

EVALUATION OF SENSORY CHARACTERISTICS OF SOME ATLANTIC SALMON PRODUCTS IMPORTED TO IRAQ

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ABSTRACT

This study was conducted on salmon (Atlantic salmon) *Salmo salar* products imported to Iraq, which are a whole fish removed head and tail, fillets, rings, fingers and cubes evaluating of the sensory characteristics of these products and determining their suitability for human consumption. The products were obtained from King of Fish and Meat company (K.F. M.), the exclusive agent in Iraq, and all products were within one meal and date, and the validity of each product was from 5/10/2021 to 4/7/2022. Results were as follows: The results of the sensory characteristics (color, flavor, freshness, juiciness, general acceptance) showed no significant differences ($p \leq 0.05$) among salmon fish products, but they did not reach the limits of rejection. The results above of sensory tests of imported salmon fish products showed that they are suitable for human consumption and proved that they are within acceptable limits after comparing them with research and standard specifications.

Keywords: color, flavor, freshness, juiciness, general acceptance.

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تقييم الصفات الحسية لبعض منتجات أسماك السالمون الأطلسي المستوردة للعراق

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المستخلص

اجريت هذه الدراسة على منتجات اسماك السالمون المستوردة للعراق وهي مكعبات ، واصابع وسمكة كاملة منزوعة الرأس والذيل وحلقات وشرائح لتقييم الصفات الحسية لهذه المنتجات وتحديد مدى صلاحيتها للاستهلاك البشري. تم الحصول على المنتجات من شركة ملك الأسماك واللحوم (K.F. M.) King of Fish and Meat company الوكيل الحصري في العراق وكانت جميع المنتجات ضمن وجبة وتاريخ واحد وكانت صلاحية كل منتج من 2021/10/5 ولغاية 2022/ 7/4. أظهرت نتائج لصفات الحسية (اللون والنكهة والطراوة والعصيرية والتقبل العام) وجود فروق معنوية ($p \leq 0.05$) بين منتجات أسماك السالمون لكنها لم تصل الى حدود الرفض. تبين مما تقدم من نتائج الفحوص الحسية لمنتجات أسماك السالمون المستوردة أنها صالحة للاستهلاك البشري وأثبتت انها ضمن الحدود المقبولة بعد مقارنتها بالبحوث والمواصفات القياسية.

الكلمات المفتاحية: اللون، النكهة، العصيرية، الطراوة، التقبل العام.

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INTRODUCTION

Fish occupies an advanced position in the diet of human beings as they are of great importance in the growth and building of the body. Fish is an essential food source (18) that should be part of human choice for its richness in proteins, fat- soluble vitamins (A, K, E and D) (1), minerals and essential fatty acids (6). Fish often consumed as an alternative source of protein due to the high cost of meat and other animal protein sources (17). The biochemical composition of fish is generally composed water content of 70 to 80 %, protein. 20 to 30 % and 2 to 12 % fat (2). fish is also considered a good food source for many peoples (23). The fisheries sector is an important part of the economies for several countries of the world (6), including Norway, which produces Atlantic salmon fish, and is scientifically known as *Salmo salar* and belongs to the Salmonidae family, which is characterized by its high nutritional value. Salmon fish is an excellent source of protein, fats, vitamins and minerals, protein contains a high concentration of essential amino acids, especially methionine and lysine (16). They are an excellent source of nutrients such as fats and vitamins including vitamin A, B12, D, Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA), iodine and selenium (14). The intake of long-chain unsaturated fatty acids is associated with reduced risk of heart disease in adults and improved functional factors of neurodevelopment in children when eating seafood, particularly fish (12). In recent years, the consumption of fish meat has increased in the world, and it is considered one of the cheapest types of meat because it is available from natural fisheries, and its costs lie in

fishing and marketing operations (7). The steady increase of the world's population in recent years, and social and economic changes have increased consumer preference for ready-to-eat foods, these foods include burgers, fish fingers, marinated and processed products from fish and other seafood, and several studies have been conducted on the quality of production of these foods (20). In view of the importance of salmon meat and its various products from a nutritional point of view and the scarcity of scientific studies that dealt with, the research aimed to study: sensory characteristics such as color, flavor, freshness, juiciness, and general acceptance of salmon fish products (whole fish, fillets, fingers, rings and small cubes). Determining their validity and quality after comparing them with the standard specifications issued by the Central Agency for Standardization and Quality Control.

MATERIALS AND METHODS

Imported salmon fish were purchased from the King of Fish and Meat Company (K.F.M) for marine fish and meat, the exclusive agent in Baghdad, Iraq, which is imported from Turkey. A total of 15 samples were used in the study at 3 replications for each sample. The sensory evaluation of imported salmon fish was carried out as grilling was used as a method of cooking fish products after cutting them in different sizes and using the electric oven for 20 minutes at a temperature of 120 °C. Sensory tests were conducted by 9 arbitrators with experience and competence in the Department of Animal Production. The samples were evaluated in terms of color, freshness, flavor, juiciness and general acceptability according to the sensory evaluation form consisting of 7 degrees (Tables 1 and 2) (28).

