SciDoc Publishers
Infer, Interpret & Inspire Science

OPEN ACCESS

International Journal of Food Science, Nutrition and Dietetics (IJFS)
ISSN 2326-3350

Effect of the Vacuum Packaging on the Shelf Life of Lakerda

Research Article

D. Kocatepe[1], H. Turan[2*], C.O. Altan[2], G. Göknar[2]

[1] School of Tourism and Hotel Management, Department of Food & BeverageManagement, Sinop University, Sinop, 57000 Turkey.
[2] Fisheries Faculty, Department of Fish Processing Technology,Sinop University, Sinop, 57000 Turkey.

Abstract

In this research, shelf life of lakerda in stretch film (A group) and vacuum packages (B group) stored for56 days at 4±2°C after the ripening and dry salting was compared. The quality control of the packaged lakerda were carried out by analyses of pH value, water activity (Aw), TVB-N, TBARS, total mesophilic (TMB) and total psychotropic (TPB) bacterial counts. The initial pH, Aw, TBARs, TVB-N value, TMB and TPB counts of lakerda were; 6.02, 0.74, 6.02 mg MDA/kg, 17.31 mg/100g, 3.68LogCFU/g and 2.61 LogCFU/g, respectively. The lakerda packed with stretch film and vacuum packs, did not exceed the limits for acceptability 35mg/100g of TVB-N during the storage periods. While the TBARs values, TMB and TBP counts of B groups did not exceed the limits for acceptability 8mg MDA/kg and 6LogCFU/g, respectively, throughout the storage period, the TBARs value of A group exceed the acceptability limit at 14th day. According to the all analyses results, vacuum packaging compared to stretch film significantly increased shelf life of lakerda ($P<0.05$).

Keywords: Dry Salting, Lakerda, Bonito (*Sardasarda*, Bloch 1793), Vacuum Packaging, Shelf Life

***Corresponding Author**:
Hülya Turan,
Fisheries Faculty, Department of Fish Processing Technology, Sinop University,Sinop, 57000, Turkey.
E-mail: hturan@sinop.edu.tr

Received: September 16, 2014
Accepted: October 13, 2014
Published: October 14, 2014

Citation: D. Kocatepe, H. Turan, C.O. Altan, G. Göknar (2014) Effect of the Vacuum Packaging on the Shelf Life of Lakerda. Int J Food Sci Nutr Diet. 3(9), 157-159. **doi:** http://dx.doi.org/10.19070/2326-3350-1400029

Introduction

The salting process is considered as one of the oldest methods of fish preservation such as fermenting, marinating, smoking and drying. And it is still being used inseveral areasof the world and Turkey because ofthe cheap and simple preservation method.

The preservative effect of salting is mainly due to the decrease in water activity (Aw) and thus prevention of growth of many spoilage organisms along with the formation of a more membranous surface with further inhibits the growth of microorganisms [1].

Depending on fish composition and size, salting may be "dry, where the fish are stacked in salt and the brine formed is allowed to run away, or "wet" where the fish are impressed in a strong brine, or "pickle". The most commonly employed method is a hybrid of the dry and wet methods; the fish are placed in dry salt and eventually become immersed in the liquid pickle formed by solution of the salt in the liquid extracted from the fish [2].

The fish species used in the Lakerda process is Atlantic bonito (Sardasarda, Bloch 1793). Especially 28-35 cm (bonito) and 40-45 cm (big bonito)in length are used for dry salting. Lakerda made almost every at home in Sinop-Turkey. Lakerda is definedas dry salted bonito in Sinopthat "bonito and big bonito are cleaned with water and then they were soaked in salted water to remove blood in fish meat. The fish are cut into threefinger thick slices. The slices are salted with thick granular salt and placed in a jar. During the ripening period, the salt solution covers the lakerda slices".

Lipid oxidation is one of the major problems in the salted fish. Lipid oxidations negative affect the taste, odor and color of salted fish. One way of extending the shelf life and quality of a salted fish is by vacuum packaging. Vacuum packaging is a way for delaying lipid oxidation (auto oxidation) because of limiting oxygen molecule [3].

In this research, the effect of stretch film and vacuum packaging on the quality of lakerda was investigated.

