The differences between glazing with solutions, coating with fish waste extracted gelatin and polyethylene-packaging of common carp fish fillets and their effects on qualitative and sensory characteristics during different freezing storage periods

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Abstract

The study was conducted to choose the best way to store the fillets of common carp fish. Samples were divided into five treatments (T1 control treatment), (T2 glazing with saline solution 2%), (T3 glazing with acid solution 2%), (T4 coating with fish ex-tracted Gelatin), (T5 normal polyethylene- packaging). These five groups (treat-ments) have been stored in freezing conditions at four periods 2,4,6,8 weeks respectively. The qualitative and sensory properties of fish fillets were studied and the best results was belonging to T4 (gelatin coating treatment). The study included the process of gelatin extraction from fish waste as well.

Keywords: Common carp, Glaze, Gelatin coating .

Introduction

Fish resources in the worldwide or in the Arab world is considered one of the important fields of economic development, because of their characteristics of continuity and renewal, in addition to what distinguishes fish from other animals, as it has a high net rate compared to sheep and cows, This percentage constitutes (50-60%) about the body of fish, . The demanding on fishes' meat is increasing due to its high nutritional value and distinctive flavor. Iraq has a good fish wealth, so it is necessary to make the most of fish production and its offal, and to preserve it from waste and loss, thus reducing economic losses. Carp is one of the most important economic fish spread in water bodies. It is also considered one of the main fish breeding in Iraqi fish farms, due to its high production rates, its resistance to any changes in different environmental conditions, its wide nutritional range and ease of cultivation [2].

The gelatin is a protein substance extracted from collagen that is sourced from fish waste or the bones and skins of calves and sheep. Technologically, gelatin can be used to improve viscosity, durability, texture, gelatinization, emulsification and stability of food, as well as for food coating, pharmaceutical and photographic uses [19].

The current study aims to investigate the differences among treatments and their effects on chemical composition, qualitative and sensory characteristics of fish fillets during different periods of freezing storage conditions.

Materials and methods

Raw materials

Fish preparation

In this experiment, common carp was used. It is considered one of the types desired by the consumer. Its length ranged between (40to45) cm and its weight ranged between (2to2.5) kg. It was obtained from the Euphrates River, Saddat alhendia city.

Fresh carp fish were taken and washed with clean running water, and then the head, tail, fins, scales and internal entrails were removed by clean knives, and fish slices were made with a length of (10to12) cm and a width of (5to7) cm. The fish fillets were divided into five sections as follows the first section T1 the control treatment (without changes), the second section T2 salt glazing the third section T3 vinegar glazing, the fourth section T4 gelatin coating and the fifth section T5, and then, all the groups were frozen at the temperature of (-18±2)c for periods of 2,4,6,8 weeks respectively.

gelatin extracting from carp fish waste.

The gelatin that used in this experiment was extracted from the head, tail and skin scales of fishes.

Where carp residues are cut into small pieces ranging in size (1-2) cm and then washed and cleaned of all suspended impurities, then placed with water in pots and heated to a temperature ranging from 90-95 Ċ for a period of 6 hours (every hour). water is replaced. To get rid of the largest amount of fat, and then the process of soaking in a solution of hydrochloric acid (2%) for a period of 72 hours, and after this process, the process of washing with running water for a period of (24) hours is carried out to get rid of the effects of hydrochloric acid in the raw material, and then the preparation is done For extraction by placing distilled water with the raw material in a ratio of (1:2). Now the extraction process begins as follows:-

Extraction at a temperature of 60ċ) (for a period of 6 hours, then the liquid is separated and filtered using a filter flask. Then it is placed in the refrigerator, and when the gel is obtained, it is extracted at laboratory temperature to be returned to the liquid state.

The liquid is taken in a glass dish and concentrated using an evaporator under a vacuum pressure of 760 mm Hg at a temperature of 50ċ , then drying the product in a vacuum oven at a temperature of 55ċ and then grinding the product using an electric grinder.

Glazing

The sections of the fishes were frozen, then glazing was done on it.
The materials used for glazing are:-

1- Salt: Iraqi-made salt of purity (99.4) according to the modern standards and regulations. A solution of table salt (2%) was used to wrap the second part of the frozen carp fish slices and freeze them for a period of (2-4-6-8) weeks.

2-Vinegar: - Use a vinegar solution (2%) to wrap the third section of frozen carp fish fillets, and freeze them for a period of (2-4-6-8) weeks.

