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Uses of Grape Seed Extract as a Preservative for Fish Fillets Under Refrigeration Storage

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ABSTRACT

The purpose of this investigation was to determine the effects of grape seed extract on some physic-chemical characteristics of fresh fish fillets stored at 4ºC for six days. Fish fillets were untreated as control (T1) sample. Grape seed extract were prepared at the concentration of 0.5, 1 and 1.5% (w/v). Fillets were dipped with pre-chilled SL up to 10 minutes (T2: 0.5%, T3: 1%, T4: 1.5%). The samples were then stored under refrigerated conditions (4.0°C). Two replicate samples were taken on 0 (before treatment), 1, 2, 4 and 6 days of the storage time. In the last day of storage (6^{th} day) T4 recorded the lowest pH value (6.16) while the highest value recorded in T1 (6.91). In the last day of storage there were significant differences among treatments, the highest WHC percentage recorded in fish fillets of T4 (49.33%), while the lowest percentage recorded in fish fillets from T1 (31.67%). After 6^{th} day of storage, the fish fillets of T4 recorded the lowest T.V.N value (13.4 mg N/100gm), while the fish fillets of T1 recorded highest value (28.3 mg N/100gm). In the last day of storage (6^{th} day) the fish fillets of T3 recorded the lowest TBA value (1.7 mg MDA /kg meat), while the highest value recorded in T1 (1.9 mg MDA /kg meat). We can concluded that use of grape seed effect on some physio-chemical properties of fish fillets but it need more investigate and use more concentration.

KEYWORDS

Grape Seed Extract, Preservative, Fish, Fillets, Refrigeration.

Introduction

The high cost of some naturally occurring and biologically active agents constitutes a major limitation on the use of this type of compounds in food production, as a result, efforts have been focused on less expensive sources such as agricultural wastes rich in polyphenols. Grape seed extract (GSE) is an industrial derivative from whole grape seeds, and is a good origin of monomeric phenolic compounds such as (+)- catechins, (-)- epicatechin, (-)-epicatechin-3-o-gallate, gallic acid and dimeric, trimeric and tetrameric procyanidins, which have antioxidant (AOX) and antimicrobial (AM) advantages. GSE AM activity is dependent according to the part, type and condition of plant that extract. GSE can be applied to edible films and coatings and is one of the most favorable envelope materials for different food model (Rubilar and Cruz 2014). The pharmaceutical and nutritional importance of grapes (Vitis vinifera) has been heralded for millennium of years. Among other profitable effects of parts of a grape, grape seeds are approve to have a powerful antioxidant property due to its good source of polyphenol compounds (Nawaz et al., 2006; Carcia-Marino et al., 2006). One of the most food products susceptible to deterioration is fish; during curing and storage, freshness drop of fish rapidly take place and decline the shelf life of the product (IFST, 1993). The quality of fish could be degenerate through a long process, in which the physical, chemical and bacteriological forms of decay are involved; enzymatic and chemical reactions are usually responsible for the incipient loss of quality whereas bacterial action is responsible for the clear damage and thereby established food shelf life (Gram & Huss, 1996). Several factors lead to the perishability of fish meat, which are: more rapid autolysis by fish enzymes, high pH of fish meat which activate microbial growth, many of fish oils seem to be extra susceptible to oxidative deterioration, softness of the fish flesh and high water content (Huss, 1994). The quality drop is due to action of bacteria and chemical reaction. The most common form of chemical drop is the deterioration of meat lipids. Lipid corrosion is a complex process and depends on chemical composition of meat, storage condition; it is also affected by some procedures steps to which meat is subjected during processing (Karakaya et al., 2011). Lipid oxidation can be reduced or block and shelf-life can be improved by the use of antioxidants in meat and meat products.

The aims of this will be use of grape seed extract as preservative for fish fillets storing in Refrigeration temperature.

Material and Methods

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Fresh common carp fish (*Caprinus caprio*) was purchased after being harvested, from a local market. After removed head and eviscerated, transported to the laboratory in cool box. The fish were prepared to produce fillet manually. The muscular part was used for the physiochemical traits test.