Material and Methods

Sample of fresh fish, namely, Bonito (*Sardasarda*, Bloch 1793) were obtained from Sinop fish markets. The fish samples were immediately transported to the laboratory. The average weights and lengths of fish were 819.23±15.54g and 38.85±0.32cm, respectively. All the fish were beheaded and washed in running tap water. In addition, they were sliced approximately three-finger thickness and the marrows at the centerof the bonitos slice were cleaned with the help of a wire. The fish slices were cleaned for the second time and they were kept in the 5% salted water withice until the drain blood from fish. This process was repeated multiple times until stopped blood escaping from fish.Cleaned fish slices were salted by 25% with thick salt. The fish slices were rubbed with thick salt and placed in a jar. A portion of the salt was placed between the fish slices and was poured into the jar. The jars were stored at 4±1°C for ripening. The solution in the jar was not

removed during the ripening period.For the ripening control, salt concentration of the fish slices was analyzed at five days intervals. During the storage time, salt concentration offish was 15% approximately in 20 days. Ripe fish slices were removed and divided into two groups with two replications. For the first group; fish slices were packed with stretch film, for the second group; fish slices were vacuumed with polyamide-polyethylene bags (thickness 98µm, oxygen permeability of 47.6 mL/m^2/24h at 23°C and water vapor permeability of 3.48 g/m^2/24h at 23°C). Two groups were stored at 4±1°C during 56 days. Samples were taken for chemical and microbiological analyses at seven days intervals.

The salt analyses were done according to the Poernomo[4].The packed lakerda were analyzed for water activity, pH according to the Manthey et al. [5], Total Volatile Basic Nitrogen (TVB-N) analysis according to the Ludorf and Meyer [6]. The method of Erkan et al. [7] was used to determine the degree of lipid oxidation (TBARs) in fish samples. Total mesophilichalophilebacteria (TMHB) and total phscrophilichalophile bacteria (TPHB) were determined using plate count agar according to the AOAC [8].

Significant differences between the groups were calculated by MINITAB 13 by one-way analysis of variance (ANOVA) using a significance level of $p<0.05$ by Tukey's test.

Results

In this study, changes in physical, chemical and microbiological properties (during the storage period of 56 days) of bonito salted by dry salting (lakerda) were investigated.

Table 1 shows the changes in salt concentrations in bonito tissue during the ripening period, while Table 2 shows the Ph, Aw, TBARs, TVB-N values and total mesophilicaerob and total phscrophilicaerob bacteria counts of packed lakerda.

Discussion and Conclusion

The salt concentration of fresh fish was found to be 0.36% (Table 1). Following the salting process, the salt concentration in the tissue increased with the movement of salt molecules to fish meat and the movement of water molecules from the fish meat because of the osmosis and hygroscopic property of salt. The salt concentration of fish tissues had been reached to 10.39% on the day 5th due to the speed of salt molecules into the fish meat ($p<0.05$). The movement of salt molecules continued to lose speed between the 5-10 days and it was found to be 15.57% on 10th day ($p<0.05$). This migration was thoroughly slowed down and the salt concentration in the fish tissue on 20th day were statistically similar with on 10th day ($p>0.05$). Salting of whole fish should be controlled precisely, as over-ripening will result in excessively soft products with sensory properties that are undesirable to most consumers [9].

Chemicalquality criteriaof lakerda packagedafter 20 days are shown in Table 2.

The pH value of lakerda were 6.02 on the first day of storage, it was ranged from 5.70 to 6.06 in packed with stretch film and from 5.77 to 6.06 in vacuumed lakerda ($p<0.05$) during the storage period (56 days).Varlık et al. [10] were reported the pH values of 6-6.5 for fresh fish, in this study the pH values are appropriate for consumed fishery products.

The status of the water defined as the relationship between the water content of food and the relative humidity of the environment and it is called as "water activity". In the other words water activity is defined as the vapor pressure of water in a substance divided by that pure water at the same temperature; therefore, pure distilled water has a water activity exactly one [11].Water activity (Aw) is the basic parameter to describe technically all the classic cured fish products (salted-salted-dried- dried and smoked) and there is a need to have a cheap and reliable equipment to measure it under topical conditions, where such products are stable foods [12]. The water activity value of salted fish is about 0.75 or less [13]. The water activity of lakerda were found as 0.74 (Table 2) due to the osmosis and hygroscopic property of salt, because of reduced water availability during salting period. The changes of water activity were not significant in both groups during storage period ($p>0.05$). The effect of different packaging methods on the Aw were not significant except from 56 days ($p<0.05$).

It's known that the salt have an enhancing effect on the lipid oxidation. The contact with air of salted fish increases the lipid oxidation. Indeed, during the storage period, the higher TBARs values were obtained for lakerda packed with stretch than packed with vacuum ($p<0.05$).In both groups, non-regular TBARs values can be related with different lipid contents of lakerda slices during storage period. Because, the fish meat has different oil lipid content according to the body parts, e.g. the fat in the tail is less than the head.

