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A study of marination of deepwater pink shrimp (*Parapenaeus longirostris*, Lucas, 1846) and its shelf life

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Abstract

Marination of deep water pink shrimp (*Parapenaeus longirostris*, Lucas, 1846) was achieved using two different formulations (with and without antimicrobial agent) and quality changes of marinated shrimps during storage period at 1 °C were investigated. No significant differences were found between chemical and sensory analysis of two different marinated groups ($p > 0.05$) during the storage period. TEA (mg malonaldehyde/kg) values of two groups reached the value of consumption limit and rancidity progressed intensely at the end of the 40th day at 1 °C. This was confirmed by sensory evaluation. There were significant differences in psychotropic bacteria and aerobic bacteria counts of two marinated groups by which lower bacterial counts were determined in marinated shrimp with antimicrobial agent at day 40. Although bacterial load of marinated shrimp without antimicrobial agent was lower than the consumption limits at the end of the 40th day of storage at 1 °C, TBA value determined the shelf life of marinated shrimps with or without antimicrobial agent.

Keywords: Shrimp; Marination; Proximate; Composition; Sensory analysis and shelf life

1. Introduction

Deep-water pink shrimp (*Parapenaeus longirostris*) is a species, which is mostly caught a lot in Turkish seas. Especially in the processing plants of Marmara and the Aegean region, shrimps are peeled, cleaned, frozen and then stored frozen. Although they are sold too soon after they are caught, quality problems occur during long storage periods (Pala, Varlik, & Aran, 1988). Especially in European countries (Germany, Netherland, Norway), shrimps of the size of deep-water pink shrimp are marinated, so new flavour and texture developments occur (Carlos & Harrison, 1999). Marinated shrimps are heavily consumed in European countries and America.

Marinades are solutions, including sugar, spices, oil, acids (from vinegar, fruit juice, wine) and they are used to improve tenderness, juiciness, flavour and aroma and to extend shelf life of meat, poultry, seafood and vegetables (Brandt, 1996; Carlos & Harrison, 1999; Feng & Huang, 2001; Harazak, 2000; Hull, 2001; Zheng, Huang, Nelson, Bartley, & Gates, 1998). Shrimps have extra shelf life after marinating (Dalgaard & Jorgensen, 1999). Although marination technology in the meat and poultry industry is well developed, there is much less information about marinated shrimps.

In Turkey, there are not many studies about marination. Studies done were mainly on marinated fish. These studies are on marinated fish products and their production rules (Ersan, 1960), fried marinated products (Ersan, 1961), salted fishes, brined fish (Bakıcı, 1987), marinating shrimps and preventing colour changes (Pala et al., 1988), effects of temperature on vinegar/salt transition in production of marinade (Varlık, Uğur, Gökoğlu, & Gün, 1993), chemical composition and sensory analysis of marinated acivades (Çelik, 1997), some changes during production of marinated anchovies with different acid–salt concentrations and determination of shelf life (Aksu et al., 1997).

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In European countries, in order to prolong the shelf life of marinated products, sorbic and benzoic acid are used. Shelf life and market success of many food products are assured by the use of preservatives in combination with other technology (Einarsson & Lauzon, 1994).

In this study, frozen shrimps were used as raw material. Shrimps were divided into two groups. Benzoic and sorbic acid (cited in the Turkish Food Codex, 1997) were added to one of the groups to evaluate the extension of the shelf life. And then chemical, sensory, enzymatic and microbiological quality analyses of marinated shrimps were done at certain intervals during the storage period at 1 °C.

2. Materials and methods

2.1. Material

In this study, shrimps caught from Marmara-region of Turkey were used as raw material. Shrimps were brought to the processing plant in boxes including ice. Shrimps were dipped into sodium metabisulphite for 10 min before they were peeled (maximum limit value is 150 mg/l in frozen shrimp, Turkish Food Codex, 1997). Then they were kept at −40 °C for 12 h and then stored at −18 °C. In this study, five months-frozen shrimps were used.