Gelatin coating

The fourth section T4, was coated with gelatin extracted from carp fish residues, and then stored In freezing conditions for periods of(2,4,6,8) weeks respectively.

Packaging with polyethylene bags.

The fifth section T4, carp fish fillets are rapped with polyethylene bags, and then frozen at intervals of storage (2-4-6-8) weeks**.**

Qualitative estimation

1-Estimation of PH

The pH of frozen fish fillet meat samples was estimated according to the method mentioned in [21].

2-Free fatty acids

The values of free fatty acids were estimated according to what was mentioned in the source [9].

3-Peroxide values

Peroxide values were estimated according to the method mentioned by [17].

4-Total volatile nitrogen

Total volatile nitrogen in frozen fish fillet meat samples was calculated according to the method mentionedby[8].

5-Value of thiobarbituric acid

The method mentioned [9] was adopted in calculating and estimating the values of thiobarbituric acid.

statistical analysis

The statistical program [18] was used in data analysis to study the effect of different treatments on the studied traits according to a completely randomized design factorial and the significant differences between the means were compared with the Least Significant Difference-LSD test.

Results and discussion

Effect of glazing and coating with gelatin, Packaging with polyethylene and freeze storage period (-18±2)ċ on the chemical parameters of carp fillets.

1-pH

Table (1) shows the effect of glazing, coating with gelatin, Packaging with polyethylene and freeze storage period on the PH values of carp. there were no significant differences in the treatments of freezing on the PH values, increased in the T1 treatment during the freezing periods, and it was during the first two weeks of freezing were (6.25) and after (8) weeks the PH values were (6.20), the reason for the pH remaining on the acidic side and not rising is due to the increased oxidation and decomposition of fatty substances by lipases and phospholipases. Thus, it will produce short chain fatty acids, which leads to a decrease in PH and an increase in acidity. These results are in agreement with the study [12][14].

While in the remaining four treatments, an increase in pH values occurred during the freezing periods. Where the highest values of pH were recorded in the T4 treatment. Where it reached (6.32) after (8) weeks, and the lowest pH was in the treatment T3 after two weeks of freezing, reaching (6.23). Proteinuria by microbial action or endogenous enzymes. The second reason is due to the accumulation of ammonia and other nitrogen compounds. These results agreed with the studies of [10][16].

Table (1): - The differences among treatments in pH values during different freezing storage periods.

Treatment	**Freezing time (week)**				
	2	4	6	8	**Average**
T1	6.25	6.23	6.21	6.20	**6.22**
T2	6.24	6.23	6.25	6.26	**6.24**
T3	6.23	6.25	6.27	6.30	**6.26**
T4	6.25	6.27	6.29	6.32	**6.28**
T5	6.26	6.27	6.29	6.31	**6.28**
LSD Values	0.178 NS	0.205 NS	0.189 NS	0.267 NS	**0.194 NS**
insignificant NS					

(T1 Control treatment without changes)(T2 brine solution2%)(T3 acid solution2%)(T4 Gelatin coating)(T5Polyethylene packaging)

2-Free fatty acid (FFA)

Table (2) shows the effect of glazing, coating with gelatin, Packaging with polyethylene, and the duration of freezing storage on the percentage of free fatty acids (FFA)

of carp. The results of the statistical analysis indicate that there were no significant differences in the averages of transactions during the periods of freezing storage, but there was a slight increase in FFA during the periods of freezing. Where the lowest value of FFA was (0.33) for T2 treatment during the first two weeks. While the highest value of FFA was recorded for the two treatments (T5, T1) was (0.55), so when you see the table that the use of vitrification and packaging had no significant effect on the average values of FFA, this is a slight increase in FFA values during freeze storage periods. Its cause is due to the breakdown and decomposition of glycerides in fat, through the enzymes of lipases and phospholipases, and thus the production of free fatty acids. As well as the existence of a direct relationship between the percentage of fat in carp and free fatty acidsThese results agreed above with the following studies [4].

