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Changes in Organoleptic Properties of Mullet Fish Steaks Cooked by Frying and Grilling Method during Frozen Storage

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ABSTRACT

Color, odor, taste, texture and overall acceptable score of cooked Mullet (fried and grilled) fish steaks during the storage period at -18°C were evaluated. The colors score of fried and grilled steaks of mullet showed good qualities as indicated by 9.1 ± 0.028 and 8.7 ± 0.034, respectively. The initial score values for taste and odor of fried and grilled Mullet samples were as high as (9 ± 0.288 and 9.5 ± 0.057) and (9 ± 0.115 and 9.5 ± 0.288), respectively. The texture score of fried and grilled which were as high as 9.3 ± 0.057 and 9.2 ± 0.115, respectively. The scores in all cooked samples slightly decreased during frozen storage from zero to 180 days either in fried or grilled Mullet fish samples. The fried and grilled cooked Mullet fish samples prepared from the pre-frozen raw fish showed good qualities. They maintained the high acceptability during frozen storage for 180 days.

KEYWORDS Mullet fish, Frying, Grilling, Sensory evaluation, Frozen storage.

INTRODUCTION

In Egypt, the total quantity of catch fish recorded 1,706,273 tones, while the total quantity of Exports and Imports of fish were 47,812 and 311,068 tonnes, respectively. Annual average share per capita of fish was 21.64 kg [1]. Mullets are one of the most important fish in Egyptian fisheries [2]. The most popular fish cooking methods are frying, grilling, boiled and baked. These methods affect in enhancing sensory evaluation parameters, hygiene quality and improve the digestibility [3]. Some chemical and physical reactions take place during cooking of fish such as improves the nutritional value of protein due to denaturation that increases its digestibility [4]. The grilling method has recently become more popular. Grilling is a mean of cooking by radiant heat from below and is different from broiling which means cooking by radiant heat from above. In the foodservice industry, the grill has become synonymous with griddle. Both terms refer to the equipment that has a flat and solid heated surface to cook, such as hamburgers, steaks, chops, and cutlets. This equipment allows cooking with or without the addition of fat [5]. Deep Fat Frying (DFF) is a major cooking method and is considered to be one of the oldest methods of food preparation. It is a cooking method of immersing foods in hot oil at a temperature above the boiling point of water. The oil temperature usually varies from 130°C to 200°C. During frying, there are many chemical reactions take place such as browning, gelatinization and denaturation due to the elevated temperature of the product [6]. Freezing is considered, all over the world, as one of the best methods for long-term preservation of perishable foods. Freezing reduces chemical reactions as well as microbial activity in the tissue, thus extending the shelf life of the product. Next, to fresh foods, frozen items attract high consumer acceptance in terms of sensory parameters including appearance, texture, and flavor, as well as nutritional value [7]. Indices of freshness or spoilage of seafood have been extensively studied, and it is generally accepted that there is a poor correlation between remaining shelf-life, as determined by sensory methods, and aerobic viable counts [8]. All these microscopic changes, caused by bacteria, autolytic enzymes or other chemical reactions, are translated into changes in the sensory attributes of fish or seafood. Sensory changes are those perceived with the senses, i.e. appearance, odor, texture and taste. If knowledge on the eating

quality of chilled fish during storage is required, a sensory assessment of the fish, cooked under controlled conditions, can be conducted [9].

Therefore, the overall objective of this study was to determine the changes in sensory evaluation scores of fried and grilled Mullet fish steaks during frozen storage at -18°C for a six months period.

MATERIALS AND METHODS

Sample preparation

Ten kilograms of fresh Mullets fish (Mugil cephalous) were obtained from one of the fishermen in Wadi El-Rayan Lake, Fayoum Governorate in February 2016. They had been transported in ICE-BOX to the laboratory of Fish Processing Technology, National Institute of Oceanography and Fisheries (NIOF), Fayoum Governorate, Egypt. In the laboratory, whole fish were immediately beheaded, gutted and cut into steaks then washed gently with tap water. Steaks samples were divided into four groups. One of them was cooked by frying and grilling methods in the same day of the acquisition of the fish, corresponding to 0 days. The other samples were packed in polyethylene bags with oxygen permeability, stored at -18˚C for six months in the domestic freezer, and removed for analysis after 60, 120 and 180 days to cook.

Table 1: Cooking techniques.

