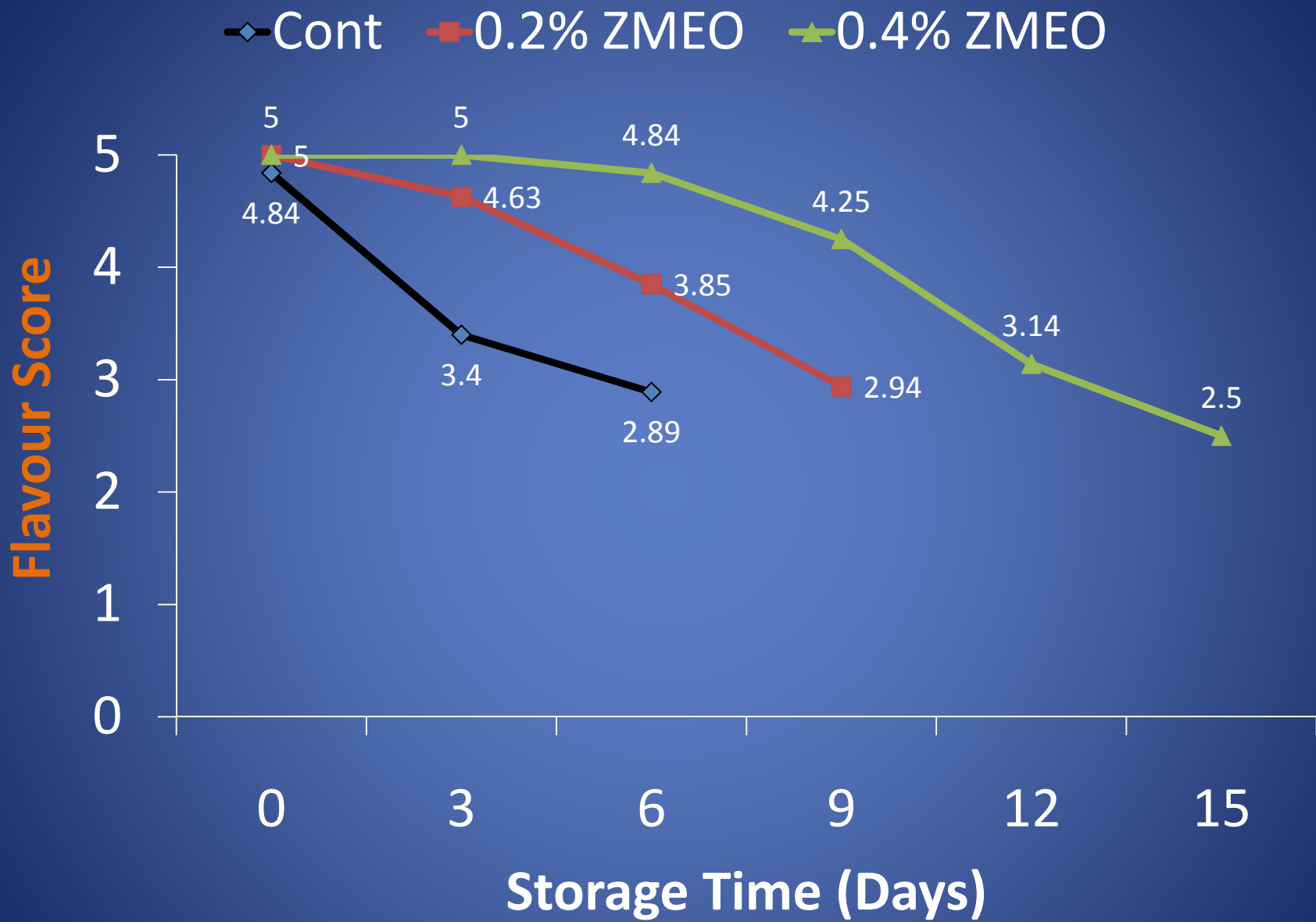
- TVC (Total Viable Count)