Table (2): The differences among treatments in free fatty acids FFA values during different freezing storage periods

Treatment	**Freezing time (week)**				
	2	4	6	8	**Average**
T1	0.35	0.41	0.48	0.55	**0.44**
T2	0.33	0.37	0.42	0.48	**0.40**
T3	0.35	0.35	0.44	0.51	**0.41**
T4	0.34	0.40	0.47	0.54	**0.43**
T5	0.36	0.41	0.47	0.55	**0.44**
LSD Values	0.066 NS	0.074 NS	0.069 NS	0.083 NS	**0.072 NS**
insignificant NS					

(T1 Control treatment without changes)(T2 brine solution2%)(T3 acid solution2%)(T4 Gelatin coating)(T5Polyethylene packaging)

3-Peroxide values (pv)

Table (3) shows the effect of glazing, coating with gelatin, Packaging with polyethylene and freeze storage period on peroxide (pv) values of carp. The results of the statistical analysis showed that there were significant differences between the average values of peroxide, where the lowest mean was the treatment (T2 1.45), and the highest mean was (T3 1.82), where there was an increase in the peroxide values during the periods of freezing storage. But during the first two weeks, there were no differences in the increase in the values of peroxide. But after (4-6-8) weeks of freezing there were differences in the values of peroxide. Where the lowest value of peroxide was recorded at the treatment (T2 0.82), and the lowest value of peroxide was recorded at the 8th week of the treatment (T3 2.93).

The reason for this increase in the values of peroxide during the different freezing periods is attributed to several reasons, including the formation of hydroperoxide resulting from the hydrolysis of fats, and thus the increase in its accumulation and this

leads to an increase in the values of peroxide [4].Where the values of peroxide are important indicators that express the oxidation of fats, and therefore fish are considered damaged when their peroxide values reach (10), and the other reason for the high values of peroxide during freezing periods is the exposure of fish to air during the cutting process for sampling, thus their exposure to air (high oxygen level) and thus makes fats more susceptible to oxidation, all of these results were consistent with the following studies and research [12].

Table (3): - The differences among treatments in peroxide (PV) (mEq/kg fat) values during different freezing storage periods.

Treatment	Freezing time (week)				
	2	4	6	8	**Average**
T1	0.93	1.21	1.52	2.83	**1.62**
T2	0.82	1.64	1.23	2.14	**1.45**
T3	0.83	1.67	1.89	2.91	**1.82**
T4	0.92	1.21	1.32	2.57	**1.50**
T5	0.93	1.34	1.43	2.63	**1.58**
LSD Values	0.216 NS	0.267 *	0.298 *	0.307 *	**0.336 ***
(P≤0.05) *					

(T1 Control treatment without changes)(T2 brine solution2%)(T3 acid solution2%)(T4 Gelatin coating)(T5Polyethylene packaging)

4-Total Volatile Nitrogen (TVN)

Table (4) indicates the effect of glazing, coating with gelatin, Packaging with polyethylene, , and freeze storage period on the values of total volatile nitrogen (TVN) for carp. The results of the statistical analysis showed that there were significant differences in the average values of TVN during the periods of freezing storage, where the lowest mean was recorded for treatment (T3 9.46), while the highest average was recorded for treatment (10.58 T5), and during the periods of freezing storage, the lowest values for TVN were during the first two weeks of Freezing reached (6.36) for T3 and the highest value was after (8) weeks of freezing for T5, reaching (13.76).

The reason for the rise of TVN for carp during the periods of freezing storage and for all treatments is due to the increase in the activity and activity of muscle tissue enzymes in the production of TVN with the passage of the progress of freeze storage. There is another reason attributed to him in the increase due to the increase in ammonia emitted by the amino adenosine monophosphate. This is where the enzymatic hydrolysis of the protein takes place. Thus, the phenomenon of denting occurs, which leads to the production of nitrogenous compounds. And the maximum permissible values of TVN for fish meat should not exceed 20 mg nitrogen / 100 g meat. These results were in agreement with [5] [11].

Table (4): - The differences among treatments in nitrogen (TVN) values (mg N/100 gm of meat) values during different freezing storage periods.