Steps	Frying	Grilling
1	Frozen Mullet steaks were thawed	Frozen Mullet steaks were thawed
2	Spices mixture was put in the steaks cavity and rubbed with flour	Rubbed with bran wheat
3	The steaks were fried in sunflower oil heated at 180°C for 5 min for each side of the steaks using electrical fryer pan Moulinex brand, French	Grilled using electrical grill machine at 260°C for 15 min for each side of the steaks
4	The fried steaks were drained in the basket to remove excess oil	The grilled fish samples were spiced for 1 min using spice solution containing red pepper garlic, black pepper, and cumin

Sensory evaluation

Fried and grilled Mullet fish steaks samples were tested for color, odor, taste, texture and overall acceptability immediately after processing and periodically during refrigeration and frozen storage by ten panelists chosen from the staff members of the shakshouka fish research station. Fish products were evaluated according to the method of [10] using the following numerical system:

- Excellent 8.6-10
- Very good 7.6-8.5
- Good 6.6-7.5
- Accepted 5.0-6.5
- Poor 4-4.9
- Very poor 0-3.9

Statistical analysis

Sensory evaluation data were analyzed statistically using SPSS 16.0 for windows (SPSS Inc., Chicago, USA). Least Significant Difference test (LSD) at ($P \leq 0.05$) and Standard Error (Mean ± SE) were calculated.

RESULTS AND DISCUSSION

Sensory quality properties

Sensory characteristics are the main criteria that affect the consumer acceptability of food products. The pre-frozen then cooked Mullet fish steaks were sensorial evaluated for their characteristics of color, taste, odor, texture and overall acceptability at intervals of two months to assess their storage stability during storage period at -18°C for six

months. Data collected from the sensory evaluation were statistically analyzed and the results obtained are tabulated in Tables 1-5.

Color

Mean score values for color of raw, fried and grilled Mullet fish steaks collected from sensory evaluation of the cooked Mullet during frozen storage are showed in Table 1. The colors of cooked mullet steaks showed good qualities as indicated by the score values of fried and grilled samples which were as high as 9.1 ± 0.028 and 8.7 ± 0.034, respectively. During frozen storage color score values slightly declined. At the end of 180 days storage color score values of the fried and grilled steaks were 8.2 ± 0.127 and 8.0 ± 0.080, respectively indicating that the cooked Mullet steaks retained their good colors without undesirable changes over the It was found that the scores in all cooked samples slightly decreased during.

Table 2: Changes in color of cooked Mullet fish steaks during frozen storage at -18˚C.

Storage time	Color score value		Sig.	L.S.D
(Months)	Fried steaks	Grilled steaks		
0	9.10 ± 0.028	8.70 ± 0.034	0.001	0.089
2	9.10 ± 0.057	8.60 ± 0.035	0.003	0.136
4	8.70 ± 0.098	8.30 ± 0.069	0.029	0.242
6	8.20 ± 0.127	8.00 ± 0.080	0.255	0.301
Sig.	0	0	-	-
L.S.D	0.242	0.163	-	-

-Data are presented as mean ±SE of replicates -SE: standard error

-Significant difference at P<0.05

Frozen storage from zero to 180 days either in fried or grilled Mullet fish samples. During storage period the color scores were relatively high scores for fried Mullet compared with grilled Mullet fish samples.

Odor and taste

Odor and taste of cooked fish products are the most important parameters, which determine the consumer acceptance. Odor and taste score values of cooked Mullet steaks made from pre-frozen samples are shown in Tables 2 and 3. The initial score values for taste and odor of fried and grilled Mullet samples were as high as (9 ± 0.288 and 9.5 ± 0.057) and (9 ± 0.115 and 9.5 ± 0.288), respectively. Indicating that odor and taste of the cooked Mullet f samples were highly accepted by the panelists. The higher score values given to the grilled samples indicated that odor and taste of the grilled Mullet fish products are relatively preferred by panelists than fried Mullet samples. During storage, no significant changes could be found in the odor and taste of the cooked samples over the entire period of 180 days months of frozen storage.

Texture

The changes in texture score values of the pr-frozen fired and grilled steaks of Mullet fish samples during storage period at -18˚C for 180 days are shown in Table 4.

Table 3: Changes in odor of cooked Mullet fish steaks during frozen storage at -18˚C.