Fish fillets were untreated as control (T1) sample. Grape seed extract were prepared at the concentration of 0.5, 1 and 1.5% (w/v). Fillets were dipped with pre-chilled SL up to 10 minutes (T2: 0.5%, T3: 1%, T4: 1.5%). The samples were stored in cooling conditions (4.0°C).

Three replicate samples were taken on 0 (before treatment), 1, 2, 4 and 6 days of the storage time.

Analysis

Water holding capacity (WHC) was measured according to Wardlaw et al., (1973), The pH of the meat specimens were measured according to Naveena & Mendiratta (2001), Total volatile basic nitrogen (TVB-N) (Malle and Poumeyrol, 1989), Thiobarbituric acid (TBA) value analysis was analyzed according to Tarladgis et al., (1960).

Statistical Analysis

The XL Stat program for Windows was used to study factors examined (treatment and period) in traits. Duncan multiple ranges used to significantly compare between means (0.05) (Steel et al., 1996).

Results

As shown in table 1, the results of pH shown there were significant different among treatments in day 1, 2 and 6th, in 1st day, T4 recorded the lowest pH value (5.75), while the highest value recorded in T2 (5.98), after 2nd day of storage, T4 recorded the lowest pH value (5.60) while T1 recorded the highest value (5.76). In the last day of storage (6th day) T4 recorded the lowest pH value (6.16) while the highest value recorded in T1 (6.91).

Table 1. pH of fish fillets treated with different concentration of grape seed extract storage for 6th day in refrigeration

Treatment	Day of storage				
	0	**1**	**2**	**4**	**6**
T1	6.20 a	5.89 ab	5.76 a	6.11 a	6.91 a
T2	6.19 a	5.98 a	5.74 a	6.12 a	6.43 b
T3	6.21 a	5.86 ab	5.74 a	6.16 a	6.23 b
T4	6.18 a	5.75 b	5.60 b	6.01 a	6.16 b
The different letter in same column mean significantly differ (P ≤0.05).					

The Water holding capacity percentage shown in table 2, there were no significant differences among treatments in 0, 1st, 2nd, 4th days of storage, while in the last day of storage there were significant differences among treatments, the highest WHC percentage recorded in fish fillets of T4 (49.33%), while the lowest percentage recorded in fish fillets from T1 (31.67%).

Table 2. W.H.C. percentage of fish fillets treated with different concentration of grape seed extract storage for 6th day in refrigeration

Treatment	Day of storage				
	0	**1**	**2**	**4**	**6**
T1	31.66 a	53.33 a	51.67 a	36.67 a	31.67 b
T2	30.00 a	46.67 a	53.33 a	46.67 a	41.67 ab
T3	32.50 a	40.00 a	50.00 a	40.00 a	48.33 ab
T4	32.83 a	53.33 a	55.00 a	46.67 a	49.33 a
The different letter in same column mean significantly differ (P ≤0.05).					

The total volatile nitrogen value (mg N/100gm) of fish fillets shown in table 3, the results show there were significant differences among treatments in 0, 2nd and 6th day of storage. In 2nd day after storage, fish fillets from T4 recorded lowest T.V.N. value (12.0 mg N/100gm), while the highest value recorded in T1 which recorded (20.6 mg N/100gm). After 6th day of storage, the fish fillets of T4 recorded the lowest T.V.N value (13.4 mg N/100gm), while

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the fish fillets of T1 recorded highest value (28.3 mg N/100gm).

Table 3. T.V.N value (mg N/100gm) of fish fillets treated with different concentration of grape seed extract storage for 6th day in refrigeration

Treatment	Day of storage				
	0	**1**	**2**	**4**	**6**
T1	1.96 a	2.04 a	2.06 a	27.2 a	28.3 a
T2	1.72 a	2.84 a	2.01 a	14.0 a	18.8 ab
T3	0.84 b	1.91 a	2.16 a	23.3 a	18.8 ab
T4	0.78 b	1.54 a	1.20 b	14.6 a	13.4 b
The different letter in same column mean significantly differ (P ≤0.05).					