Table 1. Fish sensory assessment form

Treatments(T)	color	flavor	Juiciness	freshness	degree of general acceptance
T1 cubes					
T2 fingers					
T3 whole fish					
T4 rings					
T5 fillets					

Table 2. Sensory evaluation of salmon fish products

Degree	color	flavor	Juiciness	freshness	general acceptance
7	Very acceptable	Strong flavour	So juicy	Too mushy	Very acceptable
6	Acceptable	Medium flavour	juicy	Mushy	Acceptable
5	Slightly Acceptable	little flavour	A little juicy	A little soft	slightly acceptable
4	quite acceptable	flavourless	Quite acceptable	Quite acceptable	quite acceptable
3	Slightly unacceptable	Slightly unacceptable flavor	Simple dehydration	little stiffness	A little unacceptable
2	Unacceptable	Unacceptable flavour	Dry	Solid	Unacceptable
1	Very unacceptable	Very unacceptable flavor	very dry	very solid	Very unacceptable

Statistical analysis

The results were analyzed using Complete Randomize Design (CRD) within the SAS - Statistical Analysis System (24). The results were compared using the least ($p \leq 0.05$) significant differences by testing the least significant difference (LSD) at the level of significance (0.05).

RESULTS AND DISCUSSION

Color : Table (3) indicates that the highest value of color characteristic in salmon products was recorded in the first and fourth treatments, reached to 6.29 and 6.29. The fifth treatment was the lowest at 5.96. The second and third treatments did not differ significantly ($p \geq 0.05$) from the other treatments and amounted to 6.18 and 6.07 respectively. The decrease in meat color could be attributed to the exposure of myoglobin protein to denaturation during the cooking process, that causes rapid release of the heme pigment from the myoglobin part of the molecule, and that the susceptibility of free heme pigments in the denaturated protein to oxidation is more than non-myoglobin (3). Microbial damage and chemical changes such as fat oxidation, heme pigment and proteins may lead to spontaneous oxidation of myoglobin (MB), which leads to a change in the color of the meat during freeze storage with less acceptance and palatability, and discoloration is influenced by the chemical composition of the meat and storage and cooking conditions (27). The reason for the

overall low protein content could be attributed to which it is directly related to red muscles, which are rich in capillaries that are equipped with hemoglobin and used for swimming energy (31). The concentration of myoglobin in the muscles depends on the species, age, muscle type, muscle activity, oxygen availability, and type of nutrition (13). Dawson et al. (10) confirmed that long-frozen salmon meat tends to lose pink color as a result of the formation of large ice crystals during the slow freezing process.

Flavor: Data in Table (3) shows that the highest degree of flavor was in the second treatment with reached to 6.25, while the lowest value was recorded in the third and fifth treatments with amounted to 5.88 and 5.96 respectively, and the first treatment did not differ significantly ($P > 0.05$) from the second and fourth treatments, while the fourth treatment did not differ significantly ($P > 0.05$) compared to third and fifth treatments. Flavor caused by the formation of unsaturated fatty acid peroxide, the main reason behind the strong flavor of salmon is the formation of volatile oxidation products such as aldehydes and ketones that have an intense odor and flavors (22). The content, distribution and composition of fats are important characteristics of the quality of salmon fish fillet, which affect nutritional quality and sensory qualities including flavor, smell, texture and tenderness (26). It was noted that fats have a direct impact on the flavor of meat,

as it supports the texture, juiciness and general feeling when chewing in the mouth, as well as its effect on the flavors of other substances in the meat, and that the flavor is affected by many factors, including pH, as it was found that cooked meat contains a quantity of hydrogen sulfide when the pH value is high before cooking, and pH is one of the important factors that affect the type of volatile flavor compounds that are formed in the Maillard reaction, then determines the final flavor characteristics of the cooked food, as well as the age, sex, temperature and type of nutrition affect the flavor of the meat formed (25). On the other hand, the microbial activity on the meat causes the emergence of changes in flavor due to the increased activity by microorganisms, which leads to the occurrence of fat hydrolysis and the emergence of unwanted flavors in the meat, the unwanted flavor could be obtained by absorbing the meat to the odors of neighboring materials when storing or through the casing used in packaging (8). Also, the flavor of fish, especially farmed fish, can be affected by muscle fat content and the nature of the feed, there is a difference in flavor between different species depending on their living environment (seawater and freshwater). As many factors lead to fat oxidation to peroxides, aldehydes, ketones and low aliphatic acids and aldehydes and ketones being the cause of rancid flavors (9).