Treatment	Freezing time (week)				
	2	4	6	8	**Average**
T1	7.34	9.56	11.45	13.72	**10.51**
T2	6.52	8.76	10.63	12.51	**9.60**
T3	6.36	8.63	10.51	12.34	**9.46**
T4	7.26	9.56	11.62	13.65	**10.52**
T5	7.23	9.62	11.73	13.76	**10.58**
LSD Values	0.561 *	0.774 *	0.794 *	0.821 *	**0.749 ***
(P≤0.05) *					

(T1 Control treatment without changes)(T2 brine solution2%)(T3 acid solution2%)(T4 Gelatin coating)(T5Polyethylene packaging)

5-Thiobarbituric acid (TBA)

Table (5) indicates the effect of glazing, coating with gelatin, Packaging with polyethylene, and freeze storage period on the values of thiobarbituric acid (TBA) for carp. We note from the results of the statistical analysis that there were no significant differences in the averages of transactions during the periods of freezing storage, that the lowest value of TBA was recorded for the T3 treatment in the first two weeks of freezing, which amounted to (1.34), and the highest value of TBA was recorded for the T4 treatment after (8) weeks From freezing storage where it was (1,76)

And this slight increase in carp fish from the beginning of freezing up to 8 weeks. It is attributed to the fact that the freezing and thawing process increases the values of TBA, meaning that the repeated freezing and thawing process leads to the accumulation of TBA values [6].

There is another reason that leads to the small increase in TBA values, which is the occurrence of rancid oxidation processes with the progress of freezing storage, and it is clear from this that the use of vitrification or packaging did not have a significant effect on the average values of TBA, as it was the lowest mean (1.47) for T3 treatment and the highest mean (1.54).) For the T4 treatment, this slight increase in TBA values with the progression of cryopreservation was indicated by each of the following studies[3][20].

Table (5): - The differences among treatments in thiobutyric acid values during different freezing storage periods.

Treatment	Freezing time (week)				
	2	4	6	8	**Average**
T1	1.35	1.42	1.57	1.67	**1.50**
T2	1.36	1.43	1.51	1.62	**1.48**
T3	1.34	1.42	1.52	1.61	**1.47**
T4	1.36	1.46	1.61	1.76	**1.54**
T5	1.37	1.45	1.57	1.72	**1.52**
LSD Values	0.266 NS	0.185 NS	0.172 NS	0.217 NS	**0.194 NS**
NS insignificant					

(T1 Control treatment without changes)(T2 brine solution2%)(T3 acid solution2%)(T4 Gelatin coating)(T5Polyethylene packaging)

Sensory and gustatory qualities

Table (6) indicates the sensory and taste characteristics of carp fillets. The results of the statistical analysis in the table indicated that there were significant differences in the sensory and gustatory characteristics of the five treatments. The T1 treatment in the flavor attribute was the highest than the rest of the treatments, reaching (5.2), while the T5 treatment recorded the lowest value (3.2).

In terms of freshness, treatment T4 was higher than the rest of the treatments, reaching (6.7), while (4.2) was the lowest value in treatment T2.

As for juiciness, treatment T4 outperformed by (6.1) over the rest of the treatments, where the lowest percentage was recorded in treatment T2, which amounted to (3.4).

The tissue characteristic showed that for treatment T5, the highest percentage was (6.4), and the lowest value was (3.4) for treatment T1.

Finally, we reach the trait of general acceptance, where the highest percentage of treatment T4 reached (6.4) compared to the lowest value of (4.1) for transaction T5

[1] showed that the processes of freezing and thawing fish meat have a significant effect on the physicochemical properties of frozen fish muscles and their sensory evaluation such as flavor, freshness, juiciness, texture and the degree of general acceptance of them when stored in freeze for different periods.

[15] indicated that the biochemical processes that develop after slaughter lead to the formation of large-sized ice crystals that change the structure of the muscles of frozen fish. Thus, increasing the amount of water lost after dissolving.

[7] explained that freezing meat in general and fish in particular is an excellent and good method that is used in a wide field to preserve the quality and quality of fish. At

the same time, freezing and thawing after freezing can cause chemical, physical and biological changes in the sensory characteristics of fish.

Table (6): Sensory and taste characteristics of frozen carp fillets

Treatment	Flavor	freshness	juicy	texture	general acceptance
T1	5.2	4.3	4.1	3.4	**4.2**
T2	4.5	4.2	3.4	4.3	**5.3**
T3	4.4	5.1	4.5	5.2	**5.2**
T4	3.6	6.7	6.1	6.3	**6.4**
T5	3.2	6.5	4.2	6.4	**4.1**
LSD Values	1.58 *	1.47 *	2.07 *	2.39 *	**1.96 ***
(P≤0.05) *					

(T1 Control treatment without changes)(T2 brine solution2%)(T3 acid solution2%)(T4 Gelatin coating)(T5Polyethylene packaging)

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