2.2. Marination

Frozen shrimps in plastic bags were thawed under tap water. They were put into plastic bags and boiled in a water bath for 10 min. Later, they were divided into two groups. Marinade solution was prepared by adding citric acid (JT Baker 0002520004) and NaCl (Merck K30005704146) to the tap water. This marinade solution was used for both groups except that benzoic acid (JT Baker 0023720008) or sorbic acid (JT Baker 0019910004) (cited in Turkish Food Codex, 1997) were added to the marinade solution of one group (group A). The other group, without antimicrobial agent, was called group B. Shrimps were put into plastic containers at a ratio of 1:1 (shrimp/marinade solution) and sealed with their lids.

2.3. Analytical methods

Analyses of the samples were done on homogenized shrimps in triplicate. Results are recorded as the arithmetic means of the three values.

2.3.1. Proximate composition analysis

Moisture (Ludorff & Meyer, 1973), crude fat (Bligh & Dyer, 1959), crude protein (AOAC, 981.10, 1984) and ash contents (AOAC, 935.47, 1984) of frozen, boiled and marinated shrimps were determined as proximate composition analysis.

2.3.2. Physical and chemical quality analysis

Thiobarbituric acid, as TBA, mg malonaldeyde/kg (Tarladgis, Watts, Younathan, & Dugan, 1960), total volatile base-nitrogen, TVB-N, mg N/100 g (Antonacopoulos & Vyncke, 1989), pH values and salt (%) analyses (Ludorff & Meyer, 1973) of frozen, boiled, and marinated shrimps, citric acid concentration (Karl, 1994) in marinated shrimp and citric acid concentration in brine (Ludorff & Meyer, 1973; Schormüller, 1968) were determined.

2.3.3. Enzymatic analysis

For indicating proteolytic activity, enzymatic analyses were done on the flesh and its brine (Siebert, Malortie, & Beyer, 1962) and expressed as units/mg.

2.3.4. Sensory analysis

Sensory evaluation of marinated shrimps quality was performed by five previously trained panellists, who were asked to evaluate appearance, flavour, odour and texture by using a form (modified) (Ludorff & Meyer, 1973). According to the scoring table, a total score of sensory attributes of 30 means first quality, scores from 29.9 to 26 indicated second quality, scores form 25.9 to 22 indicated third quality and scores from 21.8 to 12 indicated fourth quality.

2.3.5. Microbiological alnalysis

For all microbial counts, 10 g of shrimp was weighed and transferred into 90 ml of 0.1% peptone water (Oxoid, L37), and the ingredients were homogenized by a stomacher (IUL Instruments, Spain) for 1 min. From the 10^{-1} dilution, other decimal dilutions were prepared. Total aerobic plate (AP) count, psychrotrophic bacteria (PB) count, yeast-mold (YM) count and lactic acid bacteria (LAB) count were determined on Plate Count Agar (PCA, Oxoid CM 325) with incubation at 30 °C/ 24–48 h, on PCA, with incubation at 30 °C/3–5 days and de Man Rogosa Sharpe Agar (MRSA, Oxoid CM 361) with incubation at 30 °C (3–5 days), respectively (Ariyapitun, Mustapha, & Clarke, 1999; Dalgaard & Jorgensen, 1999; Harrigan & McCance, 1976). Similarly, the microbiological quality of frozen shrimp was assessed.

2.4. Statistical analysis

Statistical evaluations of the physical, chemical and sensory data were done by using a randomised block design.

3. Results and discussion

3.1. Proximate composition analysis

Moisture value of frozen shrimp was determined as 85.49% (Table 2). Moisture of fresh shrimp is generally 75.86% (Anon, 2002). In another study, moisture of shrimps covered with liquid ice was determined as 74.95% (Huidobro, Caballero, & Mendes, 2002).