Juiciness Table (3) show that the highest value of juice was recorded in the first treatment and reached 6.63, while the lowest value was in the third treatment was 5.88. The results of the statistical analysis indicated that the fourth and fifth treatments did not differ significantly ($P>0.05$) from the second and third treatments, amounting to 6.03 and 5.99, respectively. The reason for the differences in the degree of juiciness could be due to the effect of juiciness by several factors, including pH, ion concentration, meat quality, protein denaturation during cooking and freezing, as these factors change with the composition of muscle tissue, for example, it was observed that the water retention decreases when the pH value reaches 5.5, while the opposite occurs when the pH rises, and that the ability to preserve water decreases when the

percentage of fat increases, as well as freezing and thawing reduce the ability to retain water, as evidenced by the presence of the separated liquid or exudative drip, which decreases the freezing process (8). Farmer et al (12) observed loss of juiciness and increased hardness of Atlantic salmon (*Salmo salar*) when frozen. Mahmoud and Al-Khshali (21) showed in a study to determine the ideal duration for freezing three species of fish found in the Iraqi local markets, common carp, catfish and mullet, The highest juice value was found in common carp fish, which was 7.4, and the lowest value was recorded in khishni fish, which was 2.2. Hussein and Ahmed (16) confirmed in a study of the effect of glazing and packaging with gelatin and polyethylene and the duration of freezing storage that the fourth treatment (coated with gelatin) was superior to the rest of the treatments by 6.1, and the lowest percentage was recorded in the second treatment (2% saline solution) and reached 3.4.

Tenderness: Table (3) indicates that the highest value of freshness was recorded in the first treatment and reached to 6.44, while the lowest value was recorded in the third treatment (5.92), and the second treatment did not differ significantly ($P>0.05$) from the first, fourth and fifth treatments as it amounted to 6.25, and the results of the statistical analysis recorded no significant differences ($P>0.05$) between the fourth and fifth treatments (6.14 and 6.18) respectively. There are changes in frozen meat and tenderness changes according to the quality of frozen meat and according to storage conditions, as it was noted that there are changes in the texture of the meat resulting in a hardened and fibrous appearance, and it was found that the hardness of the meat increases with increasing storage period, but this depends on the humidity and temperature of the meat, and the reason for the hardness or its increase is attributed to the exit of the juicy liquid to the surface during the process of rehydration (8). Ibrahim and Al-Khshali (17) indicated that the highest value in the freshness test was for common carp fish reared in floating cages, which amounted to 0.6, and the lowest value was for fish reared in the waters of the Tigris River, 0.4.

General acceptance: The results of Table (3) show that the first and second treatments recorded the highest value in general acceptance and did not differ significantly ($P>0.05$) between them and the lowest value recorded in the third treatment (5.99), while the fourth and fifth treatments did not differ significantly ($P>0.05$) in comparison with the rest of the treatments. The reason for the arithmetic differences between the general averages of the degree of evaluation of general acceptance of salmon fish products may be attributed to the high percentage of fat for some treatments (third, fourth and fifth), and that the increases

in the general acceptance index is the result of the set flavor, juiciness and freshness or tenderness) that are affected by the evaluation degrees of the rest of the sensory qualities, and that the sensory qualities vary according to the chemical composition of the fish itself (19). Hussein and Ahmed (16) indicated in the study of the effect of glazing, packaging with gelatin and polyethylene and storage duration by freezing, the highest percentage of general acceptance was in treatment (gelatin-coated) (6.4), and the lowest value was in treatment (polyethylene packaging) (4.1).

Table 3. Sensory Characteristics of Imported Salmon Products (Mean \pm S E)

Treatments	color	flavor	Juiciness	tenderness	general acceptance
T1 cubes	6.29 \pm 0.07 a	6.22 \pm 0.05 ab	6.63 \pm 0.09 a	6.44 \pm 0.11 a	6.44 \pm 0.12 a
T2 fingers	6.18 \pm 0.03 ab	6.25 \pm 0.03 a	6.14 \pm 0.03 b	6.25 \pm 0.03 ab	6.51 \pm 0.14 a
T3 whole fish	6.07 \pm 0.07 ab	5.88 \pm 0.13 c	5.88 \pm 0.06 c	5.92 \pm 0.04 c	5.99 \pm 0.06 b
T4 rings	6.29 \pm 0.07 a	6.03 \pm 0.03 bc	6.03 \pm 0.03 bc	6.14 \pm 0.09 b	6.22 \pm 0.05 ab
T5 fillets	5.96 \pm 0.10 b	5.96 \pm 0.04 c	5.99 \pm 0.06 bc	6.18 \pm 0.03 b	6.25 \pm 0.03 ab
LSD	*0.233	*0.205	*0.203	0.226 *	*0.293

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