Storage time	Odor score value		Sig.	L.S.D
(Months)	Fried steaks	Grilled steaks		
0	9.00 ± 0.115	9.50 ± 0.288	0.183	0.621
2	9.00 ± 0.230	9.30 ± 0.173	0.357	0.577
4	8.60 ± 0.346	8.80 ± 0.461	0.746	1.15

6	8.00 ± 0.577	8.30 ± 0.057	0.632	1.16
Sig.	0.24	0.069	-	-
L.S.D	1.01	0.811	-	-

-Data are presented as mean ± SE of replicates.-SE: standard error

-Significant difference at P<0.05

Table 4: Changes in taste of cooked Mullet fish steaks during frozen storage at -18˚C.

Storage time	**Taste score value**		**Sig.**	**L.S.D**
(Months)	**Fried steaks**	**Grilled steaks**		
0	9.00 ± 0.288	9.50 ± 0.057	0.17	0.588
2	8.90 ± 0.519	9.20 ± 0.028	0.6	1.04
4	8.50 ± 0.173	8.80 ± 0.173	0.29	0.489
6	7.60 ± 0.346	7.70 ± 0.404	0.86	1.06
Sig.	0.082	0.002	-	-
L.S.D	1	0.628	-	-

-Data are presented as mean ± SE of replicates.-SE: standard error

-Significant difference at P<0.05

Based on sensory evaluation, panelists evaluated the texture of cooked Mullet samples as excellent at zero time of storage period as indicated from the score values for texture of fried and grilled which were as high as 9.3 ± 0.057 and 9.2 ± 0.115, respectively. No considerable effects could be observed for the texture of the cooked samples during storage at -18°C. The score values for texture of the fried and grilled samples were 7.4 ± 0.230 and 7.9 ± 0.461, respectively indicating that even after 6.0 months of storage the textures of the fried and grilled Mullet steaks were still very good.

Table 5: Changes in texture of cooked Mullet fish steaks during frozen storage at -18˚C.

Storage time	**Texture score value**		**Sig.**	**L.S.D**
(Months)	**Fried steaks**	**Grilled steaks**		
0	9.30 ± 0.057	9.20 ± 0.115	0.482	0.258
2	8.90 ± 0.028	9.00 ± 0.173	0.599	0.35
4	8.20 ± 0.005	8.50 ± 0.288	0.357	0.577
6	7.40 ± 0.230	7.90 ± 0.461	0.388	1.03
Sig.	0	0.053	-	-
L.S.D	0.338	0.824	-	-

-Data are presented as mean ± SE of replicates.-SE: standard error.-Significant difference at P<0.05

Overall acceptability

Table 5 clear the overall acceptability scores of pre-frozen fried and grilled steaks of Mullet fish samples during storage period (at -18˚C). The results indicated that pre-frozen fried and grilled Mullet fish steaks had high good quality over the entire period of storage (180 days). This is the outcome of maintaining all the sensory quality attributes without undesirable changes during storage. The undesirable quality changes in frozen fish products are usually associated with discoloration or darkening, lipid oxidation, fishy odor development, and texture toughening. Score values for color, odor, taste and texture (Tables 1-4) indicated the high stability of these quality parameters

during frozen storage. Consequently, the fried and grilled cooked Mullet fish samples prepared from the pre-frozen raw fish showed good qualities. They maintained the high acceptability during frozen storage for 180 days. Meanwhile, for some extend, it was observed that the grilled Mullet fish samples were more liked by the panelists than fried samples during storage period.

Table 6: Changes in overall acceptability of cooked Mullet fish steaks during frozen storage at -18˚C.

Storage time	**Overall acceptability score value**		**Sig.**	**L.S.D**
(Months)	**Fried steaks**	**Grilled steaks**		
0	9.10 ± 0.057	9.22 ± 0.127	0.438	0.278
2	8.97 ± 0.040	9.02 ± 0.011	0.3	0.089
4	8.50 ± 0.230	8.60 ± 0.173	0.746	0.577
6	7.80 ± 0.115	7.97 ± 0.028	0.226	0.236
Sig.	0.001	0	-	-
L.S.D	0.379	0.305	-	-

-Data are presented as mean ±SE replicates.-SE: standard error

-Significant difference at P<0.05

CONCLUSION

Fried and grilled Mullet fish steaks prepared from the pre-frozen raw fish showed good qualities. They maintained the high acceptability during frozen storage for 180 days. Meanwhile, for some extend, it was observed that the grilled Mullet fish samples were more liked by the panelists than fried samples during storage period.

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