

Full Length Research paper

The effect of package types and storage period on characteristics of *Tinca tinca*

Ramazan Şevik¹ and S. Oğuz Korkut²

¹Afyon Kocatepe University, Faculty of Engineering, Food Engineering Department, 03200, Afyonkarahisar/Turkey.

²Auaculture Research Institute Eğirdir-Isparta/Turkey.

Accepted 2 November, 2009

The aim of this study was the effect of storage periods and package types on chemical changes in kadife fish (*Tinca tinca*). *T. tinca* living in rivers and lakes in inland of Turkey could be source of human nutrition whether it is processed by suitable methods. *T. tinca* fumigated and vacuum packaged could be definitely proposed as a healthy processed fish product for human consumption. Increases in TBA and TVB-N values assign that vacuumed *T. tinca* could be safely stored to 60 days as per TBA values and 30 days as per TBV-N. Shelf life as vacuumed package is proposed as 30 days for *T. tinca*.

Key words: *Tinca tinca*, package, storage, shelf life

INTRODUCTION

Smoking is well known that it is one of the oldest food protection methods. Application of method is that with certain temperature and humidity, smoke sourced from plant material is applied to food. Smoking is not only increases resistance of food but changes appearance, taste and smell of foods. Smoking does not protect food necessitating. Together with it technical applications such as salting, curing, drying and heating are also necessary (Öztan, 2003). High temperature is the method that is described as gathering salting, drying and heating in one application (Cakli et al., 2006). Acceptability of smoking is based primarily on gaining of sensual characters to food. Shelf life in fishes fumigated mostly depends upon water content of water, salt and oil, package style and storage temperature (Duman and Patir, 2007). Bright-ness, surface appearance without salt, uniform gold color texture is quality characters of fumigated fish. Degree of change in texture probably depends on dehydration in texture during the fumigation and salt application (Salan et al., 2006). Food safety in such products depends upon combination of warm application and cold storage (Lidström et al., 2003). Besides, depending on countries, fish species, consumer demands, there could be differen-

ces in application style of fumigation. Salt rate may be changed between 2 and 20% for sea water and fresh water fishes. Some additives could also be used.

Warming temperatures and fumigation period could be changed between 5 - 120°C and 1 - 6 h, respectively (Kaya et al., 2006). Normally, packing is described that it provides clean and hygienic conditions to foods which were processed for increasing of endurance. Materials such as paper, glass and plastics could be used for package. Plastics are used in storage of fishes fumigated. Like the other meat products such as beef mince and chicken, appropriate plastic type should be selected according to fish species (Öztan, 2003). Modified atmosphere package or vacuumed package could increase shelf life of cooled fish products.

Nevertheless, it should be taken into account that cooled products could wait for a long time in market shelves (Cakli et al., 2006). To prevent oxidation of oil in fishes with fat, oxygen should be excluded from package. Vacuumed package prevents oxygen dependent deterioration and to extend shelf life (Özoğul et al., 2006). Kadife fish (*Tinca tinca*) is dominant fish type in Beyşehir Lake situated in Konya Province and no sophisticated processing methods are used it. There is lack of research in storage conditions and methods in this subject. The aim of this study was the effect of storage periods and package types on chemical changes in kadife fish (*T. tinca*).

*Corresponding author. E-mail: burakolg@hotmail.com

Table 1. The effect of storage periods and package types on chemical changes in kadife fish (*Tinca tinca*).

	Storage period					
	Protein content (%)	Ash content (%)	Fat content (%)	Water content (%)	TVB-N (mg/100 g)	TBA (mg/kg)
Control	16.9 C	1.1 D	3.2 D	77.7 A	15.5 D	0.2 C
7 th day St. Per.	24.5 B	2.2 C	4.3 C	66.6 B	17.9 C	0.6 B
14 th day St. Per.	25.7 A	2.4 B	4.6 B	65.4 B	21.3 B	0.8 B
28 th day St. Per.	25.6 A	2.6 A	5.2 A	64.0 C	30.9 A	2.3 A
Package Types						
Vacuumed Package	23.2	2.0	4.9 A	70.6 A	18.9 B	0.8 B
Normal Package	23.3	2.0	3.8 B	67.0 B	22.1 A	0.9 A
L. S. D. (%)	St. Per: 0.94	St. Per: 0.14 St. Per.xPac.Type: 0.22	St. Per: 0.32 Pac.Type: 0.11 St. Per.xPac. Type:0.26	St. Per: 1.21 Pac.Type: 1.33 St. Per.xPac.Type: 1.06	St. Per: 0.99 Pac.Type: 0.59 St. Per.xPac.Type: 1.33	St. Per: 0.32 Pac.Type: 0.12
C. V. (%)	14.4	29.5	22.1	7.9	31.5	92.1