A little fat also moves away from the fish during the ripening period and the amount of output fat changes according to the salt entrance. However, the TBARs values of lakerda packed with stretch film exceeded the limit of acceptability (8mgMDA/kg) for human consumption at 14th day (Table 2). The higher values were determined for later days. Packaging with stretch film had not been enough to protect the products from lipid oxidation. Jay [14] reported that the transmission rate of stretch film was 6500 ml/ m^2/ 24h/ 23°C/ %0RH. The lipid oxidation in the lakerda packed with stretch film was higher than vacuum groups because the oxygen permeability of stretch film was higher. In contrast, vacuum-packed groups generally considered a good quality during storage in terms of consuming.

After ripening period, the initial TVB-N value in lakerda was 17.31 mgN/100 g, this value was higher than TVB-N value (11.21 mgN/100g) of dry-salted lakerda reported by Turan et al. [15]. Varlık et al. [10] categorized a TVB-N content of 25 mgN/100g as very good, 30 mg/100g as good, 35 mgN/100g as marketable and TVB-N values over 35 mgN/100g as spoiled in seafood. The

Table 1. Salt concentrations of bonito tissues in ripening period (%)

Ripening period (day)	0	5	10	20
Salt concentration (%)	0.36±0.00^a	10.39±0.23^b	15.57±0.31^c	15.94±0.20^c

Values are shown as mean ±standard error

→a, b, c: Within the lines values with different letters are significantly different ($p<0.05$).

Table 2. The physical, chemical and microbiological qualities of lakerda packed with stretch (Group A) and vacuum (Group B)

Analysis	Groups	Storage time (Day)								
		0	7	14	21	28	35	42	49	56
pH	A	6.02±0.04 Aab	5.90±0.02 Aabcd	6.06±0.03 Aa	5.80±0.04 Abcd	5.96±0.03 Aab	5.95±0.08 Aabc	5.76±0.04 Acd	5.70±0.06 Ad	5.70±0.03 Ad
	B	6.02±0.04 Aa	6.00±0.02 Ba	5.79±0.01 Bb	5.95±0.02 Bac	5.98±0.03 Aac	5.99±0.02 Aa	5.86±0.01 Bbc	5.77±0.02 Ab	5.78±0.05 Ab
Aw	A	0.74±0.00 Aa	0.74±0.00 Aa	0.74±0.00 Aa	0.75±0.00 Aa	0.74±0.01 Aa	0.74±0.01 Aa	0.74±0.00 Aa	0.73±0.00 Aa	0.75±0.00 Aa
	B	0.74±0.00 Aa	0.74±0.00 Aa	0.74±0.00 Aa	0.75±0.00 Aa	0.75±0.00 Aa	0.74±0.00 Aa	0.74±0.00 Aa	0.73±0.00 Aa	0.73±0.00 Ba
TBARs	A	6.02±0.18 Aa	6.47±0.09 Aa	9.01±0.11 Aa	15.19±0.27 Ab	14.39±1.28 Ab	16.86±0.31 Ab	16.69±1.81 Ab	22.44±0.16 Ac	17.39±0.70 Ab
	B	6.02±0.18 Aa	2.56±0.08 Bb	3.40±0.05 Bc	5.87±0.23 Ba	3.73±0.14 Bc	5.39±0.17 Ba	3.89±0.21 Bc	5.10±0.22 Ba	4.20±0.17 Bc
TVB-N	A	17.31±0.10 Aa	19.51±0.14 Ab	20.64±0.13 Ac	20.56±0.12 Ac	20.23±0.11 Ac	20.72±0.22 Ac	20.34±0.11 Ac	20.44±0.08 Ac	27.49±0.23 Ad
	B	17.31±0.10 Aa	17.59±0.07 Ba	13.76±0.08 Bb	13.60±0.11 Bb	13.63±0.09 Bb	13.84±0.14 Bb	13.59±0.12 Bb	13.70±0.06 Bb	20.43±0.20 Bc
TMHB	A	3.68±0.03 Aa	3.80±0.03 Aa	4.00±0.03 Ab	4.86±0.01 Ac	5.11±0.08 Ad	5.35±0.03 Ae	5.44±0.00 Ae	5.97±0.04 Af	6.04±0.03 Af
	B	3.68±0.03 Aa	3.79±0.03 Aa	3.85±0.03 Ba	4.15±0.02 Bab	4.48±0.23 Bbc	4.53±0.15 Bbcd	4.88±0.03 Bcd	4.94±0.02 Bd	5.01±0.03 Bd
TPHB	A	2.61±0.03 Aa	3.77±0.02 Ab	4.02±0.02 Ac	4.18±0.03 Acd	4.53±0.09 Ae	4.36±0.04 Ade	5.15±0.01 Af	5.23±0.07 Afg	5.44±0.04 Ag
	B	2.61±0.03 Aa	3.55±0.06 Bb	3.59±0.03 Bb	4.03±0.05 Ac	4.11±0.09 Bc	4.18±0.06 Ac	4.88±0.02 Bd	4.82±0.06 Bd	5.02±0.04 Bd

Values are shown as mean ±standard error
→ a,b,..g: Within the lines values with different letters are significantly different ($p<0.05$).
↓ A, B, C: Within the columns values with different letters are significantly different ($p<0.05$).

lakerda packed with stretch film had a very good quality during the storage period except from 56 days. The TVB-N values of lakerda vacuumed had lower TVB-N values than the other group during storage period ($p<0.05$).