Moisture in frozen shrimp decreased to 77.49% after boiling (Table 2). No significant differences were determined in moisture contents marinated shrimps (group A and group B) ($p > 0.05$) (Table 1).

Fat content of frozen shrimp was 0.35%. In another study, the fat content of shrimp (*Parapenaeus longirostris*) covered with liquid ice was 0.31% (Huidobro et al., 2002). It has been reported that fat content of fresh shrimp was generally less less than this. After boiling, fat content of shrimp increased slightly and reached 0.54% (Table 1).

Protein content of frozen shrimp was determined as 11.0%, protein content of fresh shrimp is generally 20.3% (Anon, 2002).

Ash content of frozen shrimp was 2.43%. Ash concentration of raw shrimp is generally reported as 1.20% (Anon, 2002). In another study, ash content of shrimps (*Parapenaeus longirostris*) covered with liquid ice was 2.35% (Huidobro et al., 2002). Ash content of boiled raw material was determined as 2.35% (Table 1).

3.2. Physical and chemical quality analysis

3.2.1. pH value

pH values frozen shrimp and boiled shrimp were 7.64 and 7.73, respectively (data not shown). In marinated products, pH value should not be more than 4.8 (Rehbein & Oehlenschlager, 1996). Almost all food poisoning and most of the growth of spoilage bacteria may be prevented at pH 4.8 (McLay, 1972). Organic acids, due both to their ability to depress pH below the growth range of microorganisms and metabolic inhibition by the undissociated acid molecules, have an effective antimicrobial function (Feng & Huang, 2001).

pH values of flesh in group A were 4.77 and 4.72 at the beginning and at the end of the storage period, respectively, while pH values of brine in group A were 4.01 and 4.69 at the beginning and at the end of the storage period, respectively. When comparing pH values of flesh of group A and group B at the beginning and at the end of the storage, significant difference was determined ($p < 0.05$). pH values of flesh in group B were 4.66 and 4.69 at day 0, respectively. pH values of brine in group B were 4.47 and 4.69 at the beginning and at the end of the storage, respectively (Table 2). When comparison was attempted of pH values of brine in group A with pH values of brine in group B during the storage period, no significant difference was determined ($p > 0.05$) but there was a significant difference between the pH values of flesh in group A and the pH values of group B during the storage period ($p < 0.05$).

3.2.2. Salt% and citric acid

Salt contents in frozen shrimp and boiled shrimp were 1.34% and 1.31%, respectively (data not shown). Salt contents of flesh in group A were 1.89 and 1.94 at the beginning and at the end of measurement, respectively, while salt contents of brine in group A were 2.44 and 1.86 at the beginning and at the end of measurement, respectively (Table 3). Salt contents of the flesh of group

Table 1
Proximate composition*

Material	Moisture (%)	Fat (%)	Ash (%)	Protein (%)
Fresh shrimp	85.49* ± 0.59	0.35 ± 0.09	2.43 ± 0.88	11.0 ± 0.40
Boiled shrimp	77.79 ± 0.80	0.54 ± 0.05	2.35 ± 0.03	19.2 ± 0.10
Group (A)[a]	75.55 ± 0.51	0.60 ± 0.09	2.60 ± 0.76	8.60 ± 0.80
Group (B)[b]	75.48 ± 0.06	0.54 ± 0.05	2.78 ± 0.74	20.4 ± 0.00

[a] Marinated shrimp with antimicrobial agent.
[b] Marinated shrimp without antimicrobial agent.
* n:3; (arithmetic mean ± SD).