Table 2. Orthogonal comparisons of the effect of storage periods and package types on chemical changes in kadife fish (*Tinca tinca*).

The source of variation	Protein content (%)	Ash content (%)	Fat content (%)	Water content (%)	TVB-N (mg/100 g)	TBA (mg/kg)
Linear Effect	620.42**	704.27**	948.26**	3696.26**	2794.22**	563.95**
Quadratic Effect	349.22**	36.27**	24.25**	530.24**	588.13**	112.78**
Cubic Effect	56.34**	11.59**	140.64**	55.55**	101.33**	25.21**
Quartic Effect	27.97**	27.71**	43.34**	1.45**	0.37 ns	9.15*

MATERIAL AND METHOD

Coarse grain salt for brine was used. *T. tinca* fish samples were gathered from Beyşehir Lake situated in Konya province. Having identical height group, fish samples were selected and immediately brought to laboratory of Eğirdir Fisheries Research Institute in Isparta Province. After smoking application polyethylene material for package was used. Gills and inside organs were removed from samples and they were cleaned to remove. All fishes cleaned were kept in salt solution with 18% for 45 min. Then samples were hanged in smoking chambers for water removal till

surface drying for 60 min. For equalizing inside temperature of fish, samples were kept in fumigation chamber for 24 h. Smoking was done in five steps. At first, samples were kept in 30°C for 45 min. Then, smoked at 30°C for 45 min, at 50°C for 60 min, at 60°C for 60 min, at 70°C for 60 min and at 80°C for 45 min (Anonymous, 1997).

Two package methods (normal and vacuum package) were used (Gülyavuz and Ünlüsayın, 1999). For vacuum package, fillets were put in polyethylene bags (80 micron thickness) and vacuumed under 1 atmosphere pressure for 30 s then stored in 4°C. For normal package, fillets were put in polyethylene bags and stored in 4°C. All

samples were stored for 4 different storage periods, 0 (fresh fillet as a control), 7, 14 and 28 days. In the study, the effect of package types and storage periods were determined fillets for pH (Varlık et al., 2004), tiyobarbituric acid (Varlık et al., 1993), total volatile basic nitrogen, TBV-N, (İnal, 1992), water content (Anonymous, 1974a), crude ash content (Anonymous, 1974b), crude protein content (Anonymous, 1983), oil content (Keskin, 1975). The study was carried out in randomized complete block design with three replication and means were analyzed in LSD test. Orthogonal comparisons were made to determine best effect of factors on parameters (Yıldız, 1994). Data were

Table 3. Regression analyze of the effect of storage periods and package types on chemical changes in kadife fish (*Tinca tinca*).

	Linear effect	R ²	Quadratic effect	R ²
Protein content (%)	21.275 + 0.2046x	0.417	19.873 + 0.7543x-0.0194x ²	0.648
Ash content (%)	1.5449 + 0.0486x	0.759	1.3194 + 0.1355x-0.0031x ²	0.958
Fat content (%)	3.8899 +0.0501x	0.659	3.8045 + 0.083x-0.0012x ²	0.683
Water content (%)	72.53 - 03688x	0.599	74.491 - 1.125x+0.0272x ²	0.804
TVB-N (mg/100 g)	15.253 + 0.5296x	0.965	16.096 + 0.2046x+0.0117x ²	0.995
TBA (mg/kg)	0.1372 + 0.074x	0.960	0.2569 + 0.0276x+0.0017x ²	0.990

analyzed in SAS and TARIST statistical programs.