By the salting process, which is the lower value of Aw (0.75)is not due to normal spoilage bacteriainsalted fish, rather than associated withthe reason of halophile bacteria [13]. Total mesophylic halophile bacteria(TMHB) count of lakerda was 3.68 LogCFU/g before packaging. As seen in the Table 2, TMHB count of stretch groups increased steadily during storage period and it exceed the value of 6LogCFU/g on 56th day. In the vacuumed group TMHB were not exceed the acceptability value for consumption during storage period and after the day 7th, TMHB count of two groups were statistically different ($p<0.05$).Total psychrophilic halophile bacteria (TPHB) counts of two groups increased with increasing time of storage. The initial TPHB count was 2.61 LogCFU/g. During the study, the maximum TPHB count (5.44 LogCFU/g) was detected in stretch group at 56th day.

In conclusion, all analysis results show that vacuum packaging is an effective method to preserve chemical and microbiological quality of dry-salted bonito (lakerda) stored at 4±^{o}C during the 56th days. In other words, it can be said that the days of consumable the best quality of lakerda packed and storage at 4±^{o}C after ripening period was approximately two months.

References

[1]. Leroi F, Joffraud JJ. (2000) Salt and smoke simultaneously affect chemical and sensory quality of cold-smoked salmon durin 5oC storage predicted using factorial design. Journal of Food Protection. 63: 1222-1227.

[2]. Horner WFA. (1991) Salting, In: Fish Processing Technology. Preservation of fish curing (G.M. Hall, ed.) Chapman & Hall Publishers. UK. 53-61.

[3]. Taheri S, Motallebi AA. (2012) Influence of vauum packaging and long term storage on some quality parameters of cobia (Rachycentroncanadum) fillets during frozen storage. American-Eurasian J. Agric. & Environ Sci. 12(4):541-547.

[4]. Poernomo A. (1986) SaltingBehaviour of Sardines, Asean Post Production Information Exchange (APEX). Jour. Pen. PascaPanenPerikanan. 51:23-31.

[5]. Manthey M, Karnop G, Rehbein H. (1988) Quality changes of European catfish (Silurusglanis) from warm water aquaculture during storage in ice. Int. J. Food Sci. Technol. 23:1-9.

[6]. Ludorf W, Meyer V. (1973) Fische und fischerzeugnisse. Verlag Paul Parey, Printed in Germany bei A. W. Hayn'sErben.

[7]. Erkan N, Üretener G, Alpas H, Selçuk A, Özden Ö, Buzul S (2011) Effect of High Hydrostatic Pressure (HHP) Treatment on Physicochemical Properties of Horse Mackerel (Trachurustrachurus). Food and Bioprocess Technology. 4(7):1322-1329.

[8]. AOAC. (2000) Official Methods of Analysis. 17th Ed. Association of Official Analytical Chemists. Gaithersburg, MD, USA.

[9]. Hui YH, Cross HG, Kristinsson MH, Lim MH, Nip WK, Siow LF, Stanfield PS. (2006) Biochemistry of Seafood Processing (Chapter 16). In: Hui,YH (Editor), Food Biochemistry & Food Processing, Blackwell Publishing Professional. 2021 State Avenue, Ames, Iowa 50014, USA. 351-378.

[10]. Varlık C, Uğur M, Gökoğlu N,Gün H (1993) Su ÜrünlerindeKaliteKontrol İlkeveYöntemleriGıdaTeknolojisiDerneğiYayın No:17. İstanbul.

[11]. Anonymous. (2013) http://en.wikipedia.org/wiki/Water_activity

[12]. Lupin HM, Boeri RL (1988) Use of a Filament Hygrometer for Aw Measurement under Tropical Conditions. 4th FAO Expert Consultation on Fish Technology in Africa Abidjan

[13]. Lupin HM (1984) Water Activity in Preserved Fish Products. FAO/Danida National Workshop on Fish Technology and Quality Control. Ziway, Ethiopia.

[14]. Jay JM (2000) Food preservation with modified atmospheres. Chapter 14. In: Modern Food Microbiology, Sixth Ed., An Aspen Publication, Maryland. 637.

[15]. Turan H, Kaya Y, Erkoyuncu İ, Sönmez G (2006) Chemical and Microbiological qualities of dry-salted (Lakerda) Bonito (Sardasarda Bloch 1793). Journal of Food Quality. 29:470-478.