Table 2
Changes in pH values of flesh and brine in marinated shrimps during storage period

pH value	Storage period (day)					
	0	5	6	12	26	40
Group A[A]	4.77 ± 0.04[a],**	4.52 ± 0.04[b]	4.56 ± 0.09[b]	4.47 ± 0.01[b]	4.57 ± 0.10[b]	4.72 ± 0.05[a]
Group B[A]	4.66 ± 0.01[a]	4.52 ± 0.06[b]	4.53 ± 0.01[b]	4.53 ± 0.01[b]	4.54 ± 0.03[b]	4.72 ± 0.05[a]
Group A[B]	4.61 ± 0.02[b]	4.50 ± 0.00[c]	4.64 ± 0.01[b]	4.64 ± 0.01[b]	4.65 ± 0.05[b]	4.69 ± 0.01[a]
Group B[B]	4.47 ± 0.01[d]	4.52 ± 0.04[b]	4.58 ± 0.08[b]	4.63 ± 0.04[b]	4.65 ± 0.01[b]	4.69 ± 0.01[a]

[A] Flesh of marinated shrimp with antimicrobial agent.
[B] Brine of marinated shrimp without antimicrobial agent group.
** Means in the same column with the same letter do not differ significantly at the level of 0.05 significance.

Table 3
Changes in salt and acid contents of marinated shrimps during storage

Analyze salt (%), acid (%)	Storage period (day)				
	0	2	5	12	26
Salt in flesh A[A]	1.89 ± 1.50^{b},*	2.34 ± 0.20^{a}	2.18 ± 0.13^{a,b}	2.11 ± 0.08^{b}	0.94 ± 0.06^{b}
Salt in flesh B[B]	2.06 ± 0.06^{a}	1.96 ± 0.17^{a}	2.17 ± 0.12^{a}	2.06 ± 0.12^{a}	2.08 ± 0.06^{a}
Acid in flesh of A	0.30 ± 0.00^{c}	0.52 ± 0.03^{a}	0.45 ± 0.02^{a,b}	0.48 ± 0.06^{a}	0.39 ± 0.05^{b}
Acid in flesh of B	0.52 ± 0.30^{b}	0.37 ± 0.07^{a}	0.39 ± 0.05^{a}	0.42 ± 0.07^{a}	0.44 ± 0.05^{a}
Salt in brine of A	2.44 ± 0.45^{a}	2.64 ± 0.01^{a}	54 ± 0.34^{a}	2.34 ± 0.00^{a}	1.86 ± 0.17^{a}
Salt in brine of B	2.73 ± 0.17^{a}	2.73 ± 0.68^{a}	2.15 ± 0.17^{a,b}	2.34 ± 0.29^{a,b}	1.76 ± 0.00^{b}
Acid in brine of A	0.46 ± 0.56^{b}	1.00 ± 0.04^{a}	0.56 ± 0.04^{b}	0.47 ± 0.17^{b}	0.43 ± 0.02^{b}
Acid in brine of B	0.49 ± 0.04^{b}	0.79 ± 0.04^{a}	0.54 ± 0.09^{a}	0.55 ± 0.04^{a}	0.55 ± 0.05^{a}

[A] Marinated shrimp with antimicrobial agent.
[B] Marinated shrimp without antimicrobial agent.
[*] Means in the same column with the same letter do not differ significantly at the level of 0.05 significance.

B were determined at the beginning, at 12 and at the end of the measurement as 2.06, 2.06, and 2.08, respectively. Salt contents of the brine of group B were 2.73, 2.34, and 1.76, respectively. When comparing salt contents of the flesh of group A and group B, no significant difference was found ($p > 0.05$).

Citric acid contents of the flesh of group A were determined at the beginning, at day 12 and at the end of the measurement as 0.30, 0.48, and 0.39, respectively. Citric acid contents of the brine of group A were determined at the beginning, at day 12 and at the end of the measurement as 0.46, 0.47 and 0.43, respectively. Citric acid contents of the flesh of group B were determined at the beginning, at day 12 and at the end of the measurement as 0.52, 0.42 and 0.44, respectively. Contents of citric acid of the brine of group B were determined at day 12 and at the end of the measurement as 0.49, 0.55 and 0.55, respectively. No significant difference was found between the citric acid contents of flesh in group A and group B ($p > 0.05$), but there was a significant difference between the citric acid contents of brine in the two groups ($p < 0.05$).