RESULTS AND DISCUSSION

No statistical difference found between package applications. Storage period had significant effect on protein content ($P < 0.01$). The highest protein content was in 28th day storage (25.647%), whereas the lowest one in the control (16.923%). Decrease in water content increased protein content as expected. Ünlüsayın et al. (2003) found that protein content with 17.34% at the effect of storage period on protein content seemed to be more linear and quadratic. With storage period ash content increased and it reached to 2.686% in 28th storage day. Orthogonal comparisons showed that storage period linearly increased ash content (Table 2). But regression analysis explains that increase in ash content is quadratic (Table 3). Ünlüsayın et al. (2003) and Cardinal et al. (2004) stated that relative and significant increases occurred in stored of fish samples.

Opposite effect is seen in results of Table 1. Fat also increased ($p < 0.01$) during storage. Differences in storage periods were observed as significant at 1% and prolonging storage period increased fat content. It was 3.279% in control and value reached 5.217% in 28th storage day (Table 1). Tables 2 and 3 show that linear effect in fat content versus storage period occurs. Regression analysis showed that storage period increased oil content from 3.80 to 4.40% in 60-day-storage period. Similes results was found by Ünal (1995) in lipid content of *T. tinca*.

Significant differences in water content were observed in package types and storage periods ($p < 0.01$) and interaction between package types and storage periods was also significant at 1% (Table 1). Vacuumed package samples had more water content (70.640%) then unvacuum (normal) one (67.043%). With increasing storage period, water content decreased. Tables 2 and 3 show that the effect of storage period is more likely to be a quadratic than linear. Similar to our results, Cardinal et al. (2004) and Mother (1988) found that fish samples significantly lost their water content in 4 - 7 weeks of storage. Storage period had significant effect ($p < 0.01$) in TUB-N and TBA, package type also influenced TVB-N ($p < 0.001$) and TBA ($p < 0.05$) values. Interaction between package

types and storage periods was found as significant at 1% in TVB-N. More TVB-N and TBA values were taken in normal than vacuumed package (Table 1).

Similarly, TVB-N and TBA values increased during storage. We found that TBA values got to level of 8 mg/kg in 60 days. Storage was up to 28 days in TVB-N as mentioned in Materials and Methods. It was determined that critical limits for TVB-N and TBA in terms of consumption are 35 mg/100 g in TVB-N and 8 - 10 mg/kg in TBA, respectively (Varlık et al., 1993; Çaklı et al., 2006). Çaklı et al. (2006) stated that TBA values reached to critical level of 35 mg/100 g in 50th day of storage of *T. tinca* samples. Fish samples had TVB-N values as 22.4 mg/100 g in 21th day (Cardinal, 2004) and 35 mg/100 g in 87th day (Ünal, 1995) of fumigated storage.

Conclusion

T. tinca fumigated and vacuum packaged could be proposed as a healthy processed fish product for human consumption. Vacuum packed *T. tinca* could be safely stored for 60 days as per TBA, 30 days as per TBV-N.

REFERENCES

- Anonymous (1974a). Et vet Et Mamulleri Rutubet Miktarı Tayini, TS 1743, Türk Standartları Enstitüsü, Ankara (in Turkish).
- Anonymous (1974b). Et vet Et Mamulleri Kül Tayini, TS 1746, Türk Standartları Enstitüsü, Ankara (in Turkish).
- Anonymous (1983). Gıda Maddeleri Muayene vet Analiz Yöntemleri Kitabı, T.C. T.O.K.B. Gıda İşleri Genel Müd. Yay. No: 65, Özel Yayın. 62:105: 796.
- Anonymous (1997). Fish Smoking and The Environment Eastfish Magazine, 2/97, C44344, FAO East Fish Copenhagen Fachpresse Verlag, Hamburg pp.42-44.
- Çaklı S, Kilinc B, Dincer T, Talasa S (2006). Comparison of the shelf lifes of map and vacuum packaged hot smoked rainbow trout (*Onchoryncus mykiss*). Eur. Food Res. Technol. 224: 19-26.
- Cardinal M, Gunnlaugsdottir H, Bjoernevik M, Ouisse A, Vallet JL, Leori F (2004). Sensory Characteristics of Cold-Smoked Atlantic Salmon (*Salmo salar*) From European Market and Relationships With Chemical, Physical and Microbiological Measurements, Food Res. Int. 3: 181-193.
- Duman M, Patır B (2007). The Determination of some chemical and sensory characteristics of smoked mirror carp (*Cyprinus carpio* L.) filets. Science and Eng. J. Fırat Univ. 19(4): 463-472
- Gülyavuz H ve Ünlüsayın, M (1999). Su Ürünleri İşleme Teknolojisi, S.D.Ü EĞİTİR Su Ürünleri Fak. Ders Kitabı, Şahin Matbaası, Ankara p. 336.