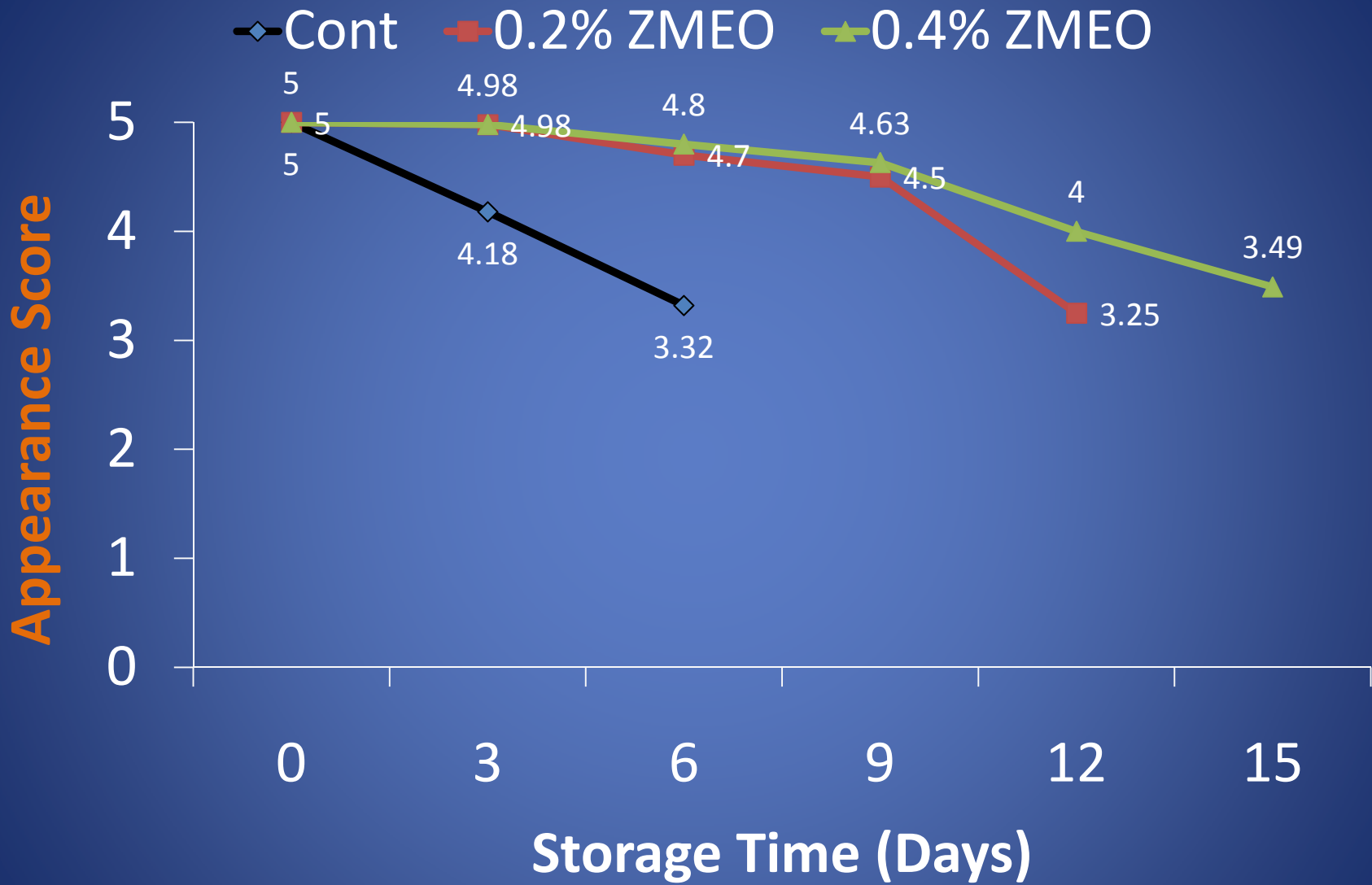


- Total viable count are used as an acceptability index for fish products because of the effect of bacteria in spoilage. Microbial counts on the fish burger are shown in Figure 3. The initial amount of bacterial count was not significantly different between the samples; this actually shows that the ingredients used were of good microbiological quality. This results are similar to findings of corbo et al., 2009; Köse et al., 2009 and Ehsani et al., 2013 .
- For fresh water and marine species, the microbiological limit recommended by the ICMSF (1986) for TVC is  $7 \log g^{-1}$ . During storage period, increase in TVC was observed for all the groups. However, TVC content of fish burgers did not exceed the limit during storage period for all groups ( $<6 \log cfu g^{-1}$ ). On the other hand, the rate of increasing was not the same in the groups. The control group contained high level of TVC compared to treatments groups. Addition of 0.4% ZMEO to catfish burger formulations significantly minimised the microbial load ( $p < 0.05$ ).

- Sensory results







- **Sensory assessment**

- The sensory scores of burgers obtained from catfish in the present study revealed that the panellists liked burgers in terms of odor, flavour and appearance. The sensorial scores decreased in all groups by increasing duration of storage (fig. 1, 2, 3). It was determined that the impact of zataria oil and storage duration were important for odor, flavour and appearance scores ( $p < 0.05$ )

- **CONCLUSION**

According to the results obtained, successful inhibition of lipid oxidation and microbial growth in burgers stored at 4 °C were possible with *Z. multiflora* essential oil. Based on chemical analysis, best result found for samples treated 0.4% ZMEO which followed by 0.2% ZMEO. The shelf-life of the catfish burger was determined to be 6, 9 and 15 days for Cnt, 0.2% ZMEO and 0.4% ZMEO, respectively.

Our study has clearly shown that addition of zataria essential oil in fish burger resulted in longer shelf life, and this method could be commercially used.