3.3. Enzymatic analysis

One of the main purposes of acid marination is to aid softening of the flesh. This is due to the proteolytic activity. These enzymes denature protein and free amino acids from and these give characteristic tastes (Clucas & Ward, 1990). Protease enzyme activity is related to salt concentration (Rehbein & Oehlenschlager, 1996). By the action of the proteolytic enzymes, maturation occurs and typical flavour and aroma are formed in salted fish. Proteolytic activity of flesh in group A was determined at day 0 as 0.01 units/mg. Since enzymes become inactivated during the boiling process. It increased at day 20 and reached to 0.31. Proteolytic activities of brine of group A were 0.03 and 0.16 at days 0 and 20, respectively. On the last day proteolytic activities of flesh and brine in group B were increased to 0.33 and 0.14, respectively (Table 4).

In all groups, proteolytic activity started to increase, especially after 20 days of storage. When comparing proteolytic activities of flesh and brine in group A with group B no significant differences were found ($p > 0.05$).

3.4. TVB-N and TBA

In marine fish, TVB-N values of 15–20 mg N/100 g show good quality, whereas TVB-N values of 50 mg N/100 g show poor quality (Conell, 1980). Crustaceans may have high TVB-N values peculiar to themselves (Oehlenschlager, 1997). TVB-N values of frozen and boiled shrimp were 27.5 and 29.9 mg N/100 g, respectively (data not shown). In another study, initial TVB-N value of shrimp (*Parapenaeus longirostris*) just after packaging in modified atmosphere, was 21 mg N/100 g

Table 4
Proteolytic activity in flesh and brine of marinated shrimps during storage period

Proteolytic activity material (unit/mg)	Storage period (day)							
	0	2	6	7	12	20	34	40
Flesh (A)[A]	0.01 ± 0.00^{c,d}	0.02 ± 0.01^{c,b}	0.11 ± 0.09^{c,d,e}	0.01 ± 0.01^{d,e}	0.01 ± 0.01^{e}	0.06 ± 0.05^{c,d,e}	0.28 ± 0.05^{a,b}	0.31 ± 0.01^{a}
Flesh (B)[B]	0.01 ± 0.01^{e,*}	09 ± 0.00^{e}	0.01 ± 0.01^{e}	0.11 ± 0.01^{d}	0.08 ± 0.01^{d}	0.17 ± 0.02^{c}	0.27 ± 0.04^{b}	0.33 ± 0.00^{a}
Brine (A)[A]	0.03 ± 0.01^{c}	0.02 ± 0.01^{c}	0.19 ± 0.11^{a}	0.09 ± 0.01^{b,c}	0.08 ± 0.01^{b,c}	0.12 ± 0.00^{a,b,c}	0.16 ± 0.12^{a,b}	0.16 ± 0.12^{a,b}
Brine (B)[B]	0.02 ± 0.00^{d}	0.02 ± 0.01^{d}	0.03 ± 0.01^{c,d}	0.15 ± 0.07^{a}	0.07 ± 0.01^{b,c,d}	0.11 ± 0.02^{a,b,c}	0.12 ± 0.04^{a,b}	0.14 ± 0.02^{a,b}

[A] With antimicrobial agent.
[B] Without antimicrobial agent.
[*] Means in the same column with the same letter do not differ significantly at the level of 0.05 significance.