- İnal T (1992). Besin Hijyeni. Hayvansal Gıdaların Sağlık Kontrolü. Final Ofset. Genişletilmiş 2. Baskı İstanbul. p.783
- Kaya Y, Turan H, Erkoyuncu İ, Sönmez G (2006). Sıcak dumanlanmış palamut (*Sarda sarda* Bloch, 1793) balığının buzdolabı koşullarında muhafazası. E.Ü. Su Ürünleri Dergisi 23(1/3): 457-460.
- Keskin H (1975). Gıda Kimyası, İstanbul Üniv. Yayın Sayı: 1980, Kimya Fat. 21: 1046.
- Lidström M, Nevas M, Hielm S, Lahtenmaki L, Peck MW, Korkeala H (2003). Thermal inactivation of nonproteolytic *Clostridium botulinum* type E spores in model fish media and in vacuum – packaged hot – smoked fish products. Appl. Environ. Microbiol. 69(7): 4029-4036
- Mother T (1988). Effect of Smoking and Drying on the Nutritive Value of Fish: A Review of Japanese Studies. Burt JR (eds). Elsevier Applied Science Publishers Ltd, London and New York pp.91-120.
- Özoğul Y, Özoğul F, Küley E (2006). Modifiye edilmiş atmosfer paketlemenin balık vet balık ürünlerine etkisi. E.Ü. Su Ürünleri Dergisi 23(1-2): 193-200.
- Öztan A (2003). Et Bulimia vet Teknolojisi. TMMOB Gıda Mühendisleri Odası Yayınları Kitaplar Serisi Yayın 1: 495
- Salan EO, Galvao JA, Oetterer M (2006). Use of smoking to add value to the Salmoned Trout. Brazilian Arch. Biol. Technol. 49(1): 57-62
- Ünal G (1995). Gökkuşluğu Alabalığı (*Oncorhynchus mykiss*)'nin Tütsülenmesi vet Bazı Kalite Kriterlerinin Tespiti Üzerine Bir Araştırma, Ege Üniv. Fen Bil. Enst. Su Ürünleri Avlama ve İşleme Tek. Anabilim Dalı Doktora Tezi, İzmir p. 120.
- Ünlüsayın M, Bilgin Ş, vet İzci L (2003). Havuz Balığı (*Carassius auratus* L., 1758) 'nın Et Verimi, Sıcak Dumanlama Sonrası Kimyasal Bileşenleri vet $+4\pm 1$ °C'deki Raf Ömrünün Tespiti, S.D.Ü. Eğirdir Su Ürünleri Fak. Dergisi 8: 62-70.
- Varlık C, Uğur M, Gökoğlu N, vet Gün H (1993). Su Ürünlerinde Kalite Kontrol İlke vet Yöntemleri. Gıda Teknolojisi Derneği. Yayın No: 17, Ank. Üniv. Zir. Fak. Gıda Böl. p.174.
- Varlık C, Erkan N, Özden Ö, Mol S, vet Baygar T (2004). Su Ürünleri İşleme Teknolojisi. İst. Üniv. Yay. No: 4465, Su Ürünleri Fak. No: 7.
- Yıldız N, Bircan H (1994). Araştırma vet Deneme Metotları. Atatürk Üniversitesi Yayın No: 697, Ziraat Fak. No: 305, DEers Kitapları