Table 4 show the results of TBA value of fish fillets after 6 days of storage, results show that there were significant differences among treatments in 1st, 2nd, 4th and 6th days of storage. After 1 day of storage, the fish fillets of T2 recorded the lowest TBA value (0.09 mg MDA /kg meat), while the highest value recorded in fish fillets of T1 (0.13 mg MDA /kg meat), after 2 days of storage, the fish fillets of T3 recorded the lowest TBA value (0.13 mg MDA /kg meat), and the highest recorded in fish fillets of T1 (0.18 mg MDA /kg meat). In 4th day of storage, the fish fillets of T3 recorded the lowest TBA value (0.12 mg MDA /kg meat) and the fish fillets of T1 recorded the highest value (0.17 mg MDA /kg meat), in the last day of storage (6th day) the fish fillets of T3 recorded the lowest TBA value (1.7 mg MDA /kg meat), while the highest value recorded in T1 (1.9 mg MDA /kg meat).

Table 4. TBA value (mg MDA /kg meat) of fish fillets treated with different concentration of grape seed extract storage for 6th day in refrigeration

Treatment	Day of storage				
	0	**1**	**2**	**4**	**6**
T1	0.13 a	0.13 a	0.18 a	1.7 a	1. 9 a
T2	0.14 a	0.09 c	0.13 b	1 3 b	1.8 b
T3	0.14 a	0.10 b	0.11 b	1. 2 b	1.7 c
T4	0.13 a	0.10 b	0.13 b	1.3 b	1 8 b
The different letter in same column mean significantly differ (P ≤0.05).					

Discussion

Benjakul et al. (2002) showed that the decay of nitrogen component lead to rise in pH of fish meat with the storage time. The results (table 1) exposed that pH mean rise with progress in storage time, which was recorded by Jayesh and Venkatarmanujam (2000) and Kandeepan and Diswas (2007). The same results of increased pH observed in this study seen in refrigerated stored chicken (Aksu et al., 2005, 2006).

The estimation of the WHC gives conclusions about the stage of decay of the proteins and therefore the freshness value of the fish (Skipnes et al., 2007). The results revealed that there are no significant differences (p>0.05) among treatments after 6 days of cold storage at 4º C (table 2), on the other hand, results showed a gradual decrease in WHC as a storage time was progressed, it may be due to the protein lose their buffering capacity as the distance from isoelectric point increases (Offer and Trinick, 1983) or due to increase moisture loss during storage (Lawrie, 2002). The use of grape seed extract effect on water holding capacity as reported in table 2, the fish fillets treated with grape seed extract recorded best results as compared to control (Delgado and Sun 2002).

If the TVB.N. value were 30mg N/100g most researcher would theorize the fish to be stale, however at 40 mg N/100 g the fish is consider as unfit for consumption. The level of TVBN for white fish is generally considered to be fresh if the T.V.N. is less than 20mg N/100 g sample if TVB.N. assay by steam distillation (Egan et al., 1981). However, levels exceeding 28 mg N TVB-N/100g meat has been reported "unacceptable" according to the Turkish Manual of Seafood Quality Control Limits (Anonymous, 2008) in high of Turkey being neighbor country. Sikorski et al. (1990) suggest that fish and fish products is unfit for human consumption when exceeding the value (T.V.N) 30mg N/100g meat. Fish fillets in all treatments are within the acceptable limited of T.V.N, but the fish fillets treated with the Grape seed extract.

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All treatment in last days of storage recorded TBA values within the good quality product (Günşen et al., 2011) who suggested that TBA values in fresh product should not be exceeded 5mg malonaldehyde/kg. While Connell (1995) specify that rancidity evidence in fish when TBA becomes more than 1-2mg malonaldehyde/kg, all treatment are within the acceptable limited but the treated with Grape seed extract recorded lowest value in comparison to control treatment (Mielink et al., 2008).

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