(Cabellero, Gançalves, & Nunes, 2002) but, in one of the studies, TVB-N value of spoiled *Penaeus monodon* was 25.6 mg N/100 g at 5 °C and 30.3 mg N/100 g at 22 °C. In another study, *Penaeus monodon* was indicated as spoiled with a TVB-N level of 30 mg N/100 g. Shamshad, Nisa, Riaz, Zuberi, and Qadri (1990) reported that the upper limit for TVB-N level was 28.5 mg N/100 g. These differences may have originated from species and storage temperature (Lou, 1998; Shamshad et al., 1990). In another study of *Panaeus merguiensis* treated with $NaHSO_3$ before ice storage, a low TVB-N value was determined (Yamagata & Low, 1995). In group A, TVB-N values were 8.87 and 9.80 mg N/100 g, at days 0 and 40, respectively (Table 5). In group B, TVB-N values were 7.00 and 8.40 mg N/100 g at day 0 and 40, respectively. It was obvious that marination decreased TVB-N values. Both groups were rated 'good quality' due to their TVB-N values.

TBA analysis is an important quality index, indicating fat oxidation. Oxidative rancidity is a complex spoilage, and especially occurs in fatty fishes (Conell, 1980). In perfect quality material, TBA value should be less than 3 mg malonaldeyde/kg and, in good quality material, TBA value should not be more than 5 mg malonaldeyde/kg. Consumption limits are from 7–8 mg malonaldeyde/kg (Schormüller, 1968, 1969). TBA values of raw material group A and group B were determined as 0.51 and 0.91 mg malonaldeyde/kg, respectively. Both groups were close to the acceptability limits for consumption and no significant differences were determined between the two groups ($p > 0.05$) (Table 5). Results of TBA analysis were parallel to sensory analysis.

TVB-N value of raw material was 27.5 mg N/100 g, whereas TBA value was 0.51 mg malonaldehyde/kg. TVB-N and TBA values were determined 29.9 mg N/100 and 0.91 mg malonaldehyde/kg, respectively.

When comparing TVB-N value of group A with group B, no significant difference was determined ($p > 0.05$). When comparing TBA values of group A with group B, a significant difference was determined according to the storage period.

Table 6
Sensory evaluations of marinated shrimps during storage period

Group	Overall quality score	Storage period (day)			
		6	12	26	40
A[a]		21.45	23.10	20.20	18.80
B[b]		24.10	22.30	20.20	19.50

[a] Marinated shrimp with antimicrobial agent.
[b] Marinated shrimp without antimicrobial agent.

3.5. Sensory analysis

According to the results of sensory evaluations, no significant difference was determined between the two groups ($p > 0.05$). When all sensory criteria were taken into consideration, the two groups were determined as 'third quality' at day 6 (Table 6). Evaluations at days 26 and 40 indicated that marinated shrimps were 'fourth quality'. Much more rancidity was experienced by the panellists in marinated shrimps at day 40 than at day 26. According to the sensory evaluations, marinated shrimps in both groups could not be consumed at day 40 since fat oxidation had progressed intensely. No significant difference was determined between the sensory evaluations of the two groups ($p > 0.05$).

3.6. Microbiological analysis

The initial microbiological quality of the frozen shrimp was as follows: 5.24, 5.75, and 1.15 log CFU/g for AP count, PB count and YM count, respectively, and 3.92 log CFU/g for LAB count (Table 7). The AP count did not exceed the maximum limit (7 log APC/g) of microbiological criteria for frozen shrimp given by ICMSF (1978). Microbial load decreased just after the shrimps were marinated (day 0). Log Ap counts of group A and group B were determined as 1.93 and 1.85, respectively, whereas no PB, LAB, YM were detected at day 0. Log Ap counts of the two groups stayed close to each other until the end of day 26. At day 40 log AP and PB counts of group A were determined as 1.98 and 1.15,

Table 5
Chemical quality changes of marinated shrimps during storage period

Chemical analysis	Storage period (day)			
	0	12	31	40
TVB-N(mg/100 g)				
A[A]	$8.87 \pm 0.81^{a,**}$	9.10 ± 0.99^{a}	11.20 ± 0.00^{a}	9.80 ± 0.00^{a}
B[B]	7.00 ± 0.00^{b}	8.40 ± 0.00^{b}	13.30 ± 0.99^{a}	8.40 ± 0.00^{b}
TBA (mg/malonaldehyde/kg)				
A	1.53 ± 0.53^{c}	5.00 ± 0.67^{b}	4.17 ± 0.95^{b}	7.29 ± 0.45^{a}
B	0.99 ± 0.63^{c}	5.00 ± 0.88^{b}	5.00 ± 0.88^{b}	6.50 ± 3.14^{b}

[A] Marinated shrimp with antimicrobial agent.
[B] Marinated shrimp without antimicrobial agent.
** Means in the same column with the same letter do not differ significantly at the level of 0.05 significance.

Table 7
Changes in microbial flora of marinated shrimp during storage period

Group	Analysis	Storage period (day)			
		0	12	26	40
A[a]	Log TV count/g	1.93 ± 0.12	1.85 ± 0.17	1.85 ± 0.32	1.98 ± 0.09
	Log PB count/g	ND*	ND	ND	1.15 ± 0.21
	Log YM count/g	ND	ND	ND	ND
	Log LAB count/g	ND	ND	ND	ND
B[b]	Log TV count/g	1.85 ± 0.13	1.84 ± 0.20	1.73 ± 0.23	4.03 ± 0.06
	Log PB count/g	ND	ND	ND	3.95 ± 0.05
	Log YM count/g	ND	ND	NO	ND
	Log LAB count/g	ND	ND	ND	ND

[a] Marinated shrimp with antimicrobial agent.
[b] Marinated shrimp without antimicrobial agent.
* ND: not determined

respectively, whereas these levels for group B were 4.03 and 3.95, respectively (Table 7). LAB and YM were still not detected at the end of day 40. Sorbates and benzoates are primarily effective against yeasts and molds, but it has been reported that they are effective against a wide range of bacteria (Jay, 1991). In this study, sorbic and benzoic acids inhibited bacterial growth during the whole storage period at 1 °C. Einarsson and Lauzon (1994) reported that the shelf life of shrimp (ca. 3% NaCl, 0.5% citric acid, 0.75% glucose), subjected to control treatment, was found to be 10 days (log AP, PB count > 6) but the sorbate–benzoate (0.1% for each) preserved the brined shrimp for 59 days at 4.5 °C. These findings correlate with ours. Although bacterial load of group B was lower than the consumption limits at the end of day 40 at 1 °C, TBA value determined the shelf life of marinated shrimps. This was confirmed by the sensory evaluation.

4. Conclusions

In this study, deep-water pink shrimp (*Parapenaeus longirostris*) was marinated according to two different formulations. Frozen shrimps were used as raw material.

Shelf life of two groups of marinated shrimps was indicated as 40 days at 1 °C. TBA value (mg malonaldehyde/kg) indicated the shelf life of marinated shrimps. At the end of day 40, all of the groups reached the borderline of consumption acceptability. Although evaluations on day 40 indicated that marinated shrimps may be consumed (A: 18.80, B: 19.50, consumption limit level: 12.00), panellists indicated that intense rancidity occurred in the product. This rancidity, produced by the fat oxidation, was the result of increase of the TBA value. Sensory evaluations were parallel to the results of TBA. Colour, taste and overall acceptability have high correlation with the TBA values. TVB-N values in the marinated samples were determined as much less than the TVB-N values in the raw material. Salt and citric acid decreased the level of TVB-N. Overall, when comparing proximate compositions, chemical and sensory analysis of group A with group B no significant difference was determined ($p > 0.05$).

This study aimed to increase the value of deep water pink shrimp (*Parapenaeus longirostris*) caught in Turkish seas after marination. Marination technology for this size of shrimp is mostly used in Europe and America, whereas its usage is only developing in Turkey. Deep water pink shrimp (*Parapenaeus longirostris*), which is not economically evaluated and suffers quality problems during frozen storage, gains new taste, texture and extra shelf life with the marination process. In this study, group B approached the shelf life of the marinated shrimps used in Europe and America according to chemical and sensory